San Francisco Public Utilities Commission
San Joaquin Regional Water Quality Improvement Project

Final Environmental Impact Report
San Francisco Planning Department Case No. 2007.0427E
State Clearinghouse No. 2007052109

Draft EIR Publication Date: August 25, 2008
Draft EIR Public Hearing Date (San Francisco): September 18, 2008
Draft EIR Public Hearing Date (Tracy): September 16, 2008
Draft EIR Public Comment Period: August 25 to October 8, 2008
EIR Certification Date: December 18, 2008

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Planning Commission
Motion No. 17784

HEARING DATE: December 18, 2008

Hearing Date:	December 18, 2008
Case No.:	**2007.0427E**
Project:	**San Joaquin Regional Water Quality Improvement Project**
Project Sponsor:	San Francisco Public Utilities Commission 1155 Market Street, 11th Floor San Francisco, CA 94103
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CERTIFYING A FINAL ENVIRONMENTAL IMPACT REPORT FOR THE PROPOSED SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT.

MOVED, that the San Francisco Planning Commission (hereinafter "Commission") hereby CERTIFIES the Environmental Impact Report identified as Case No. 2007.0427E for the San Joaquin Regional Water Quality Improvement Project (SJRWQIP), located in San Joaquin County (hereinafter "Project"), based upon the following findings:

1. The City and County of San Francisco, acting through the Planning Department (hereinafter "Department") fulfilled all procedural requirements of the California Environmental Quality Act (Cal. Pub. Res. Code Section 21000 *et seq.*, hereinafter "CEQA"), the State CEQA Guidelines (Cal. Admin. Code Title 14, Section 15000 *et seq.*, (hereinafter "CEQA Guidelines") and Chapter 31 of the San Francisco Administrative Code (hereinafter "Chapter 31").

   A. The Department determined that an Environmental Impact Report (hereinafter "EIR") was required and in accordance with 15082 of the CEQA Guidelines, the Department prepared a Notice of Preparation (NOP) of an EIR and conducted a scoping meeting (see Draft EIR, Appendix A). The NOP was circulated to local, state, and federal agencies and to other interested parties on May 17, 2007, initiating a public comment period that extended through June 18, 2007. Pursuant to CEQA Guidelines Section 15083, the Department held one public scoping meeting in Tracy on June 6, 2007. The purpose of the meeting was to present the proposed SJRWQIP to the public and receive public input regarding the

proposed scope of the EIR analysis. A scoping report was prepared to summarize the public scoping process and the comments received in response to the NOP, and the report is included in Appendix A of the Draft EIR.

B. On August 25, 2008, the Department published the Draft Environmental Impact Report (hereinafter "DEIR") and provided public notice in a newspaper of general circulation of the availability of the DEIR for public review and comment and of the date and time of the public hearings on the DEIR; this notice was mailed to the Department's list of persons requesting such notice and other interested parties.

C. Notices of availability of the DEIR and of the date and time of the public hearings were posted at the project sites, the Tesla Portal site and the Thomas Shaft site, in San Joaquin County by Department staff on August 25, 2008.

D. On August 25, 2008, copies of the DEIR were mailed or otherwise delivered to a list of persons requesting it, to those noted on the distribution list in the DEIR, and to government agencies, the latter both directly and through the State Clearinghouse. The DEIR was posted on the Department's website.

E. Notice of Completion was filed with the State Secretary of Resources via the State Clearinghouse on August 25, 2008.

2. The DEIR was circulated to local, state, and federal agencies and to interested organizations and individuals for review and comment on August 25, 2008 for a 45-day public review period. The public review period closed on October 8, 2008. Two duly advertised public hearings on the DEIR to accept written or oral comments were held; one hearing was held in Tracy on September 16, 2008, and a second hearing was held in San Francisco on September 18, 2008. The Commission acknowledges and endorses the supplemental public hearing that the Environmental Review Officer's delegate conducted in Tracy in order to allow potentially affected members of the public to present oral comments at a convenient location. The public hearings transcripts are in the Project record, and Planning Department staff reported to the Commission on the public hearing in Tracy.

3. The Department prepared responses to comments on environmental issues received at the public hearings and in writing during the public review period for the DEIR, prepared revisions to the text of the DEIR in response to comments received or based on additional information that became available during the public review period, and corrected errors in the DEIR. This material was presented in a Draft Comments and Responses document

(hereinafter "C&R"), published on December 4, 2008, distributed to the Commission and all parties who commented on the DEIR, and made available to others upon request at Department offices and on the Department's website.

4. A Final Environmental Impact Report (hereinafter "FEIR") has been prepared by the Department, consisting of the DEIR, any consultations and comments received during the review process, any additional information that became available, and the Summary of Comments and Responses, all as required by law.

5. Project files on the FEIR have been made available for review by the Commission and the public. These files are available for public review at the Department offices at 1650 Mission Street, and are part of the record before the Commission. Linda Avery is the custodian of records. Copies of the DEIR and associated reference materials as well as the C&R document are also available for review at public libraries in San Francisco and San Joaquin Counties.

6. The Commission, in certifying the completion of said FEIR, hereby does find that the SJRWQIP described in the DEIR, will not result in project-specific significant environmental effects that could not be mitigated to a less than significant level with implementation of mitigation measures. Because the project is part of the Water System Improvement Program (WSIP, the project would contribute to the following significant and unavoidable effects on the environment identified for the WSIP:

   Significant and Unavoidable WSIP Water Supply Impacts:

   - The proposed water supply and system operations would reduce stream flows and alter the stream hydrograph along Alameda Creek below the Alameda Creek Diversion Dam in the Alameda Creek watershed in Alameda County and result in a significant and unavoidable impact on stream flow in Alameda Creek between the diversion dam and the confluence with Calaveras Creek;

   - The proposed water supply and system operations would result in a potentially significant and unavoidable impact in the Peninsula watershed on fishery resources in Crystal Springs Reservoir in San Mateo County; and

   - The Program would indirectly contribute to potentially significant and unavoidable environmental impacts caused by growth in the SFPUC service area, as identified in the planning documents and associated environmental documents for the affected jurisdictions.

7. The Commission reviewed and considered the FEIR and hereby does find that the contents of said report and the procedures through which the FEIR was prepared, publicized and reviewed comply with the provisions of CEQA, the CEQA Guidelines and Chapter 31 of the San Francisco Administrative Code.

8. The Planning Commission hereby does find that the FEIR concerning File No. 2007.0427E, San Joaquin Regional Water Quality Improvement Project, reflects the independent judgment and analysis of the City and County of San Francisco, is adequate, accurate and objective, and that the C&R contains no significant revisions to the DEIR, and hereby does CERTIFY THE COMPLETION of said FEIR in compliance with CEQA and the CEQA Guidelines.

I hereby certify that the foregoing Motion was ADOPTED by the Planning Commission at its duly noticed regular meeting of December 18, 2008.

Jonas P. Ionin
Acting Commission
Secretary

AYES: Olague, Miguel, Antonini, Borden, Lee, Moore

NOES: None

ABSENT: None

EXCUSED: Sugaya

ACTION: Certification of a Final Environmental Impact Report for the Proposed San Joaquin Regional Water Quality Improvement Project

AGENDA ITEM
Public Utilities Commission
City and County of San Francisco

DEPARTMENT Infrastructure Division AGENDA NO.

MEETING DATE December 18, 2008

SUMMARY OF PROPOSED COMMISSION ACTION

Approve Water System Improvement Program (WSIP)-funded Project No. CUW38401, Tesla Treatment Facility and WSIP-funded Project No. CUW36401, Lawrence Livermore Water Quality Improvements; **Adopt** California Environmental Quality Act (CEQA) Findings, including a statement of overriding considerations and the Mitigation Monitoring and Reporting Program (MMRP) and authorize a request to the Board of Supervisors to adopt the same; and **Authorize** staff to issue a Notice to Proceed (NTP) for Phase 2A – Final Design-Build, Long Lead Item Procurement and Fabrication of Material for DB116, Tesla Treatment Facility, and to advertise a construction contract for Lawrence Livermore Water Quality Improvements.

DESCRIPTION OF PROJECT ACTION

Project Approval

The proposed project would improve already-existing uses (i.e., water treatment) at two sites. The project evaluated in the EIR titled San Joaquin Regional Water Quality Improvement Project (SFRWQIP), is listed as three separate projects in the WSIP Program EIR (PEIR): the Tesla Portal Disinfection Facility, the Hetch Hetchy Advanced Disinfection, and the Lawrence Livermore Supply Improvements. The two projects at the Tesla Portal site (the Tesla Portal Disinfection Facility and the Hetch Hetchy Advanced Disinfection) were combined into one project now called the Tesla Treatment Facility, and the Lawrence Livermore Supply Improvements project, was renamed the Lawrence Livermore Water Quality Improvements Project. Therefore, the SJRWQIP EIR describes and evaluates two projects: The Tesla Treatment Facility (at the Tesla Portal site) and the Lawrence Livermore Water Quality Improvements (at the Thomas Shaft site). For purposes of the EIR, these projects were evaluated as one project given their geographic proximity, construction schedule, and the interrelated function of the two proposed facilities at the Tesla Portal site.

Funding for the project is included in the WSIP supplemental appropriation request recently presented to the Board of Supervisors in December 2008.

APPROVAL:

PERFORMING ORGANISATION		FINANCE	Todd Rydstrom
COMMISSION SECRETARY	Michael Housh	GENERAL MANAGER	Ed Harrington

Tesla Treatment Facility (Tesla Portal Site)

At the Tesla Portal site, new water treatment facilities would be constructed to meet U.S. Environmental Protection Agency (U.S. EPA) requirements for *Cryptosporidium* reduction/inactivation in drinking water, as required under the U.S. EPA's Long Term-2 Enhanced Surface Water Treatment Rule (LT2ESWTR). The existing building that contains the Tesla Portal Hypochlorite Station would be replaced with a new Chemical Process Building and Office/Control Building. An ultraviolet (UV) facility would be constructed, which would disinfect water using a series of UV light arrays. The project components include:

- A 14,000-square-foot Chemical Process Building 32 feet in height containing three 16,000-gallon sodium hypochlorite tanks, two 10,000-gallon fluoride tanks and two outdoor 12,500-gallon carbon dioxide (CO2) tanks
- A 3,500-square-foot Office/Control Building 12 feet in height containing offices, control room, process room, laboratory, restrooms, lockers, shower, and a multipurpose room
- A 20,000-square-foot UV Building 32 feet in height containing 12 UV reactors (10 active and two standby) each with UV lamp arrays and various sensors, on a floor recessed approximately 14 feet below grade, below-grade piping vaults and two 3,000-gallon food-grade acid tanks
- Other proposed improvements at the Tesla Portal site include a 90,000-gallon containment basin lined with rip rap to capture released water for grit removal and periodic maintenance (three times per month), two valve vaults to direct adequate flow, as required, two valve houses, and other infrastructure including a microwave tower up to 100 feet in height

Lawrence Livermore Water Quality Improvements (Thomas Shaft Site)

At the Thomas Shaft site, the Lawrence Livermore Water Quality Improvements would upgrade existing water treatment with a UV facility to meet disinfection requirements of the Surface Water Treatment Rule (SWTR) and the LT2ESWTR. The project includes:

- Two UV reactors (one active and one standby) installed within the existing Chlorination Facility building
- A 360-square-foot prefabricated structure 10 feet in height within the fenced area atop Thomas Shaft

- A 2,500-gallon percolation water tank for process water

The Lawrence Livermore Water Quality Improvements are being designed for a 0.165 million gallons per day (mgd) capacity. The proposed project would allow Lawrence Livermore National Laboratory (LLNL) to take up to 0.165 mgd of their annual average demand of 0.8 mgd from Thomas Shaft, and continue to receive the remainder of the water from Mocho Shaft, a SFPUC facility located downstream of the Thomas Shaft site. The amount of water supplied to LLNL would be consistent with the existing contract between the two parties.

Adoption of CEQA Findings

The City Planning Department prepared and the Planning Commission will be asked to certify on December 18, 2008, an EIR for the SJRWQIP as required under CEQA, the CEQA Guidelines and Chapter 31 of the San Francisco Administrative Code. In order to comply with CEQA requirements, as part of the approval of the Tesla Treatment Facility and Lawrence Livermore Water Quality Improvements projects, the Commission must adopt the CEQA Findings, including a Statement of Overriding Considerations, and the MMRP, attached to the Resolution as Attachments A and B, respectively.

The SJRWQIP Final EIR (consisting of the Draft EIR and the Comments and Responses document) assessed the projects and identified some potentially significant adverse impacts to the environment, primarily related to biological resources, which can be mitigated to less than significant levels. These impacts will be reduced to less than significant levels by incorporating the mitigation measures outlined in the EIR and the MMRP in the project final design and incorporating them in the construction phase. All Project-specific significant impacts will be mitigated to a less-than-significant level. The CEQA Findings provide for adoption of the mitigation measures by the SFPUC and the MMRP provides information and allocates responsibility for implementing all of the mitigation measures proposed in the Final EIR for the SJRWQIP.

The SJRWQIP is part of the WSIP, and implementation of the WSIP would support growth in the SFPUC service area, thereby contributing indirectly to environmental impacts caused by that growth. Because the proposed projects are part of the WSIP and would contribute to the WSIP's growth inducement impact, the projects therefore would contribute to the significant and unavoidable program-level impacts associated with growth inducement. The WSIP water supply decision also caused other significant and unavoidable impacts. Because this Project is part of the WSIP, it is deemed to contribute to those impacts.

Significant and unavoidable impacts associated with the WSIP are described in Section IV of the CEQA Findings attached to the Commission Resolution as Attachment A. Therefore, this Commission will need to adopt a Statement of

Overriding Considerations, included in the CEQA Findings Section VI, explaining why the Commission has decided to approve the Tesla Treatment Facility and Lawrence Livermore Water Quality Improvements projects notwithstanding this significant and unavoidable environmental impact.

RECOMMENDATION

SFPUC staff recommends that the Commission **approve** the Tesla Treatment Facility and the Lawrence Livermore Water Quality Improvements Projects; **adopt** the CEQA Findings, including the statement of overriding considerations, and the MMRP and **authorize** staff to implement the projects following final action by the Board of Supervisors.

CONTEXT OF THIS ACTION

The WSIP is a multi-billion dollar multi-year program to upgrade the SFPUC's drinking water system. The program will deliver capital improvements that enhance the SFPUC's ability to provide reliable, affordable, high quality drinking water to its 27 wholesale customers and regional retails customers in Alameda, Santa Clara and San Mateo Counties, and to 800,000 retail customers in the City and County of San Francisco, in an environmentally sustainable manner. The proposed WSIP is structured to cost-effectively meet water quality requirements, improve seismic and delivery reliability, and meet water supply reliability goals.

The overall objectives of the SJRWQIP are to meet current and foreseeable future federal and state water quality requirements and to reduce the vulnerability of the regional water system to damage in the event of a major earthquake. The objectives are consistent with the project-specific objectives described in the WSIP PEIR. Specific project objectives are to:

Tesla Treatment Facility (Tesla Portal Site)

- Replace existing water treatment facilities that are not currently seismically safe with new facilities that are designed to meet current seismic, safety/fire, and building code standards

- Construct new water treatment facilities to meet U.S. EPA requirements for *Cryptosporidium* reduction/inactivation in drinking water, as required under the U.S. EPA's LT2ESWTR

- Improve current water quality management capabilities such as pH control

Lawrence Livermore Water Quality Improvements (Thomas Shaft Site)

- Construct new water treatment facilities to meet U.S. EPA requirements under the SWTR for the reduction/inactivation of *Giardia*, as well as assist in meeting LT2ESWTR *Cryptosporidium* requirements to enable delivery of potable water to LLNL from the Thomas Shaft of the Coast Range Tunnel

- Continue to provide back-up chlorination capabilities

The SJRWQIP Draft EIR was completed and made available to local regulatory agencies (Responsible Agencies) and the general public on August 25, 2008. The 45-day public review period ended on October 8, 2008. Public comments on the DEIR were received between August 25, 2008 and October 8, 2008. A total of nine (9) written public comments were received during the public comment period. These letters were from the California Department of Transportation (Caltrans), California Department of Fish and Game (CDFG), California Governor's Office of Planning and Research (OPR), San Francisco Department of Public Health, San Francisco Landmarks Preservation Advisory Board, Bay Area Water Supply and Conservation Agency (BAWSCA), San Joaquin Valley Air Pollution Control District (SJVAPCD), Steve Lawrence, and the Plasterers' and Cement Masons' Local Union. In addition two speakers provided oral comments at the public hearing in Tracy, California and no comments were received at the public hearing in San Francisco, California. All comments received were carefully considered, responded to, and revisions were made to the DEIR in response to these comments.

This request to approve the Tesla Treatment Facility and Lawrence Livermore Water Quality Improvements projects will allow the SFPUC to proceed with current plans to advertise a construction contract for CUW36401 Lawrence Livermore Water Quality Improvement Project, issue Notice To Proceed (NTP) for Phase 2A – Final Design, Long Lead Item Procurement and Fabrication of Material for Contract DB116, Tesla Treatment Facility, and proceed with the project improvements.

PROS/CONS

PROS

- SFPUC will proceed with meeting the objectives of the Tesla Treatment Facility and Lawrence Livermore Water Quality Improvement Projects.
- SFPUC will proceed with the improvements needed to meet U.S. EPA requirements for *Cryptosporidium* reduction/inactivation in drinking water, as required under the U.S. EPA's LT2ESWTR.

- SFPUC will proceed with meeting U.S. EPA requirements under the SWTR for the reduction/inactivation of *Giardia* to meet our contractual obligations to deliver potable water to LLNL from the Thomas Shaft of the Coast Range Tunnel.

CONS

- SFPUC will not be able to proceed with plans to meet our mandatory compliance deadline for the U.S. EPA requirements under the LT2ESWTR.
- SFPUC will not be able to meet our contractual obligations to deliver potable water to LLNL from the Thomas Shaft.
- SFPUC will not be able to replace facilities at the Tesla Portal site to reduce the vulnerability of the system to earthquakes and other seismic hazards.

ATTACHMENTS

A. CEQA Findings, including Statement of Overriding Considerations
B. Mitigation and Monitoring Program (MMRP)
C. SFPUC Standard Construction Measures and Greenhouse Gas Reduction Actions
D. SJRWQIP Final Comments and Responses Document

Contact Person: Irina P. Torrey Phone: 415-554-3232

PUBLIC UTILITIES COMMISSION

City and County of San Francisco

RESOLUTION NO. **08-0234**

WHEREAS, Public Utilities Commission staff have developed a project description under the Water System Improvement Program (WSIP) for the improvements to the regional water supply system, otherwise known as Project No. CUW38401, Tesla Treatment Facility and Project No. CUW36401 Lawrence Livermore Water Quality Improvements; and

WHEREAS, the objectives of the Project are to meet current and foreseeable future federal and state water quality requirements and reduce the vulnerability of the system to earthquakes and other seismic hazards; and

WHEREAS, a Draft Environmental Impact Report (DEIR) for the Project was prepared and published for public review on August 25, 2008; and

WHEREAS, public comments on the Draft EIR were received between August 25, 2008 and October 8, 2008; and

WHEREAS, on December 18, 2008, the Planning Commission reviewed and considered the Final EIR in Planning Department File No. 2007052109, consisting of the Draft EIR and the Comments and Responses document, and found that the contents of said report and the procedures through which the Final EIR was prepared, publicized and reviewed complied with the provisions of the California Environmental Quality Act (CEQA), the CEQA Guidelines and Chapter 31 of the San Francisco Administrative Code ("Chapter 31") and found further that the Final EIR reflects the independent judgment and analysis of the City and County of San Francisco, is adequate, accurate and objective, and that the Comments and Responses document contains no significant revisions to the Draft EIR, and certified the completion of said Final EIR in compliance with CEQA, the CEQA Guidelines and Chapter 31 in its Motion No. 17784; and

WHEREAS, this Commission has reviewed and considered the information contained in the Final EIR, all written and oral information provided by the Planning Department, the public, relevant public agencies, SFPUC and other experts and the administrative files for the WSIP and the EIR; and

WHEREAS, the EIR files have been made available for review by the Public Utilities Commission and the public, and those files are part of the record before this Public Utilities Commission; and

WHEREAS, Public Utilities Commission staff prepared Findings, as required by CEQA, and a Mitigation, Monitoring and Reporting Program (MMRP), which material was made available to the public and the Commission for the Commission's review, consideration and action; now, therefore, be it

RESOLVED, that the Public Utilities Commission has reviewed and considered the EIR and the record as a whole and hereby adopts the CEQA Findings, including the Statement of Overriding Considerations, attached to this Resolution as Attachment A and incorporated herein as part of this Resolution by this reference thereto, and adopts the Mitigation Monitoring and Reporting Program attached to this Resolution as Attachment B and incorporated herein as part of this Resolution by this reference thereto, and authorizes a request to the Board of Supervisors to adopt the same CEQA Findings, Statement and MMRP; and, be it

of this Resolution by this reference thereto, and authorizes a request to the Board of Supervisors to adopt the same CEQA Findings, Statement and MMRP; and, be it

FURTHER RESOLVED, that the Public Utilities Commission hereby adopts the SFPUC Standard Construction Measures and Greenhouse Gas Reduction Actions attached hereto as Attachment C; and, be it

FURTHER RESOLVED, that the Public Utilities Commission hereby approves WSIP-funded Project No. CUW38401, Tesla Treatment Facility and WSIP-funded Project No. CUW36401 Lawrence Livermore Water Quality Improvements; and authorizes staff to issue a Notice to Proceed (NTP) for Phase 2A – Final Design, Long Lead Item Procurement and Fabrication of Material for Contract DB116 Tesla Treatment Facility, and to advertise a construction contract for Lawrence Livermore Water Quality Improvements.

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of December 18, 2008

Michael Hasely

Secretary, Public Utilities Commission

San Francisco Public Utilities Commission
San Joaquin Regional Water Quality Improvement Project

Final Environmental Impact Report
San Francisco Planning Department Case No. 2007.0427E
State Clearinghouse No. 2007052109

Changes from the Draft EIR text are indicated by a dot (•) in the left margin

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- **Acronyms and Abbreviations**

AB	Assembly Bill
ABAG	Association of Bay Area Governments
ADF	Advanced Disinfection Facility
ADRR	Archaeological Data Recovery Report
ADT	average daily traffic
AGS	AGS, Inc.
Alquist-Priolo	Alquist Priolo Earthquake Fault Zoning Act
APCD	Air Pollution Control Districts
APE	area of potential effects
APS	auxiliary power system
AQMD	Air Quality Management District
AST	aboveground storage tank
ASTM	American Society for Testing and Materials
Basin Plan	Sacramento River and San Joaquin River Basin Plan

bgs	below ground surface
BMPs	best management practices
BNHM	Berkeley Natural History Museum
CAAQS	California Ambient Air Quality Standards
Cal-EPA	California Environmental Protection Agency
Cal-OSHA	California Occupational Safety and Health Administration
Caltrans	California Department of Transportation
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resources Board
CBC	California Building Code

CCR	California Code of Regulations
CCSF	City and County of San Francisco
CDF	California Department of Forestry and Fire Protection
CDFG	California Department of Fish and Game
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
CGS	California Geological Survey
CH_4	methane
CHIS	California Health Interview Survey
CHRIS	California Historic Resource Inventory System
CIWM	California Integrated Waste Management
CIWMB	California Integrated Waste Management Board
CMP	Congestion Management Program
CNDDB	California Natural Diversity Database
CNEL	Community Noise Equivalent Level
CNPS	California Native Plant Society
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalents
CPUC	California Public Utilities Commission
CRSB	Coast Ranges-Sierran Block
CRHR	California Register of Historical Resources
CSMGB	California State Mining and Geology Board
CT	Contact Time
CUPA	Certified Unified Program Agency
CWA	Clean Water Act
cy	cubic yard
dB	decibel
dBA	A-weighted decibel
DHS	California Department of Health Services
DTSC	Department of Toxic Substances Control
DWR	California Department of Water Resources
EIR	Environmental Impact Report
ERO	Environmental Review Officer
ESA	Environmental Site Assessment
Fed-OSHA	Federal Occupational Safety and Health Administration
FEMA	Federal Emergency Management Agency
FESA	Federal Endangered Species Act
FHWA	Federal Highway Administration
FMMP	Farmland Mapping and Monitoring Program
FTA	Federal Transit Administration
FTE	full-time equivalent
FY	fiscal year
GAMAQI	Guide to Assessing and Mitigating Air Quality Impacts
GANDA	Garcia and Associates

General Permit	Statewide General Permit for Stormwater Discharges Associated with Construction Activity
GHG	greenhouse gas
GWh	gigawatt-hours
GWP	Great Western Power Company
HAPS	hazardous air pollutants
HAVC	heating, ventilation, and air conditioning
HCP	Habitat Conservation Plan

HMBP	Hazardous Materials Business Plan
hp	horse power
HRP	Habitat Reserve Program
HSAA	Carpenter-Presley-Tanner Hazardous Substances Account Act
HWCL	California Hazardous Waste Control Law
Hz	Hertz
I-5	Interstate 5
I-580	Interstate 580
in/sec	inches per second
ITE	Institute of Traffic Engineers
ITMM	Incidental Take and Mitigation Measures
JPA	Joint Powers Authority
kWh	kilowatt-hours
LCA	California Land Conservation Act
L_{dn}	day-night noise level (24-hour average)
LEED	Leadership in Energy and Environmental Design
L_{eq}	steady-state noise level (one-hour average)
LLNL	Lawrence Livermore National Laboratory
LLNS	Lawrence Livermore National Security, LLC
L_{max}	the maximum A-weighted noise level during the measured period
L_{min}	the minimum A-weighted noise level during the measured period
LOS	level of service
LT2ESWTR	Long Term-2 Enhanced Surface Water Treatment Rule
MBTA	Migratory Bird Treaty Act
MEA	San Francisco Planning Department, Major Environmental Analysis Section
MECA	Mayor's Energy Conservation Account
mgd	million gallons per day
mg/L	milligrams per liter
MID	Modesto Irrigation District
MLD	most likely descendant
MMRP	Mitigation Monitoring and Reporting Program
mph	miles per hour
MRZ	Mineral Resource Zone
msl	mean sea level
MTBA	Migratory Bird Treaty Act
NAAQS	National Ambient Air Quality Standards
NAHC	Native American Heritage Commission
NEPDG	National Energy Policy Development Group
NHPA	National Historic Preservation Act
NO_2	nitrogen dioxide
NO_X	nitrogen oxide
N_2O	nitrous oxide
NOI	Notice of Intent
NOP	Notice of Preparation
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWIC	Northwest Information Center
O_3	ozone

OADP	Ozone Attainment Demonstration Plan
OHV	off-highway vehicle
OPR	Office of Planning and Research
OSHA	Occupational Safety and Health Administration
Pb	lead
PCBs	polychlorinated biphenyls
PEIR	Program Environmental Impact Report
PG&E	Pacific Gas and Electric Company
PM	particulate matter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
PM_{10}	particulate matter less than 10 microns in diameter
Porter-Cologne	Porter-Cologne Water Quality Control Act
ppm	parts per million
PPMRP	Pollution Prevention and Monitoring Program
PPV	peak particle velocity
PRC	California Public Resources Code
PV	photovoltaic
PVC	polyvinyl chloride pipe
PWS	pubic water system
RCRA	Resource Conservation and Recovery Act
REB	Resource Efficient Building
ROG	reactive organic gases
RWQCB	Regional Water Quality Control Board
SAAQS	State Ambient Air Quality Standards
SARA	Superfund Amendments and Reauthorization Act of 1986
SCS	Soil Conservation Service
SCADA	Supervisory Control and Data Acquisition
SFDE	San Francisco Department of the Environment
SFPUC	San Francisco Public Utilities Commission
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SJCOG	San Joaquin Council of Governments
SJMSCP	San Joaquin County Multi-Species Habitat Conservation and Open Space Plan
SJPL	San Joaquin Pipelines
SJRWQIP	San Joaquin Regional Water Quality Improvement Project
SJVAB	San Joaquin Valley Air Basin
SJVAPCD	San Joaquin Valley Air Pollution Control District
SO_2	sulfur dioxide
SR 132	State Route 132
SVRA	State Vehicular Recreation Area
SWANCC	Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
SWTR	Surface Water Treatment Rule
TAC	Technical Advisory Committee
TCE	trichloroethylene
TID	Turlock Irrigation District
TMDL	total maximum daily loads
TSCA	Toxic Substances Control Act
USACOE	United States Army Corps of Engineers
USC	U.S. Code

U.S. EPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geologic Survey
USTs	Underground Storage Tanks
UV	ultraviolet

VdB	vibration velocity level in dB
VDE	Visible Dust Emissions
VOC	volatile organic compounds
WA	Weiss Associates
WDR	waste discharge requirements
WGCEP	USGS Working Group on California Earthquake Probabilities
WSIP	Water System Improvement Program
ZEV	zero emissions vehicle
^{o}F	degrees Fahrenheit
$\mu g/m^3$	micrograms per cubic meter

CHAPTER 1
Executive Summary

1.1 Introduction and Purpose

The San Francisco Public Utilities Commission (SFPUC) proposes to construct the *San Joaquin Regional Water Quality Improvement Project* (project). The proposed project is located in unincorporated San Joaquin County at two existing facility sites, the Tesla Portal site and the Thomas Shaft site, along the SFPUC's regional water system. At the Tesla Portal site, the existing building that contains the Tesla Portal Hypochlorite Station would be replaced with a new Chemical Process Building and Office/Control Building. An ultraviolet (UV) facility would be constructed, which would disinfect water using a series of UV light arrays. At the Thomas Shaft site, the Lawrence Livermore Water Quality Improvements would upgrade existing water treatment with a UV facility to meet disinfection requirements of the Surface Water Treatment Rule and the Long Term 2 Enhanced Surface Water Treatment Rule.

The San Francisco Planning Department, Major Environmental Analysis (MEA) Section, determined that implementation of the proposed project could have a significant effect on the environment and, therefore, requires preparation of an Environmental Impact Report (EIR) pursuant to the requirements of the California Environmental Quality Act (CEQA). This EIR is intended to provide the public and responsible agencies with information about the potentially significant environmental effects of the proposed project, to identify possible ways to minimize the potentially significant effects, and to describe and evaluate feasible alternatives to the proposed project.

1.2 Project Description and Objectives

The proposed *San Joaquin Regional Water Quality Improvement Project* would consist of the following components. These, and other secondary components of the proposed project, are described in detail in Chapter 3, Project Description.

1.2.1 Tesla Treatment Facility (Tesla Portal Site)

- A 14,000-square-foot Chemical Process Building 32 feet in height containing three 16,000-gallon sodium hypochlorite tanks, two 10,000-gallon fluoride tanks and two outdoor 12,500-gallon carbon dioxide (CO_2) tanks

- A 3,500-square-foot Office/Control Building 12 feet in height containing offices, control room, process room, laboratory, restrooms, lockers, shower, and a multipurpose room

- A 20,000-square-foot UV Building 32 feet in height containing 12 UV reactors (10 active and two standby) each with UV lamp arrays and various sensors, on a floor recessed approximately 14 feet below grade, below-grade piping vaults and two 3,000-gallon food-grade acid tanks

- Other proposed improvements at the Tesla Portal site include a 90,000-gallon containment basin lined with rip rap to capture released water for grit removal and periodic maintenance (three times per month), two valve vaults to direct adequate flow, as required, two valve houses, and other infrastructure including a microwave tower up to 100 feet in height

1.2.2 Lawrence Livermore Water Quality Improvements (Thomas Shaft Site)

- Two UV reactors (one active and one standby) installed within the existing Chlorination Facility building

- A 360-square-foot prefabricated structure 10 feet in height within the fenced area atop Thomas Shaft

- A 2,500-gallon percolation water tank for process water

The proposed project would improve already-existing uses (i.e., water treatment) at the two sites. The Lawrence Livermore Water Quality Improvements are being designed for a 0.165 million gallons per day (mgd) capacity. The proposed project would allow Lawrence Livermore National Laboratory (LLNL) to take up to 0.165 mgd of their annual average demand of 0.8 mgd from Thomas Shaft, and continue to receive the remainder of the water from Mocho Shaft, an SFPUC facility located downstream of the Thomas Shaft site. The amount of water supplied to LLNL would be consistent with the preexisting contract between the two parties.

1.2.3 Project Objectives

The objectives of the proposed *San Joaquin Regional Water Quality Improvement Project* (project) consist of the following:

Tesla Treatment Facility (Tesla Portal Site)

- Replace existing water treatment facilities that are not currently seismically safe with new facilities that are designed to meet current seismic, safety/fire, and building code standards

- Construct new water treatment facilities to meet U.S. Environmental Protection Agency (U.S. EPA) requirements for *Cryptosporidium* reduction/inactivation in drinking water, as required under the U.S. EPA's Long Term-2 Enhanced Surface Water Treatment Rule (LT2ESWTR)

- Improve current water quality management capabilities such as pH control

Lawrence Livermore Water Quality Improvements (Thomas Shaft Site)

- Construct new water treatment facilities to meet U.S. EPA requirements under the Surface Water Treatment Rule (SWTR) for the reduction/inactivation of *Giardia*, as well as assist in meeting LT2ESWTR *Cryptosporidium* requirements to enable delivery of potable water to LLNL from the Thomas Shaft of the Coast Range Tunnel

- Continue to provide back-up chlorination capabilities

1.2.4 Standard Construction Measures

The SFPUC has adopted standard construction measures that would be implemented as part of all SFPUC projects, including the proposed project. The main objective of these measures is to minimize potential disruption of surrounding neighborhoods during construction and to reduce impacts on environmental resources to the extent feasible. The construction measures would be implemented individually for the facility improvements; some measures might not be applicable to some projects, while some projects would require the development of more detailed construction measures and implementation steps as the individual projects are designed. The standard construction measures to be included in project construction contracts address the following topics: neighborhood notice, seismic and geotechnical studies, onsite air and water quality measures during construction, groundwater, traffic, noise, hazardous materials, biological resources, cultural resources, and project site (i.e., the use of non-City and County of San Francisco [CCSF]-owned land during construction, which is not proposed for this project). The entire list of measures is presented in Chapter 3.

1.2.5 Proposed Construction Schedule

Construction of the Tesla Treatment Facility is anticipated to start in January 2009, and last approximately 24 months. After construction, there would be a 12-month startup testing period including UV tests by State regulators.

Construction of the Lawrence Livermore Water Quality Improvements is anticipated to start in July 2009, and last for approximately six months.

Construction at both sites generally would be conducted on weekdays from 7:00 am to 5:00 pm; however, work may occur occasionally on weekends, and could occur 24 hours a day, seven days a week at the Tesla Portal site during tie-in of the new facilities during the regularly scheduled Hetch Hetchy shutdown for approximately 36 days in January to February.

1.3 Summary of Environmental Impacts and Mitigation

Chapter 4 of this EIR evaluates the environmental effects of implementing the proposed project. Chapter 5 presents mitigation measures that would reduce potentially significant impacts to less-than-significant levels, when feasible. A summary of significant impacts and mitigation measures is provided in Table 1-1 at the end of this chapter.

- As discussed in Chapter 6, Growth Inducement, the proposed project is one of several improvement projects that comprise the SFPUC's Water System Improvement Program (known as the "Phased WSIP Variant"), and implementation of the WSIP would support growth in the SFPUC service area, thereby contributing indirectly, to environmental impacts caused by that growth. Because the proposed project is part of the WSIP and would contribute to the WSIP's growth inducement impact, the project therefore would contribute to the potentially significant and unavoidable program-level impacts associated with growth inducement.

1.4 Areas of Controversy

No areas of controversy were raised by the public or responsible agencies during the 30-day Notice of Preparation (NOP) review period, which extended from May 16 through June 18, 2007, nor have any become known to the San Francisco Planning Department since that time.

1.5 Alternatives to the Proposed Project

CEQA requires that EIRs describe and evaluate the comparative merits of a range of reasonable alternatives to projects, or to project locations, which would: (1) feasibly attain most of the basic project objectives; and (2) would avoid or substantially lessen any of the projects' significant effects. In addition to the CEQA required No Project Alternative, the alternatives described below are evaluated in Chapter 9, CEQA Alternatives, of this EIR. The Environmentally Superior Alternative is also discussed in Chapter 9.

1.5.1 Continue Water Source to Artificial Wetland at Tesla Portal Site

Under this alternative, the SFPUC would continue to provide a year round water source to the artificial wetland area at the Tesla Portal site. The source of water would change, from existing analyzer equipment to the new analyzer equipment to be located adjacent to the artificial wetland area. The amount of water provided would be roughly the same quantity that currently feeds the wetland area. Under this alternative, all other aspects of the proposed project would be implemented as described in Chapter 3. This alternative would meet the project objectives.

1.5.2 Combine Office/Control Building and UV Building at Tesla Portal Site

This alternative proposes to combine the 3,500-square-foot Office/Control Building and the UV Building in a single, two-story structure at the Tesla Portal site. Under this alternative, the total building footprint would be smaller than the proposed project; however, a two-story structure would be built instead of only one-story structures. All other improvements at the Tesla Portal site as well as the Lawrence Livermore Water Quality Improvements would be implemented as described in Chapter 3. This alternative would meet the project objectives.

1.5.3 Retrofit of Existing Tesla Portal Hypochlorite Station Building

Under this alternative, the SFPUC would retrofit the existing building that contains the Tesla Portal Hypochlorite Station rather than construct a new Chemical Process Building. This alternative would reduce the total building footprint at the Tesla Portal site. The Tesla Portal

facility must be capable of providing disinfection during the retrofit of the building. Consequently, a temporary chemical feed facility would be constructed southeast of the existing building. The Thomas Shaft Chlorination Facility would continue to provide backup disinfection.

All other improvements at the Tesla Portal site as well as the Lawrence Livermore Water Quality Improvements would be implemented as described in Chapter 3.

This alternative would not accommodate the pH adjustment equipment and, therefore, that project objective would not be met, and a building for this equipment may be needed in the future.

1.6 Overview of SFPUC Regional Water System

The proposed project is a component of the SFPUC's WSIP. As a component of the WSIP, it contributes to the impacts that the WSIP, as a program, may have on the environment. To address the potential environmental impacts of the proposed WSIP, the San Francisco Planning Department prepared a Program EIR (PEIR) that was certified by the San Francisco Planning Commission on October 30, 2008 (Motion No. 17734). At a project-level of detail, the PEIR evaluated the environmental impacts of the WSIP and, at a program-level of detail, it evaluated the environmental impacts of the WSIP's facility improvement projects. This section provides background on the SFPUC's water system, and the following sections provide background on the WSIP and the PEIR.

The CCSF, through the SFPUC, owns and operates a regional water system that extends from the Sierra Nevada to San Francisco and serves retail and wholesale customers in San Francisco, San Mateo, Santa Clara, Alameda, and Tuolumne counties. The regional water system consists of water conveyance, treatment, and distribution facilities, and delivers water to retail and wholesale customers. The existing regional system includes over 280 miles of pipelines, over 60 miles of tunnels, 11 reservoirs, five pump stations, and two water treatment plants. The SFPUC currently delivers an annual average of about 265 mgd of water to its customers. The source of the water supply is a combination of local supplies from streamflow and runoff in the Alameda Creek watershed and in the San Mateo and Pilarcitos Creeks watersheds (referred to together as the Peninsula watersheds), augmented with imported supplies from the Tuolumne River watershed. Local watersheds provide about 15 percent of total supplies and the Tuolumne River provides the remaining 85 percent.

The SFPUC serves about one-third of its water supplies directly to retail customers, primarily in San Francisco, and about two-thirds of its water supplies to wholesale customers by contractual agreement. The wholesale customers are largely represented by the Bay Area Water Supply and Conservation Agency, which consists of 27 total customers. Some of these wholesale customers have other sources of water in addition to what they receive from the SFPUC regional system, while others rely completely on the SFPUC for supply.

1.6.1 SFPUC Water System Improvement Program

On October 30, 2008, the SFPUC adopted a regional WSIP (known as the "Phased WSIP Variant") (refer to www.sfwater.org; SFPUC, 2008e). The WSIP would improve the regional

system with respect to water quality, seismic response, water delivery, and water supply to meet water delivery needs in the service area through the year 2018 and would establish level of service goals and system performance

objectives. The proposed program area spans seven counties—Tuolumne, Stanislaus, San Joaquin, Alameda, Santa Clara, San Mateo, and San Francisco.

- The WSIP includes a water supply strategy and modifications to system operations, and construction of a series of facility improvement projects. The proposed project, along with several other facility improvement projects, is a component of the WSIP.[1] The overall goals of the WSIP are to maintain high-quality water; reduce vulnerability to earthquakes; increase delivery reliability and improve the ability to maintain the system; meet customer water supply needs; enhance sustainability in all system activities; and achieve a cost-effective, fully operational system (refer to Table 2-1, WSIP Goals and Objectives). To further these program goals, the WSIP also includes objectives that address system performance in the areas of water quality, seismic reliability, delivery reliability, and water supply through the year 2018. (See SFPUC Resolution No. 08-0200.)

- To address the potential environmental impacts of the WSIP, the San Francisco Planning Department prepared a PEIR, which was certified by the San Francisco Planning Commission on October 30, 2008 (San Francisco Planning Commission Motion No. 17734). At a project-level of detail, the PEIR evaluated the environmental impacts of the WSIP's water supply strategy and, at a program level of detail, it evaluated the environmental impacts of the WSIP's facility improvement projects. The following sections summarize the WSIP and system operation strategy, along with WSIP's impacts and mitigation measures, as identified in the PEIR.

Program Description

- The WSIP involves phased implementation of a water supply strategy to meet projected water demand through 2018. It also includes full implementation of all proposed WSIP facility improvement projects to insure that the public health, seismic safety and delivery reliability goals are achieved as soon as possible.[2] Under the WSIP, the SFPUC established an interim mid-term planning horizon – 2018. Thus, the SFPUC made a decision about providing water supply to its customers through 2018 only, and is deferring a decision regarding long-term water supply after 2018 and through 2030 until it undertakes further water supply planning and demand analysis.

- The WSIP includes the following key program elements:

- Full implementation of all of the 17 proposed WSIP facility improvement projects described in the PEIR.

- Water supply delivery to regional water system customers through 2018 only of 265 mgd average annual target delivery originating from the Tuolumne, Alameda and Peninsula

[1] The proposed project is listed as three separate projects in the WSIP PEIR: the Tesla Portal Disinfection Facility, the Hetch Hetchy Advanced Disinfection, and the Lawrence Livermore Supply Improvements. For purposes of this EIR, these three projects are evaluated as one project given their geographic proximity, construction schedule, and the interrelated function of the two proposed facilities at the Tesla Portal site.

[2] The size and design of the WSIP facility improvement projects are driven by the SFPUC's system performance objectives and would not change as a result of the water supply decision included as part of the WSIP. (SFPUC Resolution No. 08-0200.)

watersheds. This includes 184 mgd for the wholesale customers (including 9 mgd for the cities of San Jose and Santa Clara), and 81 mgd for the retail customers.

- Development of 20 mgd of conservation, recycled water and groundwater within the SFPUC service area (10 mgd in the retail service area and 10 mgd wholesale service area).

- Dry year transfer from Modesto and/or Turlock Irrigation Districts of about 2 mgd coupled with the Westside Groundwater Basin conjunctive-use project to meet the drought year goal of limiting rationing to no more than 20 percent on a systemwide basis.

- Re-evaluation of 2030 demand projections, potential regional water system purchase requests, and water supply options by 2018 and a separate SFPUC decision in 2018 regarding regional water system water deliveries after 2018.

- Financial incentives to limit water sales to an annual average of 265 mgd from the watersheds.

- The WSIP would not provide water supply to meet 300 mgd average annual customer purchase requests in 2030 as proposed under the original WSIP. Rather, under the WSIP, the SFPUC will deliver to customers up to 265 mgd from the SFPUC watersheds on an average annual basis. While average annual deliveries from the SFPUC watersheds would be limited to 265 mgd, such that there would be no increase in diversions from the Tuolumne River to serve additional demand, there would be a small increase in average annual Tuolumne River diversions of about 2 mgd over existing conditions in order to meet delivery and drought reliability goals through 2018.

- The SFPUC must maintain water deliveries to all its customers for the protection of public health and safety. Therefore, the SFPUC will work with its customers to develop financial incentives to limit water sales to an average annual amount of 265 mgd from the watersheds through 2018. With the projected 20 mgd of conservation, recycled water, and groundwater projects, the system would meet average daily demand of 285 mgd in 2018.

WSIP System Operation Strategy

The WSIP also provides a future operating strategy for the regional water system, which addresses the condition of the physical facilities and infrastructure while accounting for factors that affect the system including fluctuating customer demand, meteorological and hydrological conditions, facility and infrastructure capacity and maintenance requirements, and institutional parameters. The operating strategy addresses four components of system operation: water supply and storage, water quality, water delivery, and asset management.

Day-to-day operation of the regional water system under the WSIP would be similar to existing operations, but would provide for additional facility maintenance activities and improved emergency preparedness. This would allow the SFPUC to meet its WSIP objectives and provide for increased system reliability and additional flexibility for scheduling repairs and maintenance. The proposed operations strategy would also include a multistage drought response program. Under the WSIP, regional water system operations would continue to comply with all applicable institutional and planning requirements including complying with all water quality, environmental, and public safety regulations; maximizing the use of water from local watersheds; assigning a higher priority to water delivery over hydropower generation; and meeting all downstream flow requirements.

- ## Summary of Water Supply/Operations Impacts

- The PEIR analyzed potential water supply and system operations impacts within the following geographic regions: the Tuolumne River, Alameda Creek, Peninsula, and Westside Basin groundwater resources systems. The PEIR also identified the cumulative effects of implementing the WSIP and system operations in combination with other past, present, and reasonably foreseeable future projects within each of these watersheds. It also discussed the potential effects of climate change and global warming on the regional water system.

- The WSIP would result in changes in reservoir levels and associated changes in downstream flows in rivers and creeks in the three affected watersheds, potentially resulting in groundwater, water quality, fisheries, and terrestrial biological resource impacts. In the event that deliveries to customers exceed 265 mgd, streamflow changes in the Tuolumne River watershed could affect fisheries and terrestrial biological resources. In the Alameda Creek and Peninsula watersheds, the WSIP, which includes restoring the historical storage capacities of Calaveras and Lower Crystal Springs Reservoirs, could affect reservoir levels, downstream flows, fisheries, and terrestrial biological resources. In addition, similar to the originally proposed WSIP, the WSIP will develop groundwater supplies in the North Westside Groundwater Basin as well as a conjunctive-use program in the South Westside Groundwater Basin.

The following list summarizes the WSIP impacts identified in the PEIR that are potentially significant but mitigable; potentially significant and unavoidable; and significant and unavoidable. As set forth in the PEIR, the San Francisco Planning Department has determined the potential environmental impacts on all resources not listed below would be less than significant and no mitigation measures would be required. (Refer to Chapter 6 and Appendix B.1 for further discussion of the WSIP water supply impact analysis).

Potentially Significant But Mitigable WSIP Water Supply Impacts

- Fisheries Resources: Tuolumne River; (below La Grange Dam, only when average annual deliveries from the watersheds exceed 265 mgd); Alameda Creek
- Terrestrial Biological Resources: Tuolumne River (below La Grange Dam, only when average annual deliveries from the watersheds exceed 265 mgd; and impacts on alluvial features that support meadow and riparian habitat from O'Shaughnessy Dam to Don Pedro Reservoir); Calaveras Reservoir; Alameda Creek; Calaveras Creek; Upper and Lower Crystal Springs Reservoir
- Groundwater: Pumping overdraft; change in water levels in Lake Merced and other surface water features; seawater intrusion due to decreased groundwater levels; contamination of drinking water

Potentially Significant and Unavoidable WSIP Water Supply Impacts

- Fisheries: Upper and Lower Crystal Springs Reservoir
- Growth Inducement: SFPUC Service Area

Significant and Unavoidable WSIP Water Supply Impacts

- Streamflow: Alameda Creek below Alameda Creek Diversion Dam

Alternatives to the WSIP

The PEIR evaluated seven alternatives to the WSIP, listed below, because of their apparent ability to meet most of the WSIP's goals, their ability to reduce one or more of the potentially significant impacts associated with program implementation, their potential feasibility, and their collective ability to provide a reasonable range of alternatives to foster informed decision-making and public participation. Analysis of the No Program Alternative is included as required by CEQA. Section 9.2 in the Alternatives chapter and Appendix B.3 present a more detailed summary of these alternatives.

- No Program Alternative: The SFPUC would implement only those facility improvement projects driven by regulatory requirements or existing agreements with regulatory agencies.
- No Purchase Request Increase Alternative: The SFPUC would serve wholesale customers only the amount of water required under the existing Master Water Sales Agreement between CCSF and each of the wholesale customers.

- Aggressive Conservation/Water Recycling and Local Groundwater Alternative: The SFPUC would implement all of the proposed WSIP projects, but would endeavor to accommodate increased customer purchase requests only through additional conservation, water recycling, and local groundwater projects.

- Lower Tuolumne River Diversion Alternative: The SFPUC would implement all of the proposed WSIP projects, but would serve the projected increase in customer purchase requests through 2030 through diversions from the lower Tuolumne River.

- Year-round Desalination at Oceanside Alternative: The SFPUC would implement all of the proposed WSIP projects and would construct a 25-mgd desalination plant in San Francisco to serve the projected increase in customer purchase requests through 2030.

- Regional Desalination for Drought Alternative: The SFPUC would implement all of the proposed WSIP projects and would partner with other Bay Area water agencies to construct and operate a regional desalination plant that would provide the SFPUC with supplemental supply during drought years.

- Modified WSIP Alternative: The SFPUC would implement all of the proposed WSIP projects, but would modify proposed system operations to minimize environmental effects.

- The adopted WSIP (see SFPUC Resolution No. 08-0200) incorporates elements of three alternatives: the No Purchase Request Alternative, the Aggressive Conservation/Water Recycling and Groundwater Alternative, and the Modified WSIP Alternative.

- CEQA also requires the identification of an environmentally superior alternative from among the proposed project and the set of alternatives evaluated. The Draft PEIR identified the Modified WSIP Alternative as the environmentally superior alternative for the 2030 planning horizon because it would reduce key impacts of the originally proposed WSIP on natural resources along the lower Tuolumne River, in Alameda and Pilarcitos Creeks, and in/around Crystal Springs and Pilarcitos Reservoirs, but it would continue to meet the WSIP's primary goals and objectives. Like the adopted WSIP (known as the "Phased WSIP Variant" in the Final PEIR), the Modified WSIP Alternative would maximize the use of existing facilities and the largely gravity-driven system without also requiring the construction of additional major facilities called for under many other alternatives, or substantially increasing the energy demand of the system or need for pumping. The Modified WSIP Alternative would have more impacts on the upper Tuolumne River, and possibly less on the Lower Tuolumne River. The adopted WSIP is substantially similar to the Modified WSIP Alternative in that it includes essentially the same elements through 2018.

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
Land Use and Visual Quality			
Impact 4.3-5: Permanent adverse impacts on scenic vistas or scenic resources	Tesla Portal: PSM Thomas Shaft: N/A	Mitigation Measure 4.3-5a – Architectural Design: The design of the proposed buildings at the Tesla Treatment Facility shall consider the existing visual character of the site and surrounding area, including the visibility of facilities and related structures from I-580. Proposed buildings shall be designed to minimize the intrusion of structures into the natural setting of the site by using colors that are compatible with the existing architecture and visual character of the site.	Tesla Portal
		Mitigation Measure 4.3-5b – Landscape Screens: In addition to revegetation of disturbed areas per SFPUC Standard Construction Measure #10 and Mitigation Measure 4.6-2, new plantings and/or a landscape berm shall be required to screen views of new structures and equipment from I-580 (a designated state scenic highway) to the extent possible, provided that such landscaping does not affect security of SFPUC facilities.	Tesla Portal
Geology and Soils			
Impact 4.4-9: Expansive or corrosive soils	Tesla Portal: PSM Thomas Shaft: PSM	Mitigation Measure 4.4-9 – Characterize Extent of Expansive and Corrosive Soil: If the screening analysis conducted in accordance with SFPUC Standard Construction Measure #2 identifies a potential for expansive or corrosive soils, the site-specific geotechnical investigation shall include a characterization of the presence and extent of expansive and corrosive soil at the project sites. The results and recommendations of the investigation shall be incorporated into the final project design for the Tesla Treatment Facility. For the Lawrence Livermore Water Quality Improvements, prior to construction, the SFPUC shall obtain soil samples for testing of corrosive/expansive soils and use to adjust the final project design of the pipeline, or, alternatively, the SFPUC shall implement a conservative design approach of the pipeline which shall address potential corrosivity.	Tesla Portal and Thomas Shaft
Biological Resources			
Impact 4.6-1: Impacts on wetlands and aquatic resources (construction-related impacts) and Impact 4.6 4: Impacts on	Tesla Portal: PSM Thomas Shaft: N/A	Mitigation Measure 4.6-1a – Participate in the SJMSCP: Prior to the commencement of construction activities, SFPUC shall coordinate with the Joint Powers Authority (JPA)/ Technical Advisory Committee (TAC), implement relevant ITMMs for applicable species (as identified in Mitigation Measures 4.6-3b through 4.6-3l) and pay any necessary fees to fund offsite compensation under the terms of the SJMSCP to provide replacement values	Tesla Portal and Thomas Shaft

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SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
wetlands and aquatic resources (operational impacts)		that are equal to that of the permanent loss of 3.2 acres of California annual grasslands and 0.01 acre of ruderal/disturbed land, and temporary impacts to 11.72 acres of California annual grassland and 0.96 acre of ruderal/disturbed land, and incidental take authorization for special-status species. Mitigation Measure 4.6-1b – Implement Best Management Practices to Protect the Artificial Wetland and Ephemeral Drainage: SFPUC shall implement Best Management Practices to ensure that natural flow is maintained in the ephemeral drainage during and after construction of the pipeline at the ephemeral drainage. Natural flow will be maintained by restricting construction to the dry season (e.g., April 15 – October 15) or by diverting water around the construction area (e.g., a dam and a pump) or through the construction area (e.g., a culvert) in the ephemeral drainage during the wet season (e.g., October 16 – April 14). The drainage channel will be restored and recontoured to pre-existing conditions after construction. In addition, prior to the start of staging, ground disturbing activities, or large-scale materials off-haul or delivery, SFPUC shall require the contractor to implement the following actions intended to avoid or reduce indirect and direct impacts on the ephemeral drainage at the Tesla Portal site. • SFPUC or its contractor(s) shall install appropriate erosion control (e.g., certified weed free straw bales, silt fencing, straw wattles, erosion and sediment control fabric) at the pipeline crossing and the intersections of the road and the ephemeral drainage to minimize potential for increased sedimentation and turbidity. • SFPUC shall prohibit its contractor(s) from refueling, washing, and repairing equipment in and near (i.e., within at least 25 feet) the ephemeral drainage at the Tesla Portal project site. • SFPUC shall require fencing of the artificial wetland and ephemeral drainage (e.g., temporary construction "orange mesh" fencing or silt fencing) adjacent to the footprint of the pipeline crossing and the access road crossing, and shall require signage to be placed at the sites indicating that it is a restricted area. SFPUC shall require its contractor(s) to stay out of the fenced and signed area. SFPUC shall require its	Tesla Portal

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		contractor(s) to limit vehicle speeds to 15 mph on unpaved roads in the vicinity of the fenced areas of the artificial wetland and ephemeral drainage to prevent dust effects. SFPUC shall also require its contractor(s) to control dust (i.e., stabilization of dust emissions using water or chemical stabilizer/suppressant) along the existing access road leading to the Tesla Portal project site (including the area at the intersection with the artificial wetland), as required to control dust (refer also to Mitigation Measure 4.9-1a, SJVAPCD Dust Control Measures).	
Impact 4.6-2: Impacts to sensitive habitats, common habitats, and heritage trees	Tesla Portal: PSM Thomas Shaft: LS	Mitigation Measure 4.6-2 – Return Site to Pre-Construction Condition: Vegetation removal and soil disturbance shall be limited to the minimum amount necessary for project implementation, especially where the existing access road comes near the artificial wetland, and where the proposed pipeline would cross both the artificial wetland and the ephemeral drainage. Where soils are disturbed and/or vegetation removed on the project site, such as in the construction staging area, the site shall be returned to pre-project conditions (i.e., return site contours to pre-project profiles, restore original grades where possible, lightly compact loose soils or aerate compacted soils) where necessary. Where grading occurs, 12 inches of topsoil shall be salvaged and respread in graded areas as appropriate. When natural vegetation is disturbed, small areas (e.g., less than 100 square feet in size) shall be allowed to re-vegetate passively, while larger disturbed areas (e.g., more than 100 square feet in size or in areas prone to erosion such as sloped areas) shall be re-seeded with locally available native grasses and forbs (as needed).	Tesla Portal
Impact 4.6-3: Impacts on special-status species, direct mortality and/or habitat effects	Tesla Portal: PSM Thomas Shaft: PSM	Mitigation Measure 4.6-3a – Worker Awareness Program: Prior to the commencement of construction activities, a qualified biologist shall conduct a worker awareness program (environmental education) to inform project workers of the sensitive habitat and species potentially found onsite and their responsibilities with regards to protecting those sensitive biological resources.	Tesla Portal and Thomas Shaft
		Mitigation Measure 4.6-3b – Conduct Pre-Construction Surveys for San Joaquin Whipsnake and California Horned Lizard: Prior to the start of construction, a qualified biologist shall conduct San Joaquin whipsnake surveys, and surveys for California horned lizard. These species are of very limited distribution within San Joaquin County, primarily isolated locations outside of anticipated development areas. Therefore, if discovered on a	Tesla Portal and Thomas Shaft

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		project site and prior to ground disturbance, ITMMs shall be formulated by the SJMSCP TAC and approved by the San Joaquin Council of Governments (SJCOG) with the concurrence of the Permitting Agencies' representatives on the TAC. ITMMs may consist of preconstruction surveys, avoidance techniques and/or buffer areas.	
		Mitigation Measure 4.6-3c – Implement Incidental Take Minimization Measures for San Joaquin Kit Fox: SFPUC shall implement the ITMMs identified for the San Joaquin kit fox under the SJMSCP to reduce the level of impact on the San Joaquin kit fox. Mitigation measures defined by the SJMSCP and the USFWS to protect the San Joaquin kit fox include the following: • A qualified biologist with demonstrated experience in kit fox biology, identification, and survey techniques shall conduct preconstruction surveys two calendar weeks to 30 calendar days prior to commencement of ground disturbance. Surveys shall be conducted by qualified biologists. When surveys identify potential dens (potential dens are defined as burrows at least four inches in diameter which open up within two feet), potential den entrances shall be dusted for three calendar days to register track of any San Joaquin kit fox present. If no San Joaquin kit fox activity is identified, potential dens may be destroyed. • If San Joaquin kit fox activity is identified, then dens shall be monitored to determine if occupation is by an adult fox only or is a natal den (natal dens usually have multiple openings). If the den is occupied by an adult only, the den may be destroyed when the adult fox has moved or is temporarily absent. If the den is a natal den, a buffer zone of 250 feet shall be maintained around the den until the biologist determines that the den has been vacated. • Where San Joaquin kit fox are identified, the provisions of the U.S. Fish and Wildlife Service's published "Standardized Recommendations for Protection of the San Joaquin kit fox Prior to or During Ground Disturbance" shall apply (except that preconstruction survey protocols shall remain as established in this paragraph). These standards include provisions for educating construction workers regarding the kit fox, keeping heavy equipment operating at safe speeds, checking construction pipes for kit fox occupation during construction and similar low or no-cost activities.	Tesla Portal and Thomas Shaft

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		Mitigation Measure 4.6-3d – Conduct Pre-Construction Surveys to Determine Presence/Absence of San Joaquin Pocket Mouse: Prior to the start of construction activities, a qualified biologist shall conduct surveys to determine the presence or absence of San Joaquin pocket mouse. If the species is not found, then no other mitigation is required. If the species is found in or near potential work areas, the SFPUC will coordinate with the SJMSCP TAC to formulate avoidance measures, such as buffer areas and limiting the time and extent of construction activities.	Tesla Portal and Thomas Shaft
		Mitigation Measure 4.6-3e – Breeding Season Surveys: Measures to avoid and minimize impacts on the western burrowing owl will be implemented as described below: • If project schedule permits, a qualified biologist will survey for burrows and burrowing owls during the breeding season (February 1 to August 31), immediately preceding construction. Surveys will be conducted within 500 feet of the project boundary (access permitting) in accordance with the California Burrowing Owl Consortium (1993) guidelines or as otherwise determined by CDFG. Burrows would be inspected for signs of owl activity (tracks, pellets, feathers, etc.). The locations of burrowing owl sightings, occupied burrows, and burrows with signs of owl activity will be marked on a map of the project area at a scale sufficient to accurately show the distance of active burrows to the limits of construction. Surveys will be conducted on at least four separate dates during the breeding season in areas where suitable burrows are present. If possible, surveys will be conducted during the peak of the burrowing owl breeding season, generally between April 15 and July 15. • If occupied owl burrows are found within the survey area, a determination will be made by a qualified biologist, in consultation with CDFG, as to whether work will affect the occupied burrows or disrupt reproductive behavior. • If it is determined that construction will not affect occupied burrows or disrupt breeding behavior, construction will proceed without any restrictions or mitigation measures.	Tesla Portal
		Mitigation Measure 4.6-3f – Winter Surveys: Measures to avoid and minimize impacts on the western burrowing owl will be implemented as described below:	Tesla Portal

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		• If birds are not observed during breeding season surveys, or if breeding season surveys are infeasible due to project scheduling, or if construction will occur during the wintering season, a winter survey will be conducted to identify non-breeding residents of the project site. Winter surveys will be conducted within 500 feet of the project site (access permitting) or as otherwise determined by CDFG during the period when wintering owls are most likely to be present (December 1 to January 31). The locations of burrowing owl sightings, occupied burrows, and burrows with signs of owl activity will be marked on a map of the project area at a scale sufficient to accurately show the distance of active burrows to the limits of construction. • If occupied owl burrows are found within the survey area, a determination will be made by a qualified biologist, in consultation with CDFG, as to whether or not work will affect the occupied burrows. • If it is determined that construction will not affect occupied burrows, construction will proceed without any restrictions or mitigation measures. • If it is determined that construction will affect occupied burrows, the subject owls will be passively relocated from the occupied burrow(s) using one-way doors prior to the onset of breeding season. Owls will be encouraged to relocate to alternate burrows that are at least 160 feet from the construction limits. One alternate natural or artificial burrow for each burrow excavated will be in place at least one week before one-way doors are installed on occupied burrows. One-way doors will be in place for a minimum of 48 hours before burrows are excavated. <u>Mitigation Measure 4.6-3g – Fall Surveys</u>: Measures to avoid and minimize impacts on the western burrowing owl will be implemented as described below: • If surveys must be conducted between September 1 and November 30 (which is outside of the time windows specified above), a qualified biologist will conduct a survey for burrows and burrowing owls no more than thirty (30) days prior to ground-disturbing activity. If necessary, resident owls will be passively relocated from occupied burrows, as described above. If construction activities are still ongoing beyond November 30, then winter surveys will be conducted during December and January.	Tesla Portal

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		Mitigation Measure 4.6-3h – Conduct Pre-Construction Surveys for Swainson's Hawk: A qualified biologist shall conduct a preconstruction survey for Swainson's hawk, prior to the commencement of any ground disturbing construction activities (e.g., grass/vegetation/brush/tree removal, soil excavation, grading, vehicle access, staging of materials or vehicles, large scale materials off-haul or delivery, construction of temporary or permanent access roads). In the case that Swainson's hawks are found nesting in the area, the SFPUC will notify CDFG. At a minimum the following mitigations regarding Swainson's hawk, as listed from the SJMSCP, will be implemented: • If a nest tree becomes occupied during construction activities, then all construction activities shall remain a distance of two times the dripline of the tree, measured from the nest. • If any nest trees need to be removed, they may be removed between September 1 and February 15, when the nests are unoccupied. The following two measures will also be implemented: • If any unoccupied nests are found during preconstruction surveys, these nests may be removed when the nests are unoccupied. • If any occupied nests are found during preconstruction surveys, then all construction activities shall remain at a distance of ¼ mile (1,320 feet), unless CDFG agrees to other equally effective measures (e.g., monitor occupied nest during construction in the buffer zone, limit hours of construction, restrict construction activities, etc).	Tesla Portal
		Mitigation Measure 4.6-3i – Implement Incidental Take Minimization Measures for White-Tailed Kite: SFPUC shall implement the ITMM identified for the white-tailed kite under the SJMSCP, which consists of the following: • A qualified biologist shall conduct preconstruction surveys and investigate all potential nesting trees on the project site (e.g., especially tree tops 15-59 feet above the ground in oak, willow, eucalyptus, cottonwood, or other deciduous trees), during the nesting season (February 15 to September 15) whenever white-tailed kites are noted on site or within the vicinity of the project site during the nesting season.	Tesla Portal and Thomas Shaft

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		• If the species is found nesting, a setback of 100 feet from nesting areas shall be established and maintained during the nesting season for the period encompassing nest building and continuing until fledglings leave nests, unless CDFG agrees to other equally effective measures (e.g., monitor occupied nest during construction in the buffer zone, limit hours of construction, restrict construction activities, etc.) and CDFG shall be notified of the proposed buffer zone. This setback applies whenever construction or other ground-disturbing activities must begin during the nesting season in the presence of nests which are known to be occupied. Setbacks shall be marked by brightly colored temporary fencing.	
		Mitigation Measure 4.6-3j – Implement Incidental Take Minimization Measures for California Horned Lark and Northern Harrier: SFPUC shall implement the ITMM identified for the California horned lark and northern harrier under the SJMSCP, which consists of the following: • A qualified biologist shall conduct a preconstruction survey and investigate all potential nesting trees to determine the presence or absence of the species on the project site. • If species are found, a setback of 500 feet from nesting areas shall be established and maintained during the nesting season (February 16 – August 31) for the period encompassing nest building and continuing until fledglings leave nests, unless CDFG agrees to other equally effective measures (e.g., monitor occupied nest during construction in the buffer zone, limit hours of construction, restrict construction activities, etc.), or offsite compensation shall be provided, and CDFG shall be notified of the proposed buffer zone. If a setback is used, this setback would apply whenever construction or other ground-disturbing activities must begin during the nesting season in the presence of nests which are known to be occupied. Setbacks shall be marked by brightly colored temporary fencing.	Tesla Portal and Thomas Shaft
		Mitigation Measure 4.6-3k – Conduct Pre-Construction Surveys for Golden Eagle: Prior to the start of construction, a qualified biologist shall conduct golden eagle surveys as required by the SJMSCP. Additionally, SFPUC shall implement the ITMM identified for the golden eagle under the SJMSCP, which consists of the following:	Tesla Portal and Thomas Shaft

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		• When a site inspection indicates the presence of a nesting golden eagle, CDFG will be notified and a setback of 500 feet from the nesting area shall be established and maintained during the nesting season (normally approximately February 1 – June 30) for the period encompassing nest building and continuing until fledglings leave nests, unless CDFG agrees to other equally effective measures (e.g., monitor occupied nest during construction in the buffer zone, limit hours of construction, restrict construction activities, etc.). This setback applies whenever construction or other ground-disturbing activities must begin during the nesting season in the presence of nests which are known to be occupied. Setbacks shall be marked by brightly colored temporary fencing.	
		Mitigation Measure 4.6-3l – Conduct Pre-Construction Surveys for Ferruginous Hawk and Prairie Falcon: Prior to the start of construction, a qualified biologist shall conduct surveys for ferruginous hawk and prairie falcon as required by the SJMSCP. These species currently do not nest in San Joaquin County and are not expected to nest in the County over the life of the SJMSCP. Therefore, in the highly unlikely event that one of these species is found nesting on a project site, SFPUC shall notify CDFG of the proposed buffer zone and a setback of 500 feet from the nesting area shall be established and maintained for the period encompassing nest building and continuing until fledglings leave the nests, unless CDFG agrees to other equally effective measures. ITMMs shall be formulated prior to ground disturbance by the TAC and approved by the JPA with the concurrence of the Permitting Agencies' representatives on the TAC in accordance with the SJMSCP's Adaptive Management Plan. ITMMs may consist of preconstruction surveys, avoidance techniques, and buffer areas.	Tesla Portal and Thomas Shaft
Cultural Resources			
Impact 4.7-1: Potential to disturb or destroy paleontological resources.	Tesla Portal: PSM Thomas Shaft: PSM	Mitigation Measure 4.7-1a – Paleontological Monitoring During Excavation: The SFPUC shall retain a qualified professional paleontologist to monitor excavations starting at the depth of 10 feet deep during construction at the Tesla Portal site for paleontological resources. Monitoring shall continue at the Tesla Portal site until the supervising qualified paleontologist determines that no native sediments are present or that significant paleontological resources are not likely to be discovered.	Tesla Portal

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		Mitigation Measure 4.7-1b Suspend Construction Work if Paleontological Resource is Identified: This mitigation measure builds on SFPUC Construction Measure #9 for cultural resources, which requires that construction work will be suspended immediately if there is any indication of a paleontological resource. When a paleontological resource (fossilized invertebrate, vertebrate, plant or micro-fossil) is discovered at any of the project sites, an appointed representative of the SFPUC will notify a qualified paleontologist, who will document the discovery as needed, evaluate the potential resource, and assess the significance of the find under the criteria set forth in Section 15064.5 of the CEQA Guidelines. When a fossil is found during construction, excavations within 50 feet of the find will be temporarily halted or diverted until the discovery is examined by a qualified paleontologist, in accordance with Society of Vertebrate Paleontology standards (Society of Vertebrate Paleontology, 1995). The paleontologist will notify the SFPUC to determine procedures to be followed before construction is allowed to resume at the location of the find. If the SFPUC determines that avoidance is not feasible, the paleontologist will prepare an excavation plan for mitigating the effects of the project.	Tesla Portal and Thomas Shaft
Impact 4.7-2: Potential to disturb or destroy unknown prehistoric archaeological resources or human remains.	Tesla Portal: PSM Thomas Shaft: PSM	Mitigation Measure 4.7-2a – Accidental Archaeological Discovery: SFPUC Standard Construction Measure #9 for cultural resources requires that construction activities be suspended immediately if there is any indication of an archaeological resource. To avoid any potential adverse effect from the proposed project on accidentally discovered buried or submerged historical resources as defined in CEQA Guidelines Section 15064.5(a)(c), the SFPUC shall distribute the Planning Department archaeological resource "ALERT" sheet to the project prime contractor; to any project subcontractor (including demolition, excavation, grading, foundation, pile driving, etc. firms); or utilities firm involved in soil disturbing activities within the project site. Prior to any soil disturbing activities being undertaken, each contractor is responsible for ensuring that the "ALERT" sheet is circulated to all field personnel including, machine operators, field crew, pile drivers, supervisory personnel, etc. The SFPUC shall provide the Environmental Review Officer (ERO) with a signed affidavit from the responsible parties (prime contractor, subcontractor(s), and utilities firm) confirming that all field personnel have received copies of the "ALERT" sheet.	Tesla Portal and Thomas Shaft

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		Should any indication of an archaeological resource be encountered during any soils disturbing activity of the project, the contractor and/or the SFPUC will immediately notify the ERO and will immediately suspend any soils disturbing activities within 100 feet of the discovery until the ERO has determined what additional measures should be undertaken. If the ERO determines that an archeological resource may be present within the project site, the SFPUC shall retain the services of a qualified archeological consultant. The archeological consultant shall advise the ERO as to whether the discovery is an archeological resource that retains sufficient integrity, and is of potential scientific/historical/cultural significance. If an archeological resource is present, the archeological consultant shall identify and evaluate the archeological resource. The archeological consultant shall make a recommendation as to what action, if any, is warranted. Based on this information, the ERO may require, if warranted, specific additional measures to be implemented by the SFPUC. Measures might include: preservation in situ of the archeological resource; an archaeological monitoring program; or an archeological evaluation program. If an archaeological monitoring program or archeological evaluation program is required, it shall be consistent with the MEA WSIP Archaeological Guidance (San Francisco Planning Department, 2008a) for such programs. The ERO may also require that the SFPUC immediately implement a site security program if the archeological resource is at risk from vandalism, looting, or other damaging actions. The project archeological consultant shall submit an accidental discovery Archaeological Data Recovery Report (ADRR) to the ERO, which, in addition to the usual contents of the ADRR, includes an evaluation of the historical significance of any discovered archeological resource, as well as describing the archeological and historical research methods employed in the archeological monitoring/data recovery program(s) undertaken, and presenting, analyzing, and interpreting the recovered data. Information that may put at risk any archeological resource shall be provided in a separate removable insert within the final report. Once approved by the ERO, copies of the ADRR shall be distributed as follows: the relevant California Historical Resources Information System Information Center shall receive one (1) copy and the ERO shall receive a copy of the transmittal letter of the	

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		ADRR to the Information Center. The MEA shall receive three copies of the ADRR along with copies of any formal site recordation forms (CA DPR 523 series) and/or documentation for nomination to the National Register of Historic Places/California Register of Historical Resources. The SFPUC shall receive copies of the ADRR in the number requested. In instances of high public interest in or the high interpretive value of the resource, the ERO may require a different final report content, format, and distribution than that presented above.	
		Mitigation Measure 4.7-2b – Treatment of Human Remains: The treatment of human remains and of associated or unassociated funerary objects discovered during any soils disturbing activity shall comply with applicable State laws. This shall include immediate notification of the San Joaquin County Coroner and in the event of the coroner's determination that the human remains are Native American, notification of the California State Native American Heritage Commission (NAHC) who shall appoint a Most Likely Descendant (MLD) (Public Resources Code Section 5097.98). The archaeological consultant, SFPUC, and MLD shall make all reasonable efforts to develop an agreement for the treatment of, with appropriate dignity, human remains and associated or unassociated funerary objects (CEQA Guidelines Section 15064.5(d)). The agreement should take into consideration the appropriate excavation, removal, recordation, analysis, custodianship, curation, and final disposition of the human remains and associated or unassociated funerary objects. California Public Resources Code allows 24 hours to reach agreement on these matters. If the MLDs and the other parties do not agree on the reburial method, the project will follow Section 5097.98(b) of the California Public Resources Code which states, "the landowner or his or her authorized representative shall reinter the human remains and items associated with Native American burials with appropriate dignity on the property in a location not subject to further subsurface disturbance."	Tesla Portal and Thomas Shaft
Impact 4.7-3: Potential to cause a substantial adverse change in the significance of a historical resource.	Tesla Portal: PSM Thomas Shaft: LS	Mitigation Measure 4.7-3 – Architectural Resources Protection Plan: The SFPUC shall retain a qualified historian to prepare a plan that specifies procedures for protecting historical resources at the Tesla Portal site during construction activities. The plan shall include a monitoring method to be employed by the construction contractor while working near these resources. At a minimum, the plan shall address the operation of construction	Tesla Portal

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		equipment near or adjacent to the historical resource, storage of construction materials away from the resource, and education/training of construction workers about the significance of the historical resources. The plan shall also require the construction of a temporary protective barrier around the Southwest Valve House, such as construction fencing and/or vertical and horizontal netting to prevent physical damage to the valve house.	
Air Quality			
Impact 4.9-1: Construction emissions of criteria pollutants	Tesla Portal: PSM Thomas Shaft: PSM	Mitigation Measure 4.9-1a – SJVAPCD Dust Control Measures: The following applicable general San Joaquin Valley Air Pollution Control District (SJVAPCD) recommended mitigation measures will be implemented to reduce emissions of fugitive PM_{10} dust from construction activities at both project sites, as specified in the Guide to Assessing and Mitigating Air Quality Impacts (GAMAQI), and in accordance with Regulation VIII Rules addressing construction (Rules 8011, 8021, 8031, 8041, 8051, 8061, and 8071). *SJVAPCD Regulation VIII Basic Control Measures:* • Adhere to the recordkeeping requirements specified in Rule 8011 (Section 6.2) for days that control measures are implemented. • Submit a Dust Control Plan (form available from SJVAPCD) in accordance with Rule 8021. • All disturbed areas, including storage piles that are not being actively utilized for construction purposes, shall be effectively stabilized of dust emissions using water, chemical stabilizer/suppressant, covered with a tarp or other suitable cover, or vegetative ground cover in accordance with Rule 8031. • All onsite unpaved access roads shall be effectively stabilized of dust emissions using water or chemical stabilizer/suppressant in accordance with Rule 8031. • All land clearing, grubbing, scraping, excavation, land leveling, grading, cut and fill, and demolition activities shall be effectively controlled of fugitive dust emissions utilizing application of water or by presoaking in accordance with Rule 8021. • Limit Visible Dust Emissions (VDE) to 20% opacity by applying water or chemical/organic stabilizers/suppressants or construct and maintain wind barriers	Tesla Portal and Thomas Shaft

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		sufficient to limit VDE to 20% opacity. If utilizing wind barriers, water or chemical suppressants shall also be implemented. • When materials are transported offsite, all material shall be covered, or effectively wetted to limit visible dust emissions, and at least 6 inches of freeboard space from the top of the container shall be maintained in accordance with Rule 8031. • All operations shall limit or expeditiously remove the accumulation of mud or dirt from adjacent public streets at the end of each workday. The use of dry rotary brushes is expressly prohibited except where preceded or accompanied by sufficient wetting to limit the visible dust emissions. Use of blower devices is expressly forbidden in accordance with Rule 8041. • Following the addition of materials to, or the removal of materials from, the surface of outdoor storage piles, said piles shall be effectively stabilized of fugitive dust emissions utilizing sufficient water or chemical stabilizer/suppressant in accordance with Rule 8031. • A trackout control device shall be installed and maintained at all access points to paved public roads or a carryout and trackout prevention procedure, which as been demonstrated to the satisfaction of the APCO and U.S. EPA, shall be implemented in accordance with Rule 8041. • Trackout shall be immediately removed when it extends 50 or more feet from the nearest unpaved surface exit point of the site and at the end of each workday in accordance with Rule 8041. *SJVAPCD Enhanced Control Measures* • Traffic speeds on unpaved roads shall be limited to 15 mph and speed limit signs shall be posted in accordance with Rule 8021, Section 5.3.	
		Mitigation Measure 4.9-1b – SJVAPCD Exhaust Control Measures: The following mitigation measures will be implemented during construction of the proposed project to reduce exhaust emissions: *(1) SJVAPCD Guide to Assessing and Mitigating Air Quality Impacts Mitigation Measures:* To limit exhaust emissions within the San Joaquin Region, the SJVAPCD specifies the	Tesla Portal and Thomas Shaft

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		following exhaust controls for heavy-duty equipment (scrapers, graders, trenchers, earthmovers, etc.). The SFPUC will include these measures, where feasible and applicable, in contract specifications: • Idling time (e.g., 5-minute maximum) shall be minimized. • The hours of operation of heavy-duty equipment and/or the amount of equipment in use shall be limited. • Activity management (e.g., rescheduling activities to reduce short-term impacts) shall be implemented. *(2) Regulation IX – Mobile and Indirect Sources, Rule 9510 Mitigation Measures:* Rule 9510 applies to any project subject to discretionary approval by a public agency that ultimately results in the construction of a new building, facility, or structure or reconstruction of a building, facility, or structure for the purpose of increasing capacity or activity and also involving 9,000 square feet of space. Rule 9510 requires exhaust emissions for construction equipment greater than 50 horsepower used or associated with a development project to be reduced by the following amounts from the statewide average as estimated by the California Air Resources Board (CARB): • 20% of the total NO_X emissions • 45% of the total PM_{10} exhaust emissions An applicant may reduce construction emissions on site by using less polluting construction equipment, which can be achieved by utilizing add-on controls, cleaner fuels, or newer lower emitting equipment. The requirements listed above can also be met through the payment of an offsite emissions reduction fee. The following mitigation measures will be selectively applied to achieve compliance with the emission reductions set forth by Rule 9510: • Selected construction equipment with engines equal to or greater than 50 horsepower will: o Be equipped with Tier 2 diesel engines as defined in Title 13, CCR, §2423 o Must be equipped with verified Level 3 (at least 85% reduction of PM from the baseline emission level) Diesel Emission Control Strategies as defined in	

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		Title 13, CCR, §2700 through 2710 • All construction vehicles will undergo monthly maintenance. Preventive maintenance includes complying with the manufacturer's service recommendations, using recommended types of fuel, maintaining proper fluid levels (such as oil, coolant, brake, and transmission), ensuring proper tire pressure, working signals, lights (including headlamps, turn-signal lights, tail lights, and brake lights), and brakes.	
Noise and Vibration			
Impact 4.10-1: Disturbance from temporary construction-related noise increases	Tesla Portal: PSM Thomas Shaft: LS	Mitigation Measure 4.10-1 – Vacate SFPUC Caretaker's Residence at the Tesla Portal Site: The SFPUC caretaker's residence at Tesla Portal shall be vacated during hours when construction activities at the site would produce daytime sound levels in excess of the speech interference criterion (an exterior noise level of 70 dBA) or nighttime sound levels in excess of the sleep interference criterion (an exterior noise level of 60 dBA).	Tesla Portal
Impact 4.10-3: Disturbance due to construction-related vibration	Tesla Portal: PSM Thomas Shaft: N/A	Mitigation Measure 4.10-2 – Maintain Structural Integrity of San Joaquin Pipelines The construction contractor shall perform construction (cutting and connecting a new manifold) at the tie-in of the proposed UV Building to San Joaquin Pipelines 1 and 2 in to maintain the structural integrity of the pipelines.	Tesla Portal
Energy Resources			
Impact 4.14-2: Long-term energy use during operation	Tesla Portal: PSM Thomas Shaft: PSM	Mitigation Measure 4.14-1 – Incorporate Energy Efficiency Measures: Consistent with the Energy Action Plan II priorities for reducing energy usage, the SFPUC shall ensure that energy efficient equipment is used in the proposed project at the Tesla Portal and the Thomas Shaft sites. A repair and maintenance plan shall also be prepared for each facility to minimize power use. Cooling, heating and ventilation rates will meet the standards of the American Society of Heating, Refrigeration and Air-Conditioning Engineers, California Building Code and the California Building Energy Efficiency Code. All ductwork will comply with Sheet Metal and Air Conditioning Contractors' National Association objectives. The SFPUC shall also include the use of renewable energy, such as solar power, at the Tesla Treatment Facility.	Tesla Portal and Thomas Shaft
Cumulative Effects – Traffic	Tesla Portal: PSM	Mitigation Measure 4.15-1a – SFPUC WSIP Project Construction Coordinator: Due to the	Tesla Portal and

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
	Thomas Shaft: PSM	potential for overlapping project activities in the western side of the SFPUC San Joaquin Region near the project sites, and the potential for construction vehicles to affect travel within and across different WSIP regions, the SFPUC shall identify a qualified construction coordinator responsible for coordinating project-specific traffic control plans, and for developing a public information campaign (e.g., internet website, radio and newspaper updates) to inform the public of construction activities, detour routes, and alternate routes. Throughout the seven-year construction schedule for the San Joaquin WSIP projects, the SFPUC construction coordinator shall work with local and regional agencies to pursue additional traffic mitigation measures to minimize local and regional traffic impacts and will incorporate these measures into the project-specific traffic control plans, as appropriate.	Thomas Shaft
		Mitigation Measure 4.15-1b – Combined San Joaquin Regional Traffic Control Plan: Due to the potential for overlapping project schedules in the San Joaquin Region near the project sites, the SFPUC will develop, or the SFPUC's construction contractor(s) shall be required to develop, a San Joaquin Regional Traffic Control Plan. This plan will coordinate the project-specific traffic control plans that shall be developed for individual WSIP projects in the San Joaquin Region, and identify additional measures, if necessary, to minimize the combined impacts of multiple WSIP project construction traffic on I-580, Chrisman Road, and West Vernalis Road. As applicable, these measures shall be developed consistent with the standards of San Joaquin County, Stanislaus County, and Caltrans and could include: • Additional traffic control devices, such as traffic signals at key intersections providing access to local roadways and land uses • Additional traffic control personnel at key locations to facilitate vehicular traffic flow during peak periods of truck activity • Adjustments in truck arrival and departure schedules for the various facilities (e.g., staggering departures)	Tesla Portal and Thomas Shaft
		Mitigation Measure 4.15-1c – Coordination with Other Agencies: The SFPUC WSIP construction coordinator shall coordinate with Caltrans, other county agencies, and local jurisdictions responsible for reviewing and/or approving the construction of other identified private and public development projects. Coordination efforts will be focused on minimizing traffic impacts on local access roads, particularly local streets where sensitive receptors (e.g., schools, residences, or hospitals) are located.	Tesla Portal and Thomas Shaft

1.7 References

- San Francisco Public Utilities Commission (SFPUC), Water System Improvement Program California Environmental Quality Act Findings: Findings of Fact, Evaluation of Mitigation Measures and Alternatives, and Statement of Overriding Considerations, SFPUC Resolution No. 08-0200, October 30, 2008c.

CHAPTER 2
Introduction

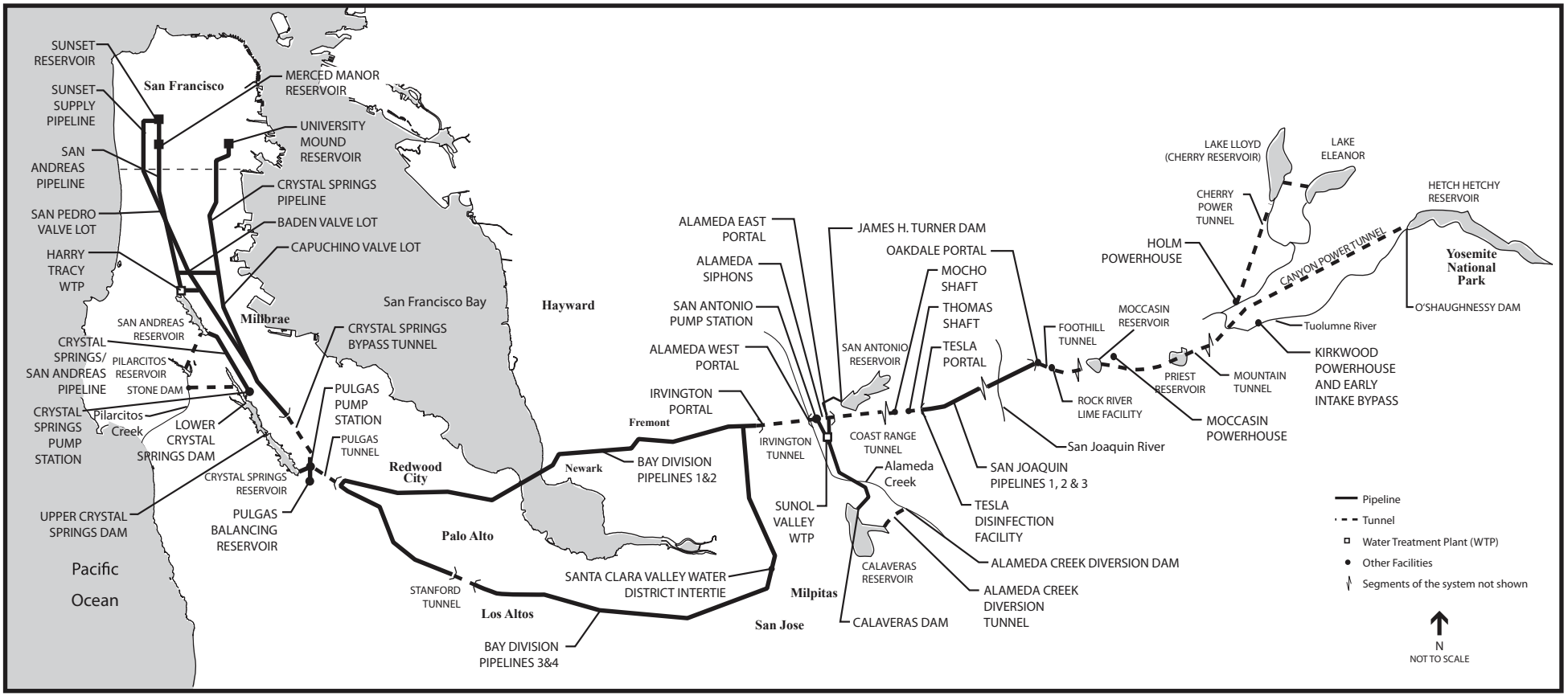
The San Francisco Public Utilities Commission (SFPUC) proposes the *San Joaquin Regional Water Quality Improvement Project* (project) to meet water quality regulatory requirements and reduce facility vulnerability to seismic events. The project proposes to construct and operate three new facilities at two existing sites located along the SFPUC's regional water system. At the Tesla Portal site, among other improvements, the existing building that contains the Tesla Portal Hypochlorite Station would be replaced with a new Chemical Process Building and Office/Control Building. In addition, an ultraviolet (UV) facility would be constructed, which would disinfect water using a series of UV light arrays. At the Thomas Shaft site, the Lawrence Livermore Water Quality Improvements would upgrade existing water treatment with a UV facility to meet disinfection requirements of the Surface Water Treatment Rule and the Long Term 2 Enhanced Surface Water Treatment Rule.

2.1 Project Background

2.1.1 SFPUC Regional Water System Overview

The City and County of San Francisco (CCSF), through the SFPUC, owns and operates a regional water system that extends from the Sierra Nevada to San Francisco and serves 2.4 million people in San Francisco, San Mateo, Santa Clara, Alameda, and Tuolumne counties. The regional water system consists of water conveyance, treatment, and distribution facilities, and delivers water to retail and wholesale customers. The existing regional system includes over 280 miles of pipelines, over 60 miles of tunnels, 11 reservoirs, five pump stations, and two water treatment plants. The SFPUC currently delivers an annual average of about 265 million gallons per day (mgd) of water to its customers. The source of the water supply is a combination of local supplies from streamflow and runoff in the Alameda Creek watershed and in the San Mateo and Pilarcitos Creeks watersheds (referred to together as the Peninsula watersheds), augmented with imported supplies from the Tuolumne River watershed. Local watersheds provide about 15 percent of total supplies and the Tuolumne River provides the remaining 85 percent. Figure 2-1 (SFPUC Regional Water System) illustrates the general location of the SFPUC regional system and water supply watersheds.

The SFPUC serves about one-third of its water supplies directly to retail customers, primarily in San Francisco, and about two-thirds of its water supplies to wholesale customers by contractual agreement. The wholesale customers are largely represented by the Bay Area Water Supply and Conservation Agency, which consists of 27 total customers, shown in Figure 2-2 (SFPUC Water Service Area – San Francisco and SFPUC Wholesale Customers). Some of these wholesale



SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT EIR

SFPUC Regional Water System

Figure 2-1

customers have other sources of water in addition to what they receive from the SFPUC regional system, while others rely completely on the SFPUC for supply.

2.1.2 SFPUC Water System Improvement Program

On October 30, 2008, the SFPUC adopted a regional Water System Improvement Program (known as the "Phased WSIP Variant") (refer to www.sfwater.org; SFPUC, 2008e; also see SFPUC Resolution No. 08-0200). The adopted WSIP would improve the regional system with respect to water quality, seismic response, water delivery, and water supply to meet water delivery needs in the service area through the year 2018 and would establish level of service goals and system performance objectives. The proposed program area spans seven counties—Tuolumne, Stanislaus, San Joaquin, Alameda, Santa Clara, San Mateo, and San Francisco.

The WSIP includes a water supply strategy, modifications to system operations, and construction of a series of facility improvement projects. The proposed project, along with several other facility improvement projects, is a component of the WSIP.[1] The overall goals of the WSIP are to maintain high-quality water; reduce vulnerability to earthquakes; increase delivery reliability and improve the ability to maintain the system; meet customer purchase requests in nondrought and drought periods; enhance sustainability in all system activities; and achieve a cost-effective, fully operational system (refer to Table 2-1). To further these program goals, the WSIP also includes objectives that address system performance in the areas of water quality, seismic reliability, delivery reliability, and water supply through the year 2018.

TABLE 2-1
WSIP GOALS AND OBJECTIVES

Program Goal	System Performance Objective
Water Quality – *maintain high quality water*	• Design improvements to meet current and foreseeable future federal and state water quality requirements. • Provide clean, unfiltered water originating from Hetch Hetchy Reservoir and filtered water from local watersheds. • Continue to implement watershed protection measures.

[1] The proposed project is listed as three separate projects in the WSIP PEIR: the Tesla Portal Disinfection Facility, the Hetch Hetchy Advanced Disinfection, and the Lawrence Livermore Supply Improvements. For purposes of this EIR, these three projects are evaluated as one project given their geographic proximity, construction schedule, and the interrelated function of the two proposed facilities at the Tesla Portal site.

TABLE 2-1
WSIP GOALS AND OBJECTIVES

Seismic Reliability – *reduce vulnerability to earthquakes*	• Design improvements to meet current seismic standards. • Deliver basic service to the three regions in the service area (East/South Bay, Peninsula, and San Francisco) within 24 hours after a major earthquake. Basic service is defined as average winter-month usage, and the performance objective for the regional system is 229 million gallon per day (mgd). The performance objective is to provide delivery to at least 70 percent of the turnouts (i.e., water diversion connecting points from the regional system to customers) in each region, with 104, 44 and 81 mgd delivered to East/South Bay, Peninsula, and San Francisco regions, respectively. • Restore facilities to meet average-day demand of up to 300 mgd within 30 days after a major earthquake.
Delivery Reliability – *increase delivery reliability and improve the ability to maintain the system*	• Provide operational flexibility to allowed planned maintenance shutdown of individual facilities without interrupting customer service. • Provide operational flexibility to minimize the risk of service interruption due to unplanned facility upsets or outages. • Provide operational flexibility and system capacity to replenish local reservoirs as needed. • Meet estimated average annual demand of up to 300 mgd under the conditions of one planned shutdown of a major facility for maintenance concurrent with one unplanned facility outage due to a natural disaster, emergency, or facility failure/upset.
Water Supply – *meet customer water needs in nondrought and drought periods*	• Meet average annual water demand of 265 mgd from the SFPUC watersheds for retail and wholesale customers during nondrought years for system demands through 2018. • Meet dry-year delivery needs through 2018 while limiting rationing to a maximum 20 percent systemwide reduction in water service during extended droughts. • Diversify water supply options during nondrought and drought periods. • Improve use of new water sources and drought management, including groundwater, recycled water, conservation, and transfers
Sustainability – *enhance sustainability in all system activities*	• Manage natural resources and physical systems to protect watershed ecosystems. • Meet, at a minimum, all current and anticipated legal requirements for protection of fish and wildlife habitat. • Manage natural resources and physical systems to protect public health and safety.
Cost-effectiveness – achieve a cost-effective, fully operational system	• Ensure cost-effective use of funds. • Maintain gravity-driven system. • Implement regular inspection and maintenance program for all facilities.

Source: SFPUC, Resolution No. 08-0200, 2008

To address the potential environmental impacts of the WSIP, the San Francisco Planning Department prepared a Program EIR (PEIR), which was certified by the San Francisco Planning Commission in its Motion No. 17734 on October 30, 2008 (San Francisco Planning Department, 2008b). At a program-level of detail, the PEIR evaluated the environmental impacts of the WSIP and, at a program level of detail, it evaluated the environmental impacts of the WSIP's facility improvement projects.

Legend

(Wholesale customers and members of
Bay Area Water Supply and Conservation Agency)

1 Alameda County Water District
2 City of Brisbane
3 City of Burlingame
4 CWS – Bear Gulch
5 CWS – Mid-Peninsula
6 CWS – South San Francisco
7 Coastside County Water District
8 City of Daly City
9 City of East Palo Alto
10 Estero Municipal Improvement District
11 Guadalupe Valley Municipal Improvement District
12 City of Hayward
13 Town of Hillsborough
14 City of Menlo Park
15 Mid-Peninsula Water District
16 City of Millbrae
17 City of Milpitas
18 City of Mountain View
19 North Coast County Water District
20 City of Palo Alto
21 Purissima Hills Water District
22 City of Redwood City
23 City of San Bruno
24 City of San Jose (North)
25 City of Santa Clara
26 Skyline County Water District
27 Stanford University
28 City of Sunnyvale
29 Westborough Water District

* Portions of Coastside County Water District not served by the SFPUC regional water system.

SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT EIR

Not to Scale

SFPUC Water Service Area - San Francisco and SFPUC Wholesale Customers

Figure 2-2

2.1.3 San Joaquin Regional Water System Facilities

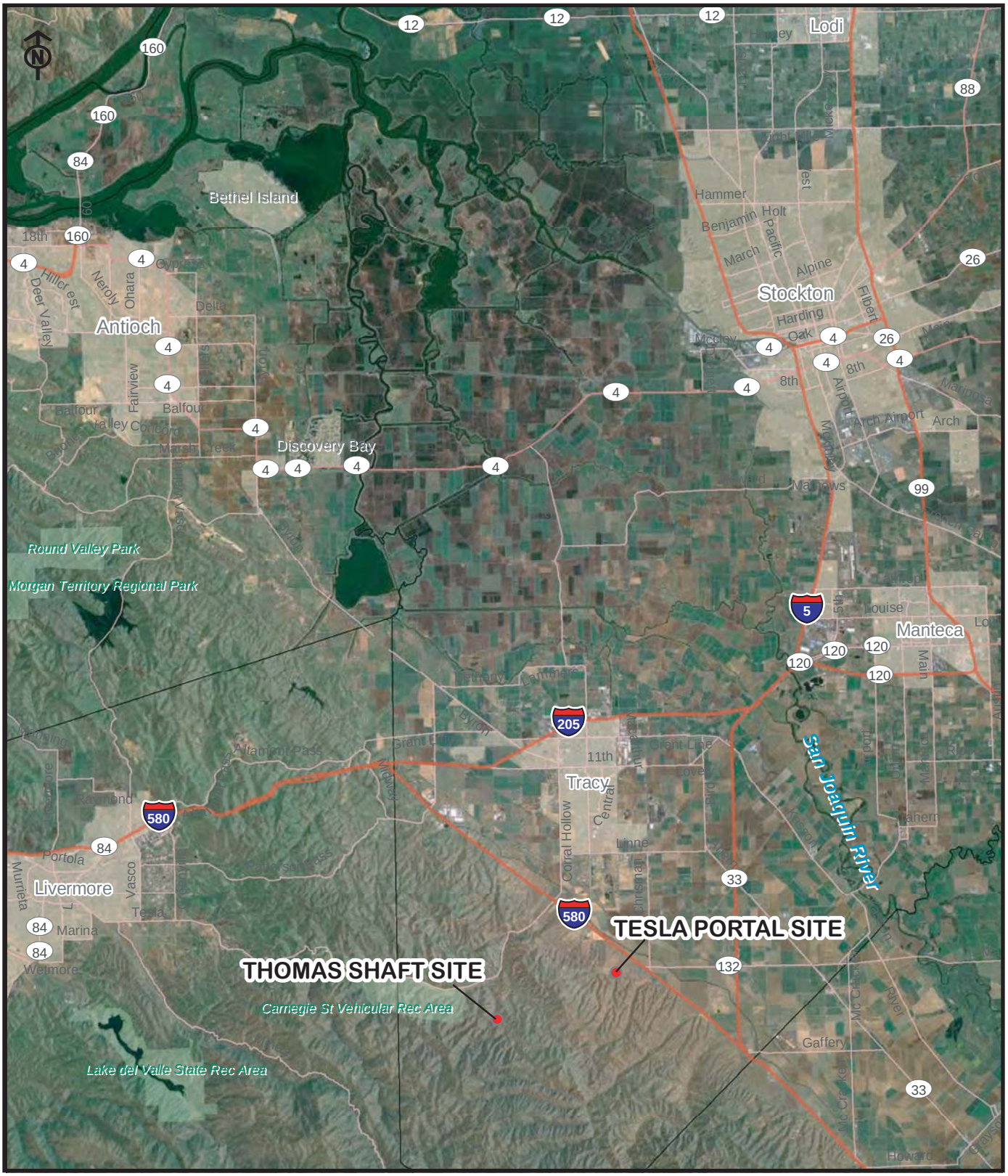
The proposed project is located at two existing facility sites along the SFPUC's regional water system: the Tesla Portal site and the Thomas Shaft site. Both of these sites are located in unincorporated San Joaquin County (refer to Figure 2-3, Vicinity Map), and are part of the SFPUC's San Joaquin Region, described below.

The Oakdale Portal is the connection between the western end of Foothill Tunnel and the San Joaquin Pipelines. From Oakdale Portal, water from the Hetch Hetchy facilities is conveyed across the San Joaquin Valley by gravity in three parallel pipelines known as San Joaquin Pipelines Nos. 1, 2, and 3 (built in 1932, 1953, and 1968, respectively). The pipelines pass through Modesto, under the San Joaquin River, and past Tracy to Tesla Portal on the west side of the San Joaquin Valley. The current capacity of the three pipelines is approximately 290 mgd; however, when originally planned in 1912, the San Joaquin Pipeline system was envisioned with an ultimate nominal capacity of 400 mgd.

The San Joaquin Pipelines end at Tesla Portal and connect to the Coast Range Tunnel. Tesla Portal, which is located on the east side of the Coast Ranges, is also the location of the Tesla Portal Hypochlorite Station, where Hetch Hetchy water is disinfected with chlorine and monitored for water quality. From Tesla Portal, the chlorinated Hetch Hetchy water is transported through the Coast Range Tunnel to system facilities in the Sunol Valley. Water delivery to Lawrence Livermore National Laboratory, a retail customer, occurs from the Coast Range Tunnel via two access shafts from the tunnel, Thomas Shaft and Mocho Shaft. At Thomas Shaft, a standby/backup chlorination facility provides disinfection in the event of operational difficulty at Tesla Portal. The 25-mile-long Coast Range Tunnel ends at the Alameda East Portal in the Sunol Valley. Again, water deliveries are transported entirely by gravity across the San Joaquin Region to the Sunol Valley.

2.2 Purpose of the Environmental Impact Report

The San Francisco Planning Department, Major Environmental Analysis (MEA) Division, determined that implementation of the proposed project could have a significant effect on the environment and, therefore, requires preparation of an Environmental Impact Report (EIR) in accordance with the requirements of the California Environmental Quality Act (CEQA) (California Public Resources Code Section 21000 et seq.) and its implementing guidelines (CEQA Guidelines) (Title 14, California Code of Regulations, Section 15000 et seq.). CEQA requires that, before a decision can be made by a state or local government agency to approve a project with potentially significant environmental effects, an EIR must be prepared that fully describes the environmental effects of the project. An EIR is an informational document for use by governmental agencies and the public. It is intended to identify and evaluate potential physical environmental impacts associated with a proposed project, to identify mitigation measures to reduce or avoid potentially significant environmental impacts, and to examine a reasonable range of feasible alternatives to the project. The information contained in the EIR is reviewed and considered by the agency's decision-making body prior to its action on the proposed project. The


THOMAS SHAFT SITE
TESLA PORTAL SITE
Carnegie St Vehicular Rec Area
Lake del Valle State Rec Area
Round Valley Park
Morgan Territory Regional Park
Bethel Island
Antioch
Discovery Bay
Stockton
Lodi
Manteca
Tracy
Livermore
San Joaquin River
Alameda Creek
Altamont Pass
Grant Line
Corral Hollow
Old River
Mormon Slough
Delta
Balfour
Marsh Creek
Gaffery
Howard
Louise
Arch Airport
Hammer
Benjamin Holt
March
Alpine
Harding
Oak
8th
Mathews
Ward
Laher
Linne
Portola
Vasco
Tesla
Marina
Westmore
Murrieta
Deer Valley
Hillcrest
Neroly
Ohara
Fairview
Cypress
Byron
Vasco
Main
Pacific
Fibert
Airport
Mariposa
Louise
Lammers
Tinsley
Midway
Chrisman
Central
Lovelace
Patterson Pass
Carnegie
Mountain House
Mc Cracken
Mc Donald
Mc Kinley
Ingram
Jasmine
Jacobson
Raymond
Livermore
Vasco
Tesla
Marina
Westmore
Portola
Balfour
Antioch
Bethel Island
Lodi
Stockton
Manteca
Tracy
Gaffery
Howard
Laher
Linne
Louise
Arch Airport
Arch
Hammer
Benjamin Holt
March
Alpine
Harding
Oak
8th
Mathews
Ward

San Francisco Planning Department is the lead agency for this EIR, and the project sponsor is the SFPUC.

2.3 CEQA Public Involvement Process

2.3.1 Notice of Preparation

In accordance with Sections 15063 and 15082 of the CEQA Guidelines, the San Francisco Planning Department, as lead agency, prepared a Notice of Preparation (NOP) of an EIR and conducted a public scoping meeting. The NOP was circulated to local, state, and federal agencies and to other interested parties on May 16, 2007, initiating a public comment period that extended through June 18, 2007. This EIR addresses the full range of environmental impacts of the proposed project. The NOP included a preliminary list of the potential environmental impacts in the following resource areas: land use, agriculture, and recreation; employment, population, and housing; aesthetics; biological resources; cultural resources; geology and soils; hydrology, groundwater, and water quality; hazards and hazardous materials; transportation, circulation, and parking; air quality; noise and vibration; utilities and public services; and energy. The NOP provided a general description of the proposed project, locations, and objectives (refer to Appendix A for a copy of the NOP).

2.3.2 Public Scoping Meeting

Pursuant to CEQA Guidelines Section 15083, the San Francisco Planning Department held a public scoping meeting on Tuesday, June 6, 2007, at the Tracy Golf and Country Club, Tracy, California.

A legal notice was placed in the Tracy Press and San Francisco Chronicle informing the general public of the scoping meeting. The purpose of the meeting was to receive public input regarding the scope of the EIR analysis, and attendees were provided an opportunity to submit verbal or written comments.

A Scoping Summary Report was prepared to summarize the public scoping process and the comments received in response to the NOP. This report is included in Appendix A. Fifteen people unrelated to project staff attended the meeting and signed the sign-in sheet, with four of those participants providing oral comments, and two providing written comments on comment cards. A transcript of the scoping meeting and reproductions of the comment cards are included in the Scoping Summary Report.

2.3.3 Public and Agency Comments on the NOP

The comment period on the NOP extended from May 16 through June 18, 2007. Four written comments were received during the public review period, and two additional written comments were received after the public review period. Written and verbal comments were also received at the public scoping meeting. The following provides a summary of the comments received:

Air Quality. Comments were received on whether chlorine would be released into the air as a result of the project. No chlorine gas is emitted currently from the project sites, and the proposed project would not result in any such emissions. Comments were received on dust emissions during construction. Refer to Section 4.9 for a discussion of air quality.

Hazardous Materials. Comments were received about the use of chlorine at the Tesla Portal site. Refer to Section 4.13 for a discussion of hazardous materials including the use of chlorine or other hazardous materials.

Biological Resources. Comments were received on whether the project would affect wetlands. The project would affect an artificial wetland and ephemeral drainage on the Tesla Portal site. Refer to Section 4.6 for a discussion of biological resources.

Traffic and Circulation. Comments were received on the potential effect of the project on traffic near the Tesla Portal site. Refer to Section 4.8 for a discussion of traffic conditions at the project site.

Single comments were received on various topics within the following environmental impact areas: visual quality (refer to Section 4.3), coordination between the WSIP Draft PEIR and the *San Joaquin Regional Water Quality Improvement Project* EIR (refer to Section 2.2 and Appendix B), cultural resources (refer to Section 4.7), cumulative impacts (refer to Section 4.15), energy (refer to Section 4.14), growth inducement (refer to Chapter 6), hydrology and water quality (refer to Section 4.5), noise (refer to Section 4.10), project description (refer to Chapter 3), and water supply (refer to Section 4.5 and Chapter 6).

2.3.4 Draft EIR Public Review

This Draft EIR will undergo a 45-day public review period, and will include a public hearing near the project sites and a public hearing before the San Francisco Planning Commission in San Francisco, to solicit comments from the public and agencies. The public comment period is from August 25 to October 8, 2008. During the public review period, comments on the accuracy and completeness of the information presented herein will be accepted.

This document is being circulated to local, state, and federal agencies and to interested organizations and individuals that may wish to review and comment on the report. Publication of this Draft EIR marks the beginning of a 45-day public review period, during which written comments may be directed to the following address:

San Francisco Planning Department
Attn: Bill Wycko, Acting Environmental Review Officer
San Joaquin Regional Water Quality Improvement Project Draft EIR
1650 Mission Street, Suite 400
San Francisco, CA 94103

Or by email to: jamie.dean@sfgov.org

Copies of the Draft EIR are available for review at the following locations:

- San Francisco Planning Department
  1650 Mission Street, Suite 400
  San Francisco, CA 94103

- San Francisco Main Library
  100 Larkin Street
  San Francisco, CA 94102

- Tracy Public Library
  20 E. Eaton Avenue
  Tracy, CA 95376-3100

The Draft EIR can also be accessed through the internet at: www.sfgov.org/site/planning/mea

Public Hearings

Public hearings on the Draft EIR to accept written or oral comments are scheduled as follows:

- September 18, 2008 – San Francisco Planning Commission – Room 400, City Hall, 1 Dr. Carlton B. Goodlett Place, San Francisco, beginning at 1:30 p.m. or later (call 558-6422, the week of the hearing for a recorded message giving a more specific time).

- September 16, 2008 – Additional public hearing – Tracy Golf and Country Club, 35200 South Chrisman Road, Tracy, beginning promptly at 6:30 p.m.

2.3.5 Comments and Responses Document and Final EIR

Written and oral comments received in response to the Draft EIR will be addressed in a Comments and Responses document. This document will be released for public review. The Draft EIR and the Comments and Responses will together constitute the Final EIR. The San Francisco Planning Commission will then consider EIR certification (CEQA Guidelines, Section 15090) during a public hearing. Following EIR certification, the SFPUC may proceed to take action on the proposed project. CEQA also requires the adoption of findings prior to approval of a project where a certified EIR identifies significant environmental effects that would be caused by the project (CEQA Guidelines Section 15091 and 15092).

2.3.6 Mitigation Monitoring and Reporting Program

- At the time of project approval, CEQA requires lead agencies to "adopt a reporting and mitigation monitoring program for the changes to the project which it has adopted or made a condition of project approval in order to mitigate or avoid significant effects on the environment" (CEQA, Section 21081.6; CEQA Guidelines, Section 15097). This EIR identifies and presents mitigation measures that would form the basis of such a mitigation monitoring and reporting program. Any measures adopted by the SFPUC as conditions for approval of the project will be included in a Mitigation Monitoring and Reporting Program to ensure compliance.

2.4 Organization of the EIR

This EIR is organized into nine chapters, as discussed below:

Chapter 1, Executive Summary. This chapter presents a summary of the SFPUC's regional water system and the WSIP, and also a summary of the proposed project and the alternatives considered in this EIR. This chapter also summarizes potentially significant environmental impacts and mitigation measures.

Chapter 2, Introduction. This chapter provides project background information and describes the purpose and organization of the EIR, as well as its preparation, review, and certification processes.

Chapter 3, Project Description. This chapter presents the proposed project description, including project objectives, a summary of project components, and describes project construction.

Chapter 4, Environmental Setting and Impacts. This chapter is presented in sections that describe the environmental setting and assess the environmental impacts for each environmental resource area. Each resource area section describes the environmental and regulatory setting, significance criteria, approach to analysis, and presents an analysis of potential environmental impacts.

Chapter 5, Mitigation Measures. This chapter presents the project-specific mitigation measures developed to address each impact considered to be potentially significant.

Chapter 6, Growth Inducement. This chapter presents the growth inducement potential of the proposed project in the context of the WSIP.

Chapter 7, Significant Environmental Effects that Cannot be Avoided if the Proposed Project is Implemented. The chapter presents a summary of significant unavoidable project impacts.

Chapter 8, Significant Irreversible Environmental Changes. This chapter presents a discussion of significant irreversible environmental changes.

Chapter 9, CEQA Alternatives. This chapter describes the alternatives to the proposed project and compares their impacts to those of the proposed project. This chapter also provides a brief description of alternatives that were considered but screened from further analysis.

2.5 References

- San Francisco Planning Department, Program Environmental Impact Report on the San Francisco Public Utilities Commission's Water System Improvement Program, Motion No. 17734, October 30, 2008b.

- San Francisco Public Utilities Commission (SFPUC), Water System Improvement Program California Environmental Quality Act Findings: Findings of Fact, Evaluation of Mitigation Measures and Alternatives, and Statement of Overriding Considerations, Resolution No. 08-0200, October 30, 2008e.

CHAPTER 3
Project Description

3.1 Project Goals and Objectives

3.1.1 Relation to Water System Improvement Program Goals

The proposed project is part of the San Francisco Public Utilities Commission's (SFPUC's) Water System Improvement Program (WSIP). The WSIP goals and objectives (refer to Table 2-1 in Chapter 2.0, Introduction) were developed based on a planning horizon through 2018. The overall goals of the WSIP for the regional water system are to:

- Maintain high-quality water
- Reduce vulnerability to earthquakes
- Increase water delivery reliability
- Meet customer water supply needs
- Enhance sustainability
- Achieve a cost-effective, fully operational system

The size and design of the individual WSIP facility improvement projects are driven by the WSIP's system performance objectives and would not change as a result of the WSIP's water supply strategy. The originally proposed WSIP included multiple program goals for improving seismic reliability and water delivery reliability, meeting current and future water quality regulations, and meeting water supply reliability goals. Design and capacity of the WSIP facility improvement projects is driven by all four of the WSIP objectives—the need to improve system performance for seismic reliability and water delivery reliability as well as maintaining high water quality standards and meeting water supply goals. All four of these objectives are factored into the decision on how to size the WSIP's individual facilities. Even if the goal of meeting projected increases in water supply demands were dropped from the mix of program objectives, the other program goals would cause the SFPUC to design WSIP facility improvement projects of the same size. All the WSIP facilities are sized to reliably deliver an average annual amount of 265 mgd (and up to 300 mgd) in light of the regional system's needs for seismic and delivery reliability during both drought and non-drought periods, and to meet water quality requirements (SFPUC Resolution No. 08-0200).

The proposed project is primarily proposed to ensure that the SFPUC maintains high-quality water that meets or exceeds regulatory standards for drinking water into the future and, therefore, would contribute to the WSIP's water quality goal. The proposed Tesla Treatment Facility is also consistent with WSIP efforts to reduce the water system's vulnerability to earthquakes.

The WSIP goals and objectives are founded on two fundamental principles pertaining to the existing regional system: (1) maintaining a clean, unfiltered water source from the Hetch Hetchy system; and (2) maintaining a gravity-driven system. The overall treatment strategy of the proposed project assumes that these goals are met.

3.1.2 San Joaquin Regional Water Quality Improvement Project Objectives

The objectives of the proposed *San Joaquin Regional Water Quality Improvement Project* (project) consist of the following:

Tesla Treatment Facility (Tesla Portal Site)

- Replace existing water treatment facilities that are not currently seismically safe with new facilities that are designed to meet current seismic, safety/fire, and building code standards

- Construct new water treatment facilities to meet U.S. Environmental Protection Agency (U.S. EPA) requirements for *Cryptosporidium* reduction/inactivation in drinking water, as required under the U.S. EPA's Long Term-2 Enhanced Surface Water Treatment Rule (LT2ESWTR)

- Improve current water quality management capabilities such as pH control

Lawrence Livermore Water Quality Improvements (Thomas Shaft Site)

- Construct new water treatment facilities to meet U.S. EPA requirements under the Surface Water Treatment Rule (SWTR) for the reduction/inactivation of *Giardia*, as well as assist in meeting LT2ESWTR *Cryptosporidium* requirements to enable delivery of potable water to Lawrence Livermore National Laboratory (LLNL) from the Thomas Shaft of the Coast Range Tunnel

- Continue to provide back-up chlorination capabilities

3.2 Project Location and Setting

The components of the proposed project, as described below in Section 3.3, would be constructed at two separate sites, the Tesla Portal site and the Thomas Shaft site. The following provides a description of the two sites.

3.2.1 Tesla Portal Site

The Tesla Portal site is located about 7.5 miles south of the City of Tracy, in unincorporated southwestern San Joaquin County. The site as a whole is about 52 acres; the proposed project, including construction staging, would occur on about 12 acres of the site.

The primary existing structure at the 52-acre site is the Tesla Portal structure. A steel overflow/surge shaft rises approximately 60 feet from a hillside near the Tesla Portal structure. The oldest buildings at the site are a wood-frame building housing the chlorination facility (the Tesla Portal Hypochlorite Station), a pump house, and a watershed keeper's cottage, all built in 1936. Two valve houses were later added in 1949 and 1963. Three 20,000-gallon water tanks are located on a hillside above the other buildings. Various minor upgrades and improvements have been added at the site over the years, including an improved access road and security gates in 2003.

The existing Tesla Portal Hypochlorite Station, constructed in 1936, originally was a gas chlorine facility and, for a while before World War II, also fed gas ammonia and provided chloramine disinfection. The facility was converted to a Hypochlorite Station in 1989. The facility is a primary disinfection point for the regional water system. At the Tesla Portal Hypochlorite Station, sodium hypochlorite, a liquid form of chlorine, is injected utilizing two tanks outside the facility and four tanks inside the facility, to reduce/inactivate viruses and *Giardia*. No chlorine gas is released during the process. The existing Tesla Portal Hypochlorite Station handles a maximum flowrate of 290 million gallons per day (mgd) and an average flowrate of 220 mgd. It is operated continuously 24 hours per day and requires routine maintenance. Facility operations are controlled via the SFPUC's Supervisory Control and Data Acquisition (SCADA) System.

There is an existing grazing lease at Tesla Portal that allows cattle grazing on the site.

The proposed new structures at this site (refer to Section 3.5) would be constructed on 3 acres of the site characterized as undeveloped grassland with gently rolling hills, generally northeast of existing structures. Outside of the boundaries of the Tesla Portal site, the areas immediately north, west, and south of the site are occupied by ranching operations on private property. Roughly 0.5 miles to the east lies the community of Chrisman a rural residential neighborhood within the unincorporated Tracy Planning Area (San Joaquin County, 1992) consisting of approximately 36 rural residential parcels. The closest residential structure to Tesla Portal is located approximately 2,500 feet to the southeast of the project area, off West Vernalis Road. There are several uninhabited ranch structures located approximately 750 feet west of the project area (refer to Figure 4.3-1a).

Tesla Portal contains a 0.308-acre artificial wetland area which, during site visits in fall 2006, was observed to have standing water and emergent vegetation (refer to Section 4.6, Biological Resources, for further discussion of the wetland area). The primary water source for this area is runoff from sampling points discharged through a pipe at the existing Tesla Portal Hypochlorite Station. This area is approximately 100 feet from the existing access road. In addition, the Tesla Portal site contains an ephemeral drainage averaging 1.5 feet in width within the project area and approximately 1,420 feet in length that flows from southwest to the northeast across the southern portion of the site. An ephemeral drainage is a stream, creek, wash or gully that has seasonal, infrequent water flow. The ephemeral drainage was dry during site visits in winter and fall 2007. The primary hydrologic sources for the ephemeral drainage include direct precipitation and surface runoff from the surrounding hills. A spillway associated with the operations at the Tesla Portal site also leads to the ephemeral drainage, and there is evidence immediately below the spillway indicating that some flow enters the ephemeral drainage from the spillway.

3.2.2 Thomas Shaft Site

The Thomas Shaft site is located about 4.4 miles southwest of the Tesla Portal, and about seven miles southwest of the City of Tracy in unincorporated southwestern San Joaquin County. The Thomas Shaft site as a whole is about 28 acres; the proposed project would occur on the developed portion of the site, which totals approximately one acre. Access to the developed portion of the site is via Thomas Shaft Road, an existing private road that starts at Corral Hollow

Road about 1.5 miles north of the site, which is shared with an adjacent property owner at its northern end.

In the developed portion of the Thomas Shaft site, a tunnel and access shaft were constructed when the Coast Range Tunnel was first installed in the area. The site also contains a backup chlorination facility, constructed in 1995 and modernized and upgraded in 2001, to chlorinate Hetch Hetchy water if adequate chlorination does not occur at the Tesla Portal Hypochlorite Station. The facility can be operated manually or using the SCADA system. Components of the facility include a chemical receiving and storage facility, a chemical unloading area, and a control and power supply area. The chemical receiving and storage facility contains three 6,000-gallon sodium hypochlorite tanks, several pumps, and associated piping and sensors. The facility also has water quality analyzers that sample water for quality control.

The area immediately surrounding Thomas Shaft on all sides is hilly grassland, with occasional oak trees (refer to Figure 4.3-1b). Cattle grazing occurs in the general vicinity on private property. No jurisdictional wetlands are present in the vicinity of the existing chlorination facility on the Thomas Shaft site; however, there are approximately 0.251 acres of unvegetated Waters of the U.S. and approximately 0.188 acres of jurisdictional wetlands located adjacent to Thomas Shaft Road near its intersection with Corral Hollow Road (CCSF Planning Department, 2007). A jurisdictional wetland is a wetland feature that meets the U.S. Army Corps of Engineers' and/or the Regional Water Quality Control Board's definition of a wetland and, therefore, would be protected and regulated by the respective agency. Aerial photographs show a rural residence about 1.25 miles to the northeast of the site. The entrance to LLNL Site 300 is located near the intersection of Thomas Shaft Road and Corral Hollow Road, about 1.5 miles to the north. LLNL Site 300 contains a variety of office buildings and other structures.

LLNL is an existing retail customer of the SFPUC. LLNL receives water through Mocho Shaft, located west of the Thomas Shaft, for Site 200 and, in the past received water from Thomas Shaft for Site 300. Due to current water quality regulations, LLNL does not presently receive water from Thomas Shaft but continues to receive water from Mocho Shaft.

- The SFPUC prepared demand projections for its retail service area, which includes LLNL, in November 2004. The demand projections were based on water deliveries in fiscal year (FY) 2000/01. Because LLNL's average annual water deliveries can vary substantially from year-to-year, the SFPUC used an average from FY 1996/97 to FY 2000/01 to develop their base year average annual water delivery for the demand projection analysis (SFPUC, 2004a).

- LLNL's annual average demand is estimated at 0.8 mgd and the future projected demand is estimated to remain at this level through 2030 (SFPUC, 2004a). Over the last 10 years (FY 1997/98 to FY 2006/07), LLNL's average annual demand has ranged from a low of 0.41 mgd to a high of 0.92 mgd, with a 10-year average of 0.68 mgd (SFPUC, 2004a).

SFPUC and LLNL have a contract, executed in 1960 and amended in 1987, under which SFPUC is to supply water to LLNL Site 300 after treatment at Thomas Shaft. To assist in water delivery, LLNL installed a 10-inch water line and pumps in 1995 across Thomas Shaft Road from the chlorination facility. However, because Thomas Shaft cannot meet SWTR standards for the

reduction/inactivation of *Giardia*, SFPUC cannot deliver water to Site 300 currently. The current water supply for Site 300 comes from onsite wells[1] serving a population of about 250 workers and visitors.

3.3 Proposed Project Components

The proposed *San Joaquin Regional Water Quality Improvement Project* consists of the components identified in Table 3-1, Summary of Project Components.

TABLE 3-1

SUMMARY OF PROJECT COMPONENTS

Project Component	Tesla Treatment Facility (Tesla Portal Site)	Lawrence Livermore Water Quality Improvements (Thomas Shaft Site)
New Facilities	• Chemical Process Building (14,000 square feet) would include: – Three 16,000-gallon sodium hypochlorite tanks – Two 10,000-gallon fluoride tanks • Office/Control Building (3,500 square feet) • UV Building (20,000 square feet) would include: – 12 UV reactors (10 active, two standby) operating 24 hours/day – Below-grade piping vaults – Two 3,000-gallon food-grade acid tanks • Two diesel standby generators (1,500 kW each maximum) • Two 15,000-gallon above ground diesel fuel tanks • Two 12,500-gallon CO_2 tanks with control panels and injection water pumps • Analyzer shed (100 square feet) with water quality sampling equipment • Two valve vaults (approximately 26' × 36' × 16' deep) • Two valve houses (approximately 26' × 36' × 12' high) • 90,000-gallon containment basin lined with rip rap for blow off water (50' × 50' × 5' deep) • New septic tank and leach field • Microwave tower up to 100 feet in height	• Two UV reactors (one active, one standby) installed in existing Chlorination Facility building, operating five hours/day • Prefabricated building within fenced area atop Thomas Shaft (approximately 18' × 20' × 10' high) • Percolation water tank (2,500-gallon concrete tank with crushed rock bottom) for process water

1 The wells are owned by the Department of Energy/National Nuclear Security Administration, and operated by Lawrence Livermore National Security, LLC (LLNS), the contractor in charge of LLNL. LLNS is a limited liability corporation made up of Bechtel National, Inc., the University of California, BWX Technologies, Inc., and the Washington Group International, Inc. The team also includes Battelle Memorial Institute, four small business subcontractors, and Texas A&M University.

TABLE 3-1
SUMMARY OF PROJECT COMPONENTS

Project Component	Tesla Treatment Facility (Tesla Portal Site)	Lawrence Livermore Water Quality Improvements (Thomas Shaft Site)
Existing Facility Modifications	• Steel or concrete enclosure placed around the Portal and covered with soil backfill • New and replacement fencing 3,000 feet in length, 8-foot high	• Replace two existing 100 hp pumps with two approximately 30 hp pumps (one active, one standby)
Roadway Improvements	• 40,000 square feet of new paved areas – New paved 20-foot wide loop road (1,500 feet long) – New asphalt surfacing and widen existing access road from 17 to 20 feet – New parking areas • Remove portion of existing access road (approximately 700 feet)	None
Water Discharges	• Blow off for grit removal (10,000 gallons each blow off, approximately three times/ month)	• Process water (approximately 500 gallons/day to percolation tank)
Trenching	• 144" pipeline (1,200 feet) • 84" pipeline (300 feet) • 48" pipeline (600 feet)	• 12" pipeline (150' × 3' × 3' trench)
Outdoor Lighting	• Along building exterior walls and parking areas	None
Utility Upgrades	• New transformer	None
Operational Changes	• Increased staff from three FTE to five FTE	• Minor increased maintenance activities related to pumps and UV lamp replacement
Staging Area	• 9-acre area located onsite	• Located onsite on paved area adjacent to Chlorination Facility building
Construction Schedule	• January 2009 – January 2011 (24 months) • After construction, there would be a 12-month commissioning (startup testing) period including UV tests by State regulators	• July 2009 – December 2009 (6 months)

The tie-in of new facilities described in this table would occur during the regularly scheduled Hetch Hetchy shutdown in January to February. No interruption to SFPUC customers would occur, as they would continue to be served by other system sources.

The proposed project would not require any land acquisition.

3.3.1 Tesla Treatment Facility (Tesla Portal Site)

The existing building at the Tesla Portal site that contains the Tesla Portal Hypochlorite Station does not meet current seismic, safety/fire, and building code standards. The proposed Tesla Treatment Facility would replace this building with a new 14,000-square-foot Chemical Process Building approximately 32 feet in height containing disinfection and related equipment, and supporting facilities and infrastructure. The building would contain three 16,000-gallon sodium hypochlorite tanks, two 10,000-gallon fluoride tanks, two 12,500-gallon carbon dioxide (CO_2)

tanks, a chemical spill control system, electrical room, shop/storage room, and chemical feed equipment, including metering pumps, transfer pumps, piping and instrumentation (e.g., pressure gauges, flow meters, and tank level indicators).

- *Giardia* inactivation is currently accomplished through the addition of sodium hypochlorite (chlorine) to the regional water supply at the Tesla Disinfection Facility or at Thomas Shaft, which provides adequate contact time for the inactivation of *Giardia*. To provide adequate *Giardia* disinfection to LLNL Site 300, additional ultraviolet (UV) facilities would be installed at Thomas Shaft (see Section 3.2). Chlorine would be fed from the Chemical Process Building and injected into the out flow manifolds. Although the location of the chlorination function at the site would change, the chlorine injection process itself would be essentially unchanged. In addition, to lower the pH of the water, fluoride and CO_2 would be added to improve current water quality management capabilities.

The functions of the Chemical Process Building would continue to be monitored and operated manually or via SCADA. The existing building that contains the Tesla Portal Hypochlorite Station would no longer be occupied or used to house treatment processes but would be maintained to prevent deterioration, and may be used to store equipment.

In addition to the Chemical Process Building, a new 3,500-square-foot Office/Control Building approximately 12 feet in height is proposed. The Office/Control Building would contain offices, control room, process room, laboratory, restrooms, lockers, shower, and a multipurpose room. Both the Chemical Process Building and Office/Control Building would have heating, ventilation, and air conditioning systems as well as fire protection systems, using water sprinklers, and dry chemical systems.

At the Tesla Portal site, a new ultraviolet (UV) disinfection facility is also proposed that would allow the SFPUC to achieve the high level of disinfection to inactivate *Cryptosporidium* to levels mandated under LT2ESWTR by running Hetch Hetchy water past arrays of UV lamps. The proposed UV Building would be up to 20,000 square feet and approximately 32 feet in height above ground, and would contain 12 UV reactors (10 active and two standby) each containing UV lamp arrays and various sensors, on a floor recessed approximately 14 feet below grade. In addition, the building would contain below-grade piping vaults and two 3,000-gallon food-grade acid tanks. Two diesel standby generators are proposed adjacent to the UV Building and two 15,000-gallon above ground diesel fuel tanks are proposed adjacent to the Chemical Process Building.

The Tesla Treatment Facility is being designed to withstand seismic events, and for "zero failure" by providing both backup UV reactors and backup generators in the event of a power outage. In addition, power supply at the site is being upgraded to improve reliability and to minimize the potential for power outages or UV reactor down time, thus minimizing the potential for unplanned discharges of water that do not meet water quality requirements. If unplanned discharges were to occur, the water would be discharged within the Sunol Valley, as is currently the case, to the San Antonio Reservoir, to the Sunol Valley Water Treatment Plant or to San Antonio Creek via the existing San Antonio Pipeline. In addition, if implemented, the proposed

WSIP Alameda Siphons Seismic Reliability Upgrade project would provide an additional discharge point to an adjacent quarry pit.

The tie-in of the proposed UV Building to San Joaquin Pipeline (SJPL) Nos. 1, 2 and 3 would require cutting into all three pipelines and connecting a new manifold that would combine the

flows and redirect the water through an array of UV reactors inside the building, into a new outlet manifold and back into the SJPLs. All tie-ins would occur upstream of the existing valve-houses. Construction of both the upstream and downstream manifolds would require cutting into the pipe in two places (one upstream, one downstream) and removing about 300 feet total of each pipeline. The new manifolds would be constructed in the place vacated by the demolished pipe. In addition, the upstream manifold would incorporate a line-sized isolation valve in each pipeline. A connection to the manifold and an isolation valve would also be constructed to accommodate future connection of a fourth San Joaquin pipeline.[2] This connection would be located approximately 900 feet east of an existing connection point on the Coast Range tunnel manifold that was originally provided for this purpose, thus this connection point would be relocated to accommodate the proposed Tesla Treatment Facility. Approximately 400 feet of each existing SJPL would be capped and remain in place between the upstream and downstream manifolds. All new and existing segments under the proposed project would be located below grade, or enclosed in structures.

The proposed Tesla Treatment Facility would be controlled independently of the operation of the SJPL valves. The facility design criteria is listed at 315 mgd to account for design limitations and to allow the facility to provide reliable disinfection for a future flowrate of 313 mgd, consistent with the proposed water supply option identified in the WSIP.

The project would also replace and upgrade the existing communication system at the Tesla Hypochlorite Station with an improved system, and provide the foundation infrastructure to integrate the new Tesla Treatment Facility communication system with the existing Sunol Valley Water Treatment Plant and the pipelines control center at Moccasin. To facilitate the communication improvements, a microwave tower would be installed adjacent to the three existing water tanks located on the hillside above the other existing structures on the site. The proposed lattice tower would be up to 100 feet in height with two 8-foot-diameter microwave dishes mounted at the top of the tower, one directed toward the Livermore Hills (approximately 320 degrees northwest) and the other directed toward Oakdale (Warnerville Road Switchyard approximately 60 degrees northeast). Other smaller antennas would also be mounted at the top of the tower. The tower would be constructed of galvanized steel, and the microwave dishes, antennas or other equipment on the tower would be painted gray to reduce visibility. The tower would be installed on a concrete foundation that would be a maximum of 30 feet by 30 feet. Access to the tower would be via an existing unpaved road. An underground electrical line would be required from the tower to a new transformer adjacent to the UV Building.

Additional improvements proposed at the Tesla Portal site consist of a new steel or concrete enclosure around the Tesla Portal that would be covered with soil backfill, installation of new paved areas (detailed in Table 3-1), a 90,000-gallon containment basin lined with rip rap to capture released water for grit removal and periodic maintenance (three times per month), and a 100-square-foot analyzer shed approximately 10 feet in height for water quality sampling equipment. Water discharged to the proposed containment basin would be raw water (no

[2] A Notice of Preparation for the proposed SJPL System Project (Case No. 2007.0118E) was published by the San Francisco Planning Department in spring 2007, and the preparation of a Draft EIR is underway.

chlorine). In addition to the underground piping (listed in Table 3-1), other small diameter piping would be laid for process sample lines.

Security improvements are also proposed, including approximately 3,000 feet of new and replacement fencing, 8 feet in height surrounding the proposed developed area where the new treatment facilities would be located, and other security features (e.g., controlled gate and entry system, and intrusion detection system). Finally, the project proposes an outdoor lighting system designed to utilize a minimum number of fixtures based on the recommendations of the Illumination Engineering Society of North America and the guidelines of California Code of Regulations Title 24. Pole mounted high-pressure sodium or metal halide lamps would be used for outdoor areas such as roadways and parking. Along building exterior walls, compact fluorescent or low-wattage metal halide lamp fixtures would be used. During tie-ins or at other times, as needed, some weekend or nighttime construction work may be necessary. If nighttime construction work is conducted, temporary additional nighttime lighting would be needed.

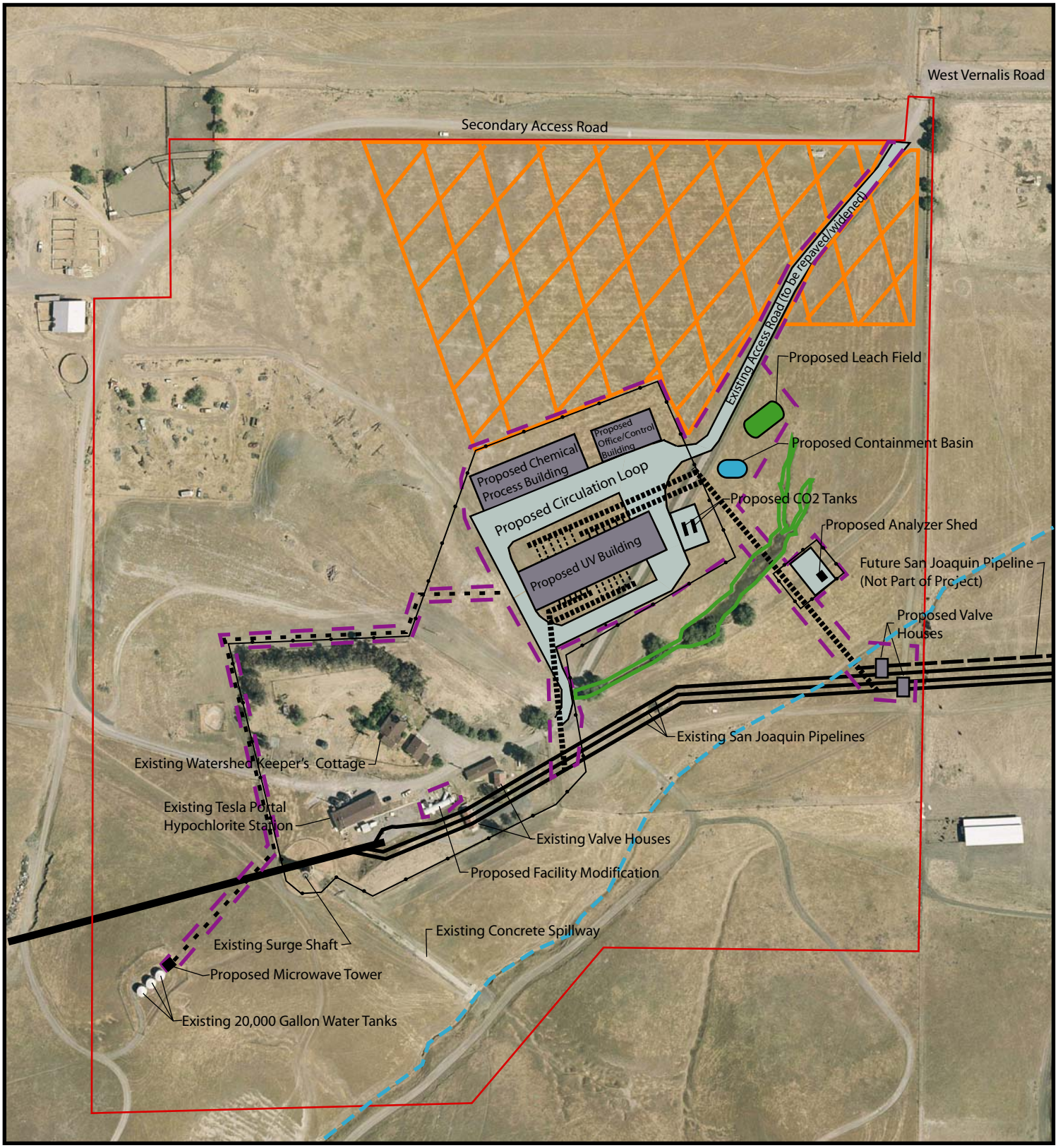
Figure 3-1 shows the location of the proposed Chemical Process Building, Office/Control Building, UV Building, and additional project features. The new facilities, including buildings and paved areas, would be constructed northeast of existing structures at Tesla Portal, on an approximately three-acre site that currently is undeveloped grassland. An additional approximately nine-acre undeveloped grassland area extending on both sides of the entrance road would be used for construction staging.

Pacific Gas and Electric Company (PG&E) currently provides electrical service to the Tesla Portal site. Proposed facilities at the site would increase the consumption of electricity and would require a new electrical transformer (8 feet by 10 feet by 9 feet in height), which is proposed adjacent to the UV Building. An above ground power line would extend from the existing power pole to the new transformer, and then the power line would be undergrounded from the transformer to the new buildings. Natural gas service would not be required for the new facilities.

Telephone service would be extended to new buildings from existing connections at the Tesla Portal site. Drinking water would continue to be obtained from the existing SFPUC system serving the site. To handle sewage and graywater, a new septic tank and leachfield would be installed to the east of the new buildings. Storm water would be collected and directed away from the new structures and released in a soakaway system that would be located near the leachfield.

The primary water source for the artificial wetland described above in Section 3.2 (runoff from sampling points at the existing Tesla Portal Hypochlorite Station) would be discontinued. However, surface runoff may continue to be directed into the artificial wetland.

The proposed Chemical Process Building, Office/Control Building, and UV Building would be constructed with concrete walls and foundations. Each of these buildings would require that existing vegetation in the vicinity be cleared and the sites graded. Approximately 3.2 acres would be graded in total at this site. The maximum excavation depth would be 20 feet. Excavated material would be used as fill for site grading. Due to the relatively flat nature of the site, it is expected that the cut and fill volumes would be balanced to minimize the import or export of soils. The extent of fill activities would be within the 3.2-acres that would be graded, except areas



Legend

- Proposed Pipelines
- Project Boundary
- Proposed Underground Electrical Line
- Proposed Construction Staging Area
- Proposed Fenceline
- Artificial Wetland
- Proposed New Buildings
- Proposed New/Expanded Paved Area
- Potential Construction Footprint
- Ephemeral Drainage

0 250 500 Feet

APPROXIMATE

SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT EIR

Tesla Portal Site Plan

Figure 3-1

that would be excavated for new pipeline or the electrical line for the microwave tower that would be outside the graded area. The excavated material from these areas would be used to refill the trenches. Thus, truck traffic would be relatively limited. Except for brief periods when concrete would be poured, approximately 25 to 30 truck round-trips per day would occur during construction, including worker commuter truck trips (refer to Section 4.8, Traffic, Transportation and Circulation). Current staffing levels are approximately three full-time equivalent (FTE) personnel on site. The proposed project would add two FTEs. The additional staff would be onsite intermittently, as needed.

The existing disinfection function of Tesla Portal would not be interrupted during construction as a result of the project. The tie-in of new facilities would occur during the scheduled Hetch Hetchy shutdown in January to February. No interruption in service to SFPUC customers would occur as they would continue to be served by other system sources.

3.3.2 Lawrence Livermore Water Quality Improvements (Thomas Shaft Site)

SFPUC has a contractual agreement with LLNL to deliver drinking water to LLNL Site 300. Presently, SFPUC cannot supply LLNL Site 300 because water from Thomas Shaft does not meet SWTR standards for *Giardia* reduction/inactivation. To meet SWTR requirements, and assist in meeting LT2ESWTR requirements, the treatment facility serving LLNL Site 300 at Thomas Shaft would be upgraded by installation of a UV disinfection system. The UV system would be installed in the existing Chlorination Facility building at the site, and consist of two UV reactors, each containing several UV lamp arrays, as well as a power supply and control panel. Refer to Figure 3-2, Thomas Shaft Site Plan. The Lawrence Livermore Water Quality Improvements are being designed for a 0.165 mgd capacity. The proposed project would allow LLNL to take up to 0.165 mgd of their annual average demand of 0.8 mgd from Thomas Shaft, and continue to receive the remainder of the water from Mocho Shaft.

A 2,500-gallon concrete percolation tank with crushed rock bottom would be installed for process water discharge at the Thomas Shaft site. The water discharged to the tank would have chlorine residual from chlorination that occurs at the Tesla Portal site. The tank would not be sealed at the bottom, and would be filled with 12 to 18 inches of crushed rock. Two 12-inch diameter polyvinyl chloride (PVC) pipes would be installed 15 feet deep to allow water to reach sand to facilitate percolation. The tank would be the discharge point for process water used for sampling chlorine residual, pH and turbidity of water at Thomas Shaft before and after UV disinfection, and for chlorinated process water from existing Thomas Shaft Chlorination Facility sampling instruments.

- Other improvements proposed at the Thomas Shaft site include installation of a 360-square-foot prefabricated structure 10 feet in height within the fenced area atop Thomas Shaft and replacing two existing 100 horse power (hp) pumps with two 30 hp pumps (one active and one standby). An approximately 150 foot by 3 foot by 3 foot trench would be excavated from the existing Chlorination Facility building to the Thomas Shaft and to the percolation tank (as shown on Figure 3-2). Prior to commencement of this project, fencing will be installed as part of another

project (Thomas Shaft Roadway Improvement Project, SFPUC Resolution No. 08-0061) and will remain installed around the steam engine foundation and bucket assembly; this fence will avoid potential inadvertent physical impacts or damage to the resource that could occur during project construction.

Source: Google Earth

Not To Scale

SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT EIR

Thomas Shaft Site Plan

Figure 3-2

The cut and fill volumes would be minimal (only from some minor trenching) and can be roughly balanced on-site. The import or export of soils is not expected. Approximately five truck round-trips per day would occur during construction, including worker commuter truck trips (except for a brief period when concrete would be poured for the small prefabricated building foundation). Existing operations, which are minimal, would not be interrupted as a result of the project. No new utility service from offsite sources would be required.

3.4 Project Construction

3.4.1 SFPUC Standard Construction Measures

SFPUC has established standard construction measures that are implemented as part of all SFPUC projects, including the project that is the subject of this EIR (SFPUC, 2007c). The objective of these measures is to minimize potential disruption of surrounding neighborhoods during construction and to reduce impacts on existing resources to the extent feasible. Each SFPUC project manager, environmental project manager, and contract manager would ensure that projects involving construction work contain uniform provisions to address these issues. To that end, each construction contract or project must include the following standard construction measures in the contract or project implementation procedures, as appropriate. The measures would apply to work that would require any environmental review and is conducted by SFPUC staff or by outside contractors under contract with the SFPUC. The standard construction measures consist of the following provisions:

1. *Neighborhood Notice*: The SFPUC will provide reasonable advance notification to the businesses, owners and residents of adjacent areas potentially affected by the WSIP projects about the nature, extent and duration of construction activities. Interim updates should be provided to such neighbors to inform them of the status of the construction.

   Where schools would be affected, the SFPUC will coordinate with school facility managers to schedule construction for time periods with the least impact on school activities and facilities to ensure student safety and to minimize disruption to educational and recreational uses of the school property.

2. *Seismic and Geotechnical Studies*: Projects will incorporate review of existing information and, if necessary, new engineering investigations to provide relevant geotechnical information about the particular site and project, including a characterization of the soils at the site, and the potential for subsidence and other ground failure. Construction will address any recommendations by such geotechnical reports to ensure seismic stability and reliability of the proposed project. All SFPUC projects must be designed for seismic reliability and minimum potential water loss and property damage. All components of the water system improvement program must be designed to continue water service during a major earthquake.

3. *On-Site Air and Water Quality Measures During Construction*: All construction contractors must take measures to minimize fugitive dust and dirt emissions resulting from the construction, and implement measures to minimize any construction effects on

local air and water quality, including a local storm drain system or watercourse. These measures could include preparation of a Stormwater Pollution Prevention Plan (SWPPP), if required by the relevant Regional Water Quality Control Board. At a minimum, construction contractors should prepare an erosion and sediment control plan and undertake the following measures, as applicable, to minimize any adverse effects:

- Erosion and sedimentation controls tailored to the site and project
- Dust control plan
- Placement of straw rolls around each of the nearby stormwater inlets
- Preservation of existing vegetation
- Installation of silt fences
- Use of wind erosion control (e.g., geotextile or plastic covers on stockpiled soil)
- Sweeping of nearby streets
- Stabilization of site ingress/egress locations to minimize erosion, and/or
- Spraying the disturbed areas of the site, or any stockpiled soil, with water to minimize fugitive dust emissions

4. *Groundwater*: If groundwater is encountered during any excavation activities, the construction contractor shall prepare a dewatering plan so that water is discharged to the stormwater system in compliance with the local standards and discharge permit requirements.

5. *Traffic*: Each contractor shall prepare a traffic control plan which will minimize the impacts on traffic and on-street parking on any streets affected by construction of the proposed project. As appropriate, SFPUC or the contractor will consult with local traffic and transit agencies.

6. *Noise*: The contractor will comply with local noise ordinances regulating construction noise to the extent feasible, and will undertake efforts to minimize any noise disruption to nearby neighbors and sensitive receptors during construction.

7. *Hazardous Materials*: Appropriate measures will be implemented to characterize and dispose of hazardous materials should they be encountered during excavation and construction. Contract specifications will mandate full compliance with all applicable local, state and federal regulations related to the identification, transportation and disposal of hazardous materials/soils. As necessary, a spill prevention and countermeasure plan will be prepared.

A qualified environmental professional will conduct any necessary site assessment. The site assessment would include a regulatory database review to identify permitted hazardous materials and environmental cases in the vicinity of each project no more than three months before construction, and a review of appropriate standard information sources to determine the potential for soil or groundwater contamination to occur. Follow-up sampling would be conducted as necessary to characterize soil and groundwater quality prior to construction and, if needed, site investigations or remedial activities would be performed in accordance with applicable laws. The environmental professional would prepare a report documenting the activities performed, summarize the results and make recommendations for appropriate handling of any contaminated materials during construction. A contingency plan would also be prepared identifying measures to be taken should unanticipated contamination be identified during construction. Construction contractors will conduct asbestos and lead abatement in accordance with established regulations.

8. *Biological Resources*: As an initial matter, SFPUC will have a qualified professional screen the project site and area to determine whether biological resources may be affected by construction activities. In the event further investigation is necessary, the SFPUC will comply with all requirements for investigation, analysis and protection of biological resources.

   A qualified biologist must conduct any required biological screening survey. The biologist will review standard information sources to determine special status species with the potential to occur on the project site. The biologist would carry out a site survey by walking or driving over the project site, as appropriate, to note the general resources and whether any habitat for special-status species is present. The biologist would then document the survey with a brief letter report or memo, setting forth the date of the visit, whether habitat for special-status species is present, providing a map or description showing where sensitive areas exist within the site, and identifying any appropriate avoidance measures.

9. *Cultural Resources*: As an initial matter, SFPUC project managers will screen the project site and area to determine whether cultural resources, including archaeological and other historical resources, may be affected by construction activities. In the event further investigation is necessary, the SFPUC will comply with all requirements for investigation, analysis and protection of cultural resources.

   Any screening for cultural resources would include screening for archaeological, paleontological and historic resources. For projects requiring excavation, deep grading, well drilling or tunneling into geologic material at sites identified as having high potential for encountering paleontological resources, a state-registered professional geologist or qualified professional paleontologist will conduct a site-specific evaluation of the paleontological sensitivity. The assessment will include a report of findings for the SFPUC.

A qualified archaeologist, historian or paleontologist will conduct all cultural resources survey and screening work. Screening surveys for cultural resources would include a cultural resources records search to be conducted at the appropriate office member of the California Historical Resources Information System. A field survey will be conducted if determined necessary after the cultural resources records search. Any impacts on identified cultural resources will be avoided to the extent feasible.

Any initial historic resource screening will identify historic resources on the project site as well as adjacent to the project site.

It is possible that project work may affect accidentally discovered buried or submerged cultural resources. Any contractor must distribute the Planning Department archaeological resource "ALERT" sheet to any person involved in soil-disturbing activities. If there is any indication of an archaeological or a paleontological resource during the soils disturbing activity of the project, the contractor shall immediately suspend any soils disturbing activities in the area and notify the SFPUC of such discovery. The SFPUC will then work with the Planning Department's Environmental Review Officer to determine what additional measures should be implemented, based on reports from a qualified archaeological or paleontological consultant.

10. *Project Site*: The SFPUC will conduct construction activities on SFPUC-owned lands to the extent feasible and minimize the need for use of non-SFPUC-owned land during construction. In cases where construction easement or staging areas are needed on non-SFPUC land, the SFPUC will restore these areas to their prior condition so that the owner may return them to their prior use, unless otherwise arranged with the property owner.

    The site will be maintained to be clean and orderly. Construction staging areas will be sited away from public view where possible. Nighttime lighting will be directed away from residential areas.

    Upon project completion, the construction contractor will return the SFPUC project site to its general condition before construction, including re-grading of the site and re-vegetation of disturbed areas.

3.4.2 Greenhouse Gas Reduction Actions

In addition to the Standard Construction Measures listed above, the SFPUC is committed to the following greenhouse gas (GHG) reduction actions as part of the WSIP. The following actions would be part of the project:

A. The SFPUC will include the first two following measures in contractor specifications and implement the third measure during project planning and design, which in addition to having other environmental benefits, would also help reduce GHG emissions. Some of these measures are part of the California Air Resources Board's (CARB) "Early Action Measures" (refer to Section 4.9, Air Quality).

1. The SFPUC will require that all contractors maintain tire inflation to the manufacturers' inflation specifications.

2. The SFPUC will implement a construction worker education program.

3. Projects that include construction of new buildings will consult with the SFPUC Power Enterprise's Energy Efficiency Group to incorporate all applicable energy efficiency measures into project design. Projects with building components will attempt to maximize energy efficiency by exceeding Title 24 minimum requirements by at least 5 percent. Projects with building components will attempt to meet or exceed LEED Silver certification as required by the City's Green Building Ordinance.

- B. This EIR also includes mitigation measures to help reduce GHG emissions. They include exhaust controls (Mitigation Measure 4.9-1b) and energy efficiency measures (Mitigation Measure 4.14-1). In addition, CARB regulations (Title 13 of the California Code of Regulations, Sections 2480 and 2485), which limit idling of diesel-fueled commercial motor vehicles, would help to limit GHG emissions associated with project construction vehicles.

3.4.3 Construction Labor Force

At the Tesla Portal site, the construction labor force would include eight field management and office staff and an average of approximately 30 field construction workers per month (field construction workers could range from 23 and 61 with an average of approximately 30 per month). Approximately six to 12 workers, including management staff and field construction workers are anticipated at the Thomas Shaft site.

3.4.4 Construction Activity

Apart from truck shipments of construction materials, construction activities for the proposed project would be confined to the proposed site locations and immediate vicinities. The general types of proposed modifications to the treatment facilities at the Tesla Portal and Thomas Shaft sites include:

- Process improvements and additions
- Hydraulic system improvements
- Structural/seismic improvements
- Instrumentation and controls improvements
- Electrical and power system improvements
- Site grading, paving, and drainage

Construction associated with the proposed facilities would be phased so that system operations would not be interrupted during construction. Construction activities anticipated for the Tesla Treatment Facility under the proposed project include ground clearing, excavation, grading, trenching for new pipeline segments, construction of proposed buildings, paving of roadways and parking areas, and installation of equipment. At the Tesla Portal site, nighttime lighting of the construction staging and development areas is proposed to provide security during construction. For the Lawrence Livermore Water Quality Improvements, construction activities would include minor grading and excavation, trenching for new pipeline, and installation of prefabricated building and equipment. Table 3-2, Construction Equipment, shows the types of equipment that would be used at each site.

TABLE 3-2
CONSTRUCTION EQUIPMENT

Equipment Type	Tesla Treatment Facility	Lawrence Livermore Water Quality Improvements
Air Compressor	x	
Backhoe	x	x
Baker Tank	x	
Bulldozer	x	x
Compactor	x	x
Concrete mixer	x	
Concrete pump	x	
Concrete vibrator	x	
Crane, derrick	x	
Crane, mobile	x	x
Dewatering Pump	x	
Excavator	x	x
Generator	x	x
Grader	x	x
Loader	x	x
Paver	x	
Pneumatic tools (e.g., jackhammer, impact wrench)	x	x
Scarifier	x	
Scraper	x	
Ventilation Fan	x	
Trucks	x	x
Welding Equipment	x	x

Access to the Tesla Portal site for construction vehicles and workers would be via I-580, West Vernalis Road and the existing paved road onsite. For the Thomas Shaft site, construction access would be via I-580, Corral Hollow Road and Thomas Shaft Road.

3.5 Project Construction Schedules

Construction at the Tesla Portal site is anticipated to start in January 2009, and last approximately 24 months. After construction, there would be a 12-month commissioning (startup testing) period including UV tests by State regulators.

Construction at the Thomas Shaft site is anticipated to start in July 2009, and last for approximately six months.

Construction at both sites generally would be conducted on weekdays from 7:00 am to 5:00 pm; however, work may occur occasionally on weekends, and could occur 24 hours a day, seven days a week at the Tesla Portal site during tie-in of the new facilities during the regularly scheduled Hetch Hetchy shutdown for approximately 36 days in January to February.

3.6 Water Quality Regulatory Requirements

3.6.1 Safe Drinking Water Act

The water quality regulations governing the regional water system are associated with the federal and California Safe Drinking Water regulations. The federal Safe Drinking Water Act, passed in 1974 and amended in 1986 and 1996, is the nation's major law regulating drinking water quality and is implemented by the U.S. EPA. The act authorizes the U.S. EPA to set national health-based standards for drinking water and requires many actions to protect drinking water and its sources, including rivers, lakes, reservoirs, springs, and groundwater wells. In addition to source water protection, the act also provides for treatment, monitoring, sampling, analytical methods, reporting and public information requirements. Implementation and enforcement of this act has been delegated to the states. In California, the Safe Drinking Water Act is under the jurisdiction of the California Department of Health Services, Division of Drinking Water and Environmental Management. Drinking water regulations are set forth in the California Code of Regulations, Title 22 and Title 17.

The amended federal Safe Drinking Water Act established phases of regulation and a number of regulatory deadlines to address drinking water requirements. This amended act is being implemented through subsidiary rules for regulation of specific contaminants or for monitoring or treatment requirements. The major U.S. EPA subsidiary rules are listed below:

- Surface Water Treatment Rule
- Interim Enhanced Surface Water Treatment Rule
- Total Coliform Rule
- Stage 1 Disinfectants and Disinfection Byproducts Rule
- Long Term 1 Enhanced Surface Water Treatment Rule
- Stage 2 Disinfectants and Disinfection Byproducts Rule

- Long Term 2 Enhanced Surface Water Treatment Rule
- Variances and Exemptions Rule
- Lead and Copper Rule
- Radionuclides Rule
- Filter Backwash Recycling Rule
- Arsenic Rule
- Public Notification Rule

3.6.2 Surface Water Treatment Rule

In 1991, the U.S.EPA adopted the Surface Water Treatment Rule, which included water quality provisions for unfiltered systems, referred to as 'filtration avoidance.' In 1993, the SFPUC applied for the ability to comply with federal filtration avoidance regulations; the California Department of Health Services (DHS) reviewed and approved this application, and forwarded their recommendation to the U.S. EPA that the Hetch Hetchy supply be approved as an unfiltered source that meets all criteria in the federal statute for filtration avoidance. The U.S. EPA also approved this application in 1993. In 1998, the State added filtration avoidance provisions to Title 22 of the California Code of Regulation, under which the Hetch Hetchy supply is currently regulated. In 2000, the SFPUC adopted resolution number 00-0277, reaffirming its policy to maintain the 'filtration avoidance' status for Hetch Hetchy water and directing its staff to prepare and submit operating fund and capital project budget requests which are consistent with proactive maintenance of 'filtration avoidance.'

Water from Hetch Hetchy Reservoir can be delivered to SFPUC customers without filtration, provided that it meets the filtration avoidance requirements outlined in the Surface Water Treatment Rule. These requirements include meeting source water quality standards, disinfection criteria, and site-specific criteria. In the Hetch Hetchy system, the Tesla Portal facility is the compliance point for some pathogens and turbidity, and Alameda East Portal is the disinfection compliance point. The SFPUC conducts extensive routine water quality monitoring and watershed protection activities, and submits a monthly report to the DHS to fulfill the filtration avoidance requirements. The report indicates coliform and turbidity levels and excursions, compliance with disinfection requirements, compliance with Total Coliform Rule, quarterly disinfection byproduct levels, operability of disinfection equipment, watershed control activities, and any detected outbreaks of waterborne disease. In addition, the SFPUC submits an Annual Watershed Sanitary Survey Report summarizing compliance with watershed control program requirements. Since 1993, these activities have demonstrated that without filtration, the water from Hetch Hetchy Reservoir consistently meets or exceeds all water quality standards, indicating a high level of public health protection for regional system customers. Water from Lake Eleanor, Cherry Reservoir, and reservoirs in the Alameda and Peninsula watersheds requires filtration at

either the Sunol Valley or Harry Tracy Water Treatment Plants before it can be delivered to customers.

3.7 Approvals and Permits Required

The City and County of San Francisco Planning Department is the CEQA Lead Agency for the proposed project, and the certification of the Final EIR by the San Francisco Planning Commission would be a required approval.

The SFPUC would consider the certified Final EIR prior to consideration of approval of the proposed project and, if approved, the SFPUC would adopt CEQA findings and a Mitigation Monitoring and Reporting Program.

The San Francisco Board of Supervisors would consider appeals of EIR certification by the San Francisco Planning Commission. The San Francisco Board of Supervisors would also appropriate funding for implementation of the proposed project, including general obligation bond monies and annual budget appropriations. In addition to CEQA, the proposed project would be subject to additional compliance and/or permitting requirements under state and federal regulations. Individual regulations, codes, and standards are described in Chapter 4, which evaluates the proposed project's impacts on specific environmental resources. The following federal, state, regional, or local permit approvals may be needed for the proposed project:

- Statewide General Waste Discharge Requirements for Dredged or Fill Discharges to Waters Deemed by the U.S. Army Corps of Engineers to be outside Federal Jurisdiction (General WDRs) for temporary impacts to the unnamed ephemeral drainage (Tesla Portal site only).
- Construction General Permit from Central Valley Regional Water Quality Control Board (RWQCB) for stormwater and groundwater discharges associated with construction activity where the activity disturbs more than one acre (Tesla Portal and Thomas Shaft Site).
- RWQCB Waste Discharge Requirement for discharge to land may be required if water is discharged to the artificial wetland or the containment basin on the Tesla Portal site and/or for discharges to the percolation tank at the Thomas Shaft site (Tesla Portal and Thomas Shaft sites).
- Section 1602 Permit from California Department of Fish and Game (CDFG) may be needed for temporary impacts from pipeline installation across an unnamed ephemeral drainage (Tesla Portal site only).
- Coverage under the San Joaquin County Multi-Species Habitat Conservation and Open Space Plan for potential impacts to species listed under the Federal and State Endangered Species Acts (Tesla Portal and Thomas Shaft sites).
- Modification to Regional Operational Permit will be issued by the California Department of Public Health for changes in disinfection equipment used (Tesla Portal and Thomas Shaft sites).

3.8 References

City and County of San Francisco (CCSF) Planning Department, *Thomas Shaft Roadway Improvement Project Initial Study/Mitigated Negative Declaration,* July 24, 2007.

- SFPUC, *City and County of San Francisco Retail Water Demands and Conservation Potential*, prepared for San Francisco Public Utilities Commission, Planning Bureau, by Margaret A. Hannaford, PE and Hydroconsult, Inc., November 2004a.

SFPUC, *Standard Measures to be Included in Construction Contracts and Project Implementation*, Susan Leal, SFPUC General Manager, February 7, 2007c.

- San Francisco Public Utilities Commission (SFPUC), Advanced Disinfection Workplan, Conceptual Engineering Report, May 2007d.

- SFPUC, Thomas Shaft Roadway Improvement Project, SFPUC Resolution No. 08-0061. April 8, 2008a.

San Joaquin County, San Joaquin County General Plan 2010, July, 1992.

CHAPTER 4
Environmental Setting and Impacts

4.1 Approach to Analysis

Each environmental topic in this Environmental Impact Report (EIR) is analyzed with respect to significance criteria that are based on San Francisco Planning Department, Major Environmental Analysis (MEA) Division guidance. MEA guidance is, in turn, based on Appendix G of the California Environmental Quality Act (CEQA) Guidelines with some modifications. Categories used to determine impact significance are discussed below in Section 4.1.2. In determining the significance of a potential impact, the analysis first describes the nature, magnitude, and severity of a potential effect and determines whether or not it is applicable to the proposed *San Joaquin Regional Water Quality Improvement Project* (project), potentially significant, or less than significant. As part of the significance determination process, the analysis evaluates whether there are applicable regulations requiring compliance with measures that could reduce a potentially significant impact to a less-than-significant level. If so, compliance with the regulation is assumed, and the impact is considered to be less than significant.

The analysis also considers whether implementation of San Francisco Public Utilities Commission (SFPUC) Standard Construction Measures could avoid potential impacts. As described in Chapter 3, the SFPUC has established 10 construction measures that would be implemented as part of the proposed project. The objective of these measures is to minimize potential disruption of surrounding neighborhoods during construction and to reduce impacts on existing resources to the extent feasible. Each SFPUC project manager, environmental project manager, and construction manager would ensure that every project involving construction work contains uniform provisions to address these issues. The measures would apply to any construction activities that require environmental review and would be conducted by SFPUC staff or by outside contractors under contract with the SFPUC.

In cases where an impact would be potentially significant and there are no applicable regulations or SFPUC standard construction measure, or such regulations and measures exist but by themselves would not reduce an impact to a less-than-significant level, then the impact would remain potentially significant. If there are feasible measures available that could reduce these potentially significant impacts to a less-than-significant level, then the impact is considered potentially significant but mitigable, and the EIR identifies mitigation measure(s) to address the potentially significant impact. Impacts described in this chapter are numbered so they can be cross-referenced to the mitigation measures presented in Chapter 5.

Environmental impacts are assessed for the following areas:

4.2 Plans and Policies

4.3 Land Use and Visual Quality

4.4 Geology, Soils, and Seismicity

4.5 Hydrology and Water Quality

4.6 Biological Resources

4.7 Cultural Resources

4.8 Traffic, Transportation, and Circulation

4.9 Air Quality

4.10 Noise and Vibration

4.11 Public Services and Utilities

4.12 Agricultural Resources

4.13 Hazards

4.14 Energy Resources

4.15 Cumulative Effects

6.0 Growth-Inducement Potential and Indirect Effects of Growth

Except for the Cumulative Effects section and the Growth-Inducement Potential and Indirect Effects of Growth chapter, each section includes a brief introduction, description of the existing setting, and regulatory framework. Significance criteria are presented for each issue area, and project impacts are assessed in terms of those criteria. Sections conclude with a reference section. Mitigation measures are described in the sections, and presented in detail in Chapter 5.

The proposed project would have no effects in the following CEQA environmental topic areas: population and housing (however, the indirect effects of growth are discussed in Chapter 6, Growth-Inducement Potential and Indirect Effects of Growth); recreation; and wind and shadow. Potential impacts of the proposed project in these three environmental topic areas are discussed below.

- Inapplicable Population and Housing Impact Criteria

Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extensions of roads or other infrastructure. Implementation of the proposed project would not induce growth directly as the project does not propose to construct new homes or businesses in the area. Additionally, the project would not extend new roads or other infrastructure into undeveloped areas. Indirect growth inducement effects from implementation of the project as part of the overall Water System Improvement Program (WSIP) are addressed in Chapter 6, Growth-Inducement Potential and Indirect Effects of Growth.

Displace substantial numbers of existing housing units or create demand for additional housing, necessitating the construction of replacement housing. No housing would be displaced by the proposed project. Therefore, this impact would not apply at either site.

Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere. No persons would be displaced by the proposed project. Therefore, this impact would not apply at either site.

- Inapplicable Recreation Impact Criteria

Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated. The project does not include any proposal to construct new homes or businesses in the project areas that would result in localized population growth that would increase the use of existing neighborhood and regional parks or other recreational facilities. (Indirect growth inducement impacts from implementing the project as part of the overall WSIP are presented in Chapter 6, Growth-Inducement Potential and Indirect Effects of Growth.) Thus, no impact would occur.

Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment. The project does not include the construction or expansion of recreational facilities. Therefore, this impact would not apply.

Physically degrade existing recreational resources. The project includes improvements on lands that are owned and used by the SFPUC for its regional water system. No existing recreational resources would be physically affected. Therefore, this impact would not apply.

- Inapplicable Wind and Shadow Impact Criteria

Alter wind in a manner that substantially affects public areas. The Tesla Portal and Thomas Shaft sites are not located in proximity to any public areas, and the proposed project would have no effect on wind patterns that could affect such areas. Therefore, this impact would not apply.

Create new shadow in a manner that substantially affects outdoor recreation facilities or other public areas. The facilities that would be installed under the proposed project would create no

new shadows that would affect any recreational facilities or public areas. Therefore, this impact would not apply.

4.1.1 Impact Significance Categories

For the impact analyses, the following categories are used to describe impact significance:

Not Applicable (N/A). An impact is considered not applicable if there is no potential for impacts or if the environmental resource does not occur within the study area or the area of potential effects.

Less than Significant (LS). This determination applies if there is a potential for some limited impact, but not a substantial adverse effect that qualifies under the significance criteria as a significant impact. LS impacts do not require mitigation. These include impacts that would become less than significant with the implementation of SFPUC Standard Construction Measures, set out in Chapter 3, which are standard operating procedures of the agency and part of the project.

Potentially Significant, Mitigable (PSM). The PSM determination applies if there is the potential for a substantial adverse effect that meets the significance criteria, but mitigation is available to reduce the impact to a less-than-significant level.

Significant Unavoidable (SU). This determination applies if there is certainty for a substantial adverse effect that meets the significance criteria but for which there appears to be no feasible mitigation available to reduce the impact to a less-than-significant level. The word "potentially" is not used for impacts where it can be determined that: (1) the impact would occur; and (2) the impact could not be mitigated to a less-than-significant level. For SU impacts, mitigation would be required to the extent feasible even if the severity of the impact with mitigation would not be reduced to a less-than-significant level.

4.1.2 Water System Improvement Program

- As discussed in Section 1.2, the proposed project, along with several other facility improvement projects, are components of the SFPUC's WSIP. The Program EIR (PEIR), which was certified by the San Francisco Planning Commission on October 30, 2008, addressed the potential environmental impacts of the WSIP and evaluated regional water supply alternatives. Because the proposed project is a component of the WSIP the project would also contribute to the WSIP's water supply impacts.

- The PEIR analyzed potential water supply and system operations impacts (separate from environmental impacts associated with the facility improvements) within the following geographic regions: the Tuolumne River, Alameda Creek, Peninsula, and Westside Basin groundwater resources systems. The PEIR also identified the cumulative effects of implementing the WSIP and system operations in combination with other past, present, and reasonably foreseeable future projects within each of these watersheds. It also

discusses the potential effects of climate change and global warming on the regional water system.

- The WSIP would result in changes in reservoir levels and associated changes in downstream flows in rivers and creeks in the three affected watersheds, potentially resulting in groundwater, water quality, fisheries, and terrestrial biological resources,. In the event that deliveries to customers exceed 265 mgd (average annual), streamflow changes in the Tuolumne River watershed could affect fisheries and terrestrial biological resources. In the Alameda Creek and Peninsula watersheds, the WSIP, which includes restoring the historical storage capacities of Calaveras and Lower Crystal Springs Reservoirs, could affect reservoir levels, downstream flows, fisheries, and terrestrial biological resources. In addition, similar to the originally proposed WSIP, the WSIP will develop groundwater supplies in the North Westside Groundwater Basin as well as a conjunctive-use program in the South Westside Groundwater Basin.

- As stated above, the proposed project is a component of the WSIP and therefore would contribute also to the water supply impacts included in the tables below. Tables 4.1-1 through 4.1-4 summarize the WSIP water supply impacts and mitigation measures for each geographic region as analyzed in the PEIR. Table 4.1-5 lists cumulative water supply impacts. Appendix B.1 presents the program-level environmental impact analysis and mitigation measures for the water supply and system operations associated with the WSIP. In addition to water supply impacts and mitigation measures, the PEIR provides a program-level analysis of the impacts associated with facility improvement projects, including construction and cumulative construction, and operation impacts. This EIR addresses the same issues as the PEIR for the proposed project at a project-level detail.

Table 4.1-1
Summary of Water Supply Impacts and Mitigation Measures – Tuolumne River System and Downstream Water Bodies

Impact	Significance Determination					Mitigation Measures
		Biological Resource Impacts				
	All Impacts (except Biological Resources)	Sensitive Habitats	Key Special-Status Species	Other Species of Concern	Common Habitats and Species	
STREAM FLOW						
Impact 5.3.1-1: Effects on flow along the Tuolumne River below O'Shaughnessy Dam.	LS					None required.
Impact 5.3.1-2: Effects on flow along Cherry Creek below Cherry Dam.	LS					None required.
Impact 5.3.1-3: Effects on flow along Eleanor Creek below Eleanor Dam.	LS					None required.
Impact 5.3.1-4: Effects on flow along the Tuolumne River below La Grange Dam.	LS					None required.
Impact 5.3.1-5: Effects on flow along the San Joaquin River and the Sacramento–San Joaquin Delta.	LS					None required.
GEOMORPHOLOGY						
Impact 5.3.2-1: Effects on sediment transport and channel characteristics between O'Shaughnessy Dam and Don Pedro Reservoir.	LS					None required.
Impact 5.3.2-2: Effects on sediment transport and channel characteristics below La Grange Dam.	LS					None required.
SURFACE WATER QUALITY						
Impact 5.3.3-1: Effects on water quality in Hetch Hetchy Reservoir and along the Tuolumne River below O'Shaughnessy Dam.	LS					None required.

Table 4.1-1
Summary of Water Supply Impacts and Mitigation Measures – Tuolumne River System and Downstream Water Bodies

Impact	Significance Determination					Mitigation Measures
		Biological Resource Impacts				
	All Impacts (except Biological Resources)	Sensitive Habitats	Key Special-Status Species	Other Species of Concern	Common Habitats and Species	
Impact 5.3.3-2: Effects on water quality in Don Pedro Reservoir and along the Tuolumne River below La Grange Dam.	LS					None required.
SURFACE WATER QUALITY (cont.)						
Impact 5.3.3-3: Effects on water quality along the San Joaquin River and the Sacramento–San Joaquin Delta.	LS					None required.
SURFACE WATER SUPPLIES						
Impact 5.3.4-1: Effects on Tuolumne River, San Joaquin River, and Stanislaus River water users.	LS					None required.
Impact 5.3.4-2: Effects on Delta water users.	LS					None required.
GROUNDWATER						
Impact 5.3.5-1: Alteration of stream flows along the Tuolumne River, which could affect local groundwater recharge and groundwater levels.	LS					None required.
Impact 5.3.5-2: Alteration of stream flows along the Tuolumne River, which could affect local groundwater quality.	LS					None required.
FISHERIES						
Impact 5.3.6-1: Effects on fishery resources in Hetch Hetchy Reservoir.	LS					None required.

Table 4.1-1
Summary of Water Supply Impacts and Mitigation Measures – Tuolumne River System and Downstream Water Bodies

Impact	Significance Determination					Mitigation Measures
		Biological Resource Impacts				
	All Impacts (except Biological Resources)	Sensitive Habitats	Key Special-Status Species	Other Species of Concern	Common Habitats and Species	
Impact 5.3.6-2: Effects on fishery resources along the Tuolumne River between Hetch Hetchy Reservoir and Don Pedro Reservoir.	LS					None required.
Impact 5.3.6-3: Effects on fishery resources in Don Pedro Reservoir.	LS					None required.
FISHERIES (cont.)						
Impact 5.3.6-4: Effects on fishery resources along the Tuolumne River below La Grange Dam.	LS when average annual deliveries from the watersheds are maintained at 265 mgd or less; PSM if deliveries exceed 265 mgd					**Measure 5.3.6-4a, Avoidance of Flow Changes by Reducing Demand for Don Pedro Reservoir Water:** The SFPUC will pursue a water transfer arrangement with MID/TID and/or other water agencies which would offset the WSIP's effects on water storage in Don Pedro Reservoir and minimize WSIP-induced changes in releases from La Grange Dam. **If Measure 5.3.6-4a proves to be infeasible, the SFPUC will implement Measure 5.3.6-4b. **Measure 5.3.6-4b, Fishery Habitat Enhancement:** The SFPUC will implement or fund one of two fishery habitat enhancement projects that are consistent with the Lower Tuolumne River Restoration Plan; augmentation of spawning gravel at five selected sites or the filling or isolation from the river of one of the existing inactive quarry pits.
Impact 5.3.6-5: Effects on fishery resources along the San Joaquin River.	LS					None required.

Table 4.1-1
Summary of Water Supply Impacts and Mitigation Measures – Tuolumne River System and Downstream Water Bodies

Impact	Significance Determination					Mitigation Measures
		Biological Resource Impacts				
	All Impacts (except Biological Resources)	Sensitive Habitats	Key Special-Status Species	Other Species of Concern	Common Habitats and Species	
TERRESTRIAL BIOLOGY						
Impact 5.3.7-1: Impacts on riparian habitat and related biological resources in Hetch Hetchy Reservoir and along the bedrock channel portions of the Tuolumne River from O'Shaughnessy Dam to Don Pedro Reservoir.		LS	LS	LS	LS	None required.
TERRESTRIAL BIOLOGY (cont.)						
Impact 5.3.7-2: Impacts on alluvial features that support meadow and riparian habitat along the Tuolumne River from O'Shaughnessy Dam to Don Pedro Reservoir.		PSM	PSM	PSM	PSM	The SFPUC will implement Measure 5.3.7-2 to reduce adverse impacts on sensitive habitats, key special-status species, other species of concern, and common habitats and species to a less-than-significant level. **Measure 5.3.7-2, Controlled Releases to Recharge Groundwater in Streamside Meadows and Other Alluvial Deposits:** The SPPUC will manage releases to the Tuolumne River from Hetch Hetchy Reservoir during the spring with the goal of recharging groundwater that supports meadow and riparian habitat. The SFPUC will periodically survey meadow habitat to determine the efficacy of release management and will modify releases as necessary to sustain meadow habitat.
Impact 5.3.7-3: Impacts on biological resources in Lake Eleanor and along Eleanor Creek.		LS	LS	LS	LS	None required.

Table 4.1-1
Summary of Water Supply Impacts and Mitigation Measures – Tuolumne River System and Downstream Water Bodies

Impact	Significance Determination					Mitigation Measures
		Biological Resource Impacts				
	All Impacts (except Biological Resources)	Sensitive Habitats	Key Special-Status Species	Other Species of Concern	Common Habitats and Species	
Impact 5.3.7-4: Impacts on biological resources in Lake Lloyd and along Cherry Creek.		LS	LS	LS	LS	None required.
Impact 5.3.7-5: Impacts on biological resources in Don Pedro Reservoir.		LS	LS	LS	LS	None required.
TERRESTRIAL BIOLOGY (cont.)						
Impact 5.3.7-6: Impacts on biological resources along the Tuolumne River below La Grange Dam.		LS when average annual deliveries from the watersheds are maintained at 265 mgd or less; PSM if deliveries exceed 265 mgd	LS when average annual deliveries from the watersheds are maintained at 265 mgd or less; PSM if deliveries exceed 265 mgd	LS when average annual deliveries from the watersheds are maintained at 265 mgd or less; PSM if deliveries exceed 265 mgd	LS when average annual deliveries from the watersheds are maintained at 265 mgd or less; PSM if deliveries exceed 265 mgd	The SFPUC will implement Measures 5.3.6-4a or 5.3.7-6 to reduce adverse impacts on sensitive habitats, key special-status species, other species of concern, and common habitats and species to a less-than-significant level. **Measure 5.3.6-4a, Avoidance of Flow Changes by Reducing Demand for Don Pedro Reservoir Water** – see description above. **If Measure 5.3.6-4a proves to be infeasible, the SFPUC will implement Measure 5.3.7-6. **Measure 5.3.7-6, Lower Tuolumne River Riparian Habitat Enhancement:** Consistent with the Lower Tuolumne River Restoration Plan, the SFPUC will protect and enhance one mile of riparian vegetation within the contemporary floodplain.
Impact 5.3.7-7: Conflicts with the provisions of adopted conservation plans or other approved biological resources plans for the Tuolumne Wild and Scenic River.		LS				None required.

Table 4.1-1
Summary of Water Supply Impacts and Mitigation Measures – Tuolumne River System and Downstream Water Bodies

Impact	Significance Determination					Mitigation Measures
		Biological Resource Impacts				
	All Impacts (except Biological Resources)	Sensitive Habitats	Key Special-Status Species	Other Species of Concern	Common Habitats and Species	
RECREATIONAL AND VISUAL RESOURCES						
Impact 5.3.8-1: Effects on reservoir recreation due to changes in water system operations.	LS					None required.
Impact 5.3.8-2: Effects on river recreation due to changes in water system operations.	LS					None required.
Impact 5.3.8-3: Effects on the aesthetic values of the Tuolumne Wild and Scenic River.	LS					None required.
ENERGY RESOURCES						
Impact 5.3.9-1: Effects on hydropower generation at facilities along the Tuolumne River	B					None required.

Table 4.1-2
Summary of Water Supply Impacts and Mitigation Measures – Alameda Creek Watershed

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts				
		Sensitive Habitats	Key Special Status-Species	Other Species of Concern	Common Habitats and Species	
STREAM FLOW						
Impact 5.4.1-1: Effects on flow along Calaveras Creek below Calaveras Reservoir.	LS					None required
Impact 5.4.1-2: Effects on flow along Alameda Creek below the diversion dam.	SU					**Measure 5.4.1-2, Diversion Tunnel Operation:** The SFPUC will implement operational criteria for the diversion dam which will require that water not needed to fill Calaveras Reservoir would be released to Alameda Creek below the diversion dam.
Impact 5.4.1-3: Effects in San Antonio Reservoir and along San Antonio Creek.	LS					None required.
Impact 5.4.1-4: Effects on flow along Alameda Creek below the confluence of San Antonio Creek.	LS					None required.
GEOMORPHOLOGY						
Impact 5.4.2-1: Effects on channel formation and sediment transport along Calaveras Creek.	LS					None required.
Impact 5.4.2-2: Effects on channel formation and sediment transport along Alameda Creek downstream of the diversion dam.	LS					None required.
Impact 5.4.2-3: Effects on channel formation and sediment transport along San Antonio Creek downstream of San Antonio Reservoir.	LS					None required.

Table 4.1-2
Summary of Water Supply Impacts and Mitigation Measures – Alameda Creek Watershed

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts				
		Sensitive Habitats	Key Special Status-Species	Other Species of Concern	Common Habitats and Species	
SURFACE WATER QUALITY						
Impact 5.4.3-1: Effects on water quality in Calaveras Reservoir.	LS					None required.
Impact 5.4.3-2: Effects on water quality in San Antonio Reservoir.	LS					None required.
Impact 5.4.3-3: Changes in water quality along Calaveras, San Antonio, and Alameda Creeks.	LS					None required.
GROUNDWATER BODIES						
Impact 5.4.4-1: Changes in groundwater levels, flows, quality, and supplies.	LS					None required.
FISHERIES						
Impact 5.4.5-1: Effects on fishery resources in Calaveras Reservoir.	B					None required.
Impact 5.4.5-2: Effects on fishery resources along Calaveras Creek below Calaveras Dam and along Alameda Creek below confluence with Calaveras Creek.	B					None required.

Table 4.1-2
Summary of Water Supply Impacts and Mitigation Measures – Alameda Creek Watershed

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts				
		Sensitive Habitats	Key Special Status-Species	Other Species of Concern	Common Habitats and Species	
FISHERIES (cont.)						
Impact 5.4.5-3: Effects on fishery resources along Alameda Creek downstream of Alameda Creek Diversion Dam.	PSM					**Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek:** The SFPUC will release a minimum flow of approximately 10 cubic feet per second from the diversion dam and monitor the effects of the release on resident trout spawning and egg incubation. ** If monitoring results for Measure 5.4.5-3a indicate the measure is unsuccessful, the SFPUC will implement Measure 5.4.5-3b. **Measure 5.4.5-3b, Alameda Diversion Dam Restrictions or Fish Screens:** If after 10 years the minimum release does not sustain the resident trout population, the SFPUC will either increase releases from the diversion dam or install a fish passage barrier on the diversion tunnel.
Impact 5.4.5-4: Effects on fishery resources in San Antonio Reservoir.	B					None required.
Impact 5.4.5-5: Effects on fishery resources along San Antonio Creek below San Antonio Reservoir.	LS					None required.
Impact 5.4.5-6: Effects on fishery resources along Alameda Creek below confluence with San Antonio Creek.	LS					None required.

Table 4.1-2
Summary of Water Supply Impacts and Mitigation Measures – Alameda Creek Watershed

Impact	Significance Determination					Mitigation Measures
		Biological Resource Impacts				
	All Impacts (except Biological Resources)	Sensitive Habitats	Key Special Status-Species	Other Species of Concern	Common Habitats and Species	
TERRESTRIAL BIOLOGY						
Impact 5.4.6-1: Effects on riparian habitat and related biological resources in Calaveras Reservoir.		PSM	PSM	LS	LS	The SFPUC will implement Measure 5.4.6-1 to reduce adverse impacts on sensitive habitats and key special-status species to a less-than-significant level. **Measure 5.4.6-1, Compensation for Impacts on Terrestrial Biological Resources:** The SFPUC will protect, restore. and enhance existing riparian habitat and/or create new habitat that compensates for WSIP-induced habitat losses at Calaveras Reservoir. Compensatory habitat may be provided as part of the SFPUC's Habitat Reserve Program.
Impact 5.4.6-2: Effects on riparian habitat and related biological resources along Alameda Creek, from below the diversion dam to the confluence with Calaveras Creek.		LS	PSM	LS	N/A	The SFPUC will implement Measures 5.4.1-2 and 5.4.5-3a to reduce adverse impacts on key special-status species to a less-than-significant level. **Measure 5.4.1-2, Diversion Tunnel Operation** – see description above. **Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek** – see description above.
Impact 5.4.6-3: Effects on riparian habitat and related biological resources along Calaveras Creek, from Calaveras Reservoir to the confluence with Alameda Creek.		LS	PSM	LS	LS	The SFPUC will implement Measure 5.4.6-3 to reduce adverse impacts on key special-status species to a less-than-significant level. **Measure 5.4.6-3, Operational Procedures for Calaveras Dam Releases:** The SFPUC will manage releases from Calaveras Reservoir to mimic a more natural hydrologic regime in the creek for the benefit of terrestrial biological resources. The specifics of this mitigation measure will be determined as part of project-level CEQA review.

Table 4.1-2
Summary of Water Supply Impacts and Mitigation Measures – Alameda Creek Watershed

Impact	Significance Determination					Mitigation Measures
		Biological Resource Impacts				
	All Impacts (except Biological Resources)	Sensitive Habitats	Key Special Status-Species	Other Species of Concern	Common Habitats and Species	
TERRESTRIAL BIOLOGY (cont.)						
Impact 5.4.6-4: Effects on riparian habitat and related biological resources along Alameda Creek, from the confluence with Calaveras Creek to the confluence with San Antonio Creek.		LS	PSM	LS	LS	The SFPUC will implement Measures 5.4.6-3 and 5.4.5-3a to reduce adverse impacts on key special-status species to a less-than-significant level. **Measure 5.4.6-3, Operational Procedures for Calaveras Dam Releases** – see description above. **Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek** – see description above.
Impact 5.4.6-5: Effects on riparian habitat and related biological resources in San Antonio Reservoir.		LS	LS	LS	LS	None required.
Impact 5.4.6-6: Effects on riparian habitat and related biological resources along San Antonio Creek between Turner Dam and the confluence with Alameda Creek.		LS	LS	LS	N/A	None required.
Impact 5.4.6-7: Effects on riparian habitat and related biological resources along Alameda Creek below the confluence with San Antonio Creek.		LS	LS	LS	N/A	None required.
Impact 5.4.6-8: Conflicts with the provisions of adopted conservation plans or other approved biological resources plans.		LS				None required.
RECREATION AND VISUAL						
Impact 5.4.7-1: Effects on recreational facilities and/or activities.	LS					None required.
Impact 5.4.7-2: Visual effects on scenic resources or visual character of the water bodies.	LS					None required.

Table 4.1-3
Summary of Water Supply Impacts and Mitigation Measures – Peninsula Watersheds

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts				
		Sensitive Habitats	Key Special-Status Species	Other Species of Concern	Common Habitats and Species	
STREAM FLOW						
Impact 5.5.1-1: Effects on flow along San Mateo Creek.	LS					None required.
Impact 5.5.1-2: Effects on flow along Pilarcitos Creek.	LS					None required.
GEOMORPHOLOGY						
Impact 5.5.2-1: Changes in sediment transport and channel morphology in the Peninsula watershed.	LS					None required.
WATER QUALITY						
Impact 5.5.3-1: Effects on water quality in Crystal Springs Reservoir, San Andreas Reservoir, and San Mateo Creek.	LS					None required.
Impact 5.5.3-2: Effects on water quality in Pilarcitos Reservoir and along Pilarcitos Creek.	LS					None required.
GROUNDWATER						
Impact 5.5.4-1: Alteration of stream flows along Pilarcitos Creek, which could affect groundwater levels and water quality.	LS					None required.
FISHERIES						
Impact 5.5.5-1: Effects on fishery resources in Crystal	PSU					**Measure 5.5.5-1, Create New Spawning Habitat Above Crystal Springs Reservoir:** The SFPUC will survey the extent and quality of

Table 4.1-3
Summary of Water Supply Impacts and Mitigation Measures – Peninsula Watersheds

Impact	Significance Determination					Mitigation Measures
		Biological Resource Impacts				
	All Impacts (except Biological Resources)	Sensitive Habitats	Key Special-Status Species	Other Species of Concern	Common Habitats and Species	
Springs Reservoir (Upper and Lower).						fish spawning habitat lost due to inundation and, if feasible, create new spawning habitat at a higher elevation. The specifics of this mitigation measure will be determined as part of project-level CEQA review.
Impact 5.5.5-2: Effects on fishery resources in San Andreas Reservoir.	LS					None required.
Impact 5.5.5-3: Effects on fishery resources along San Mateo Creek.	LS					None required.
Impact 5.5.5-4: Effects on fishery resources in Pilarcitos Reservoir.	LS					None required
Impact 5.5.5-5: Effects on fishery resources along Pilarcitos Creek below Pilarcitos Reservoir.	LS					None required

Table 4.1-3
Summary of Water Supply Impacts and Mitigation Measures – Peninsula Watersheds

Impact	Significance Determination					Mitigation Measures
		Biological Resource Impacts				
	All Impacts (except Biological Resources)	Sensitive Habitats	Key Special-Status Species	Other Species of Concern	Common Habitats and Species	
TERRESTRIAL BIOLOGY						
Impact 5.5.6-1: Impacts on biological resources in Upper and Lower Crystal Springs Reservoirs.		PSM	PSM	PSM	PSM	The SFPUC will implement Measures 5.5.6-1a and 5.5.6-1b to reduce adverse impacts on sensitive habitats, key special-status species, other species of concern, and common habitats and species to a less-than-significant level. In addition, the SFPUC will implement Measure 5.5.6-1c to mitigate adverse impacts to key special-status plant species (i.e., fountain thistle) adapted to serpentine seeps. **Measure 5.5.6-1a, Adaptive Management of Freshwater Marsh and Wetlands at Upper and Lower Crystal Springs Reservoirs:** The SFPUC will develop an adaptive management plan to minimize adverse effects of the WSIP-induced rise in average water levels, and periodic drawdown of reservoir water levels for maintenance, on San Francisco garter snakes and red-legged frogs. **Measure 5.5.6-1b, Compensation for Impacts on Terrestrial Biological Resources:** The SFPUC will protect, restore, and enhance existing wetland and upland habitat and/or create new habitat that compensates for WSIP-induced habitat losses at Crystal Springs Reservoir. Compensatory habitat may be provided as part of the SFPUC's Habitat Reserve Program. **Measure 5.5.6-1c, Compensation for Serpentine Seep-Related Special-Status Plants:** The SFPUC will protect, restore, and enhance existing habitat and/or create new habitat that compensates for WSIP-induced habitat losses for plant species adapted to serpentine seeps.
Impact 5.5.6-2: Impacts on biological resources in San Andreas Reservoir.		LS	LS	LS	LS	None required.
Impact 5.5.6-3: Impacts on biological resources along San Mateo Creek below Lower Crystal Springs Dam.		LS	LS	LS	LS	None required.

Table 4.1-3
Summary of Water Supply Impacts and Mitigation Measures – Peninsula Watersheds

Impact	Significance Determination					Mitigation Measures
		Biological Resource Impacts				
	All Impacts (except Biological Resources)	Sensitive Habitats	Key Special-Status Species	Other Species of Concern	Common Habitats and Species	
TERRESTRIAL BIOLOGY (cont.)						
Impact 5.5.6-4: Impacts on biological resources in Pilarcitos Reservoir.		LS	LS	LS	LS	None required.
Impact 5.5.6-5: Impacts on biological resources along Pilarcitos Creek below Pilarcitos Reservoir.		LS	LS	LS	LS	None required.
Impact 5.5.6-6: Impacts along Pilarcitos Creek below Stone Dam.		LS	LS	LS	LS	None required.
Impact 5.5.6-7: Conflicts with the provisions of adopted conservation plans or other approved biological resource plans.		LS				None required.
RECREATIONAL AND VISUAL RESOURCES						
Impact 5.5.7-1: Effects on recreational facilities and/or activities.	LS					None required.
Impact 5.5.7-2: Visual effects on scenic resources or the visual character of water bodies.	LS					None required.

Table 4.1-4
Summary of Water Supply Impacts and Mitigation Measures – Westside Groundwater Basin

Impact	Significance Determination		Mitigation Measures
	North Westside Groundwater Basin	South Westside Groundwater Basin	
RECREATIONAL AND VISUAL RESOURCES (cont.)			
Impact 5.6-1: Basin overdraft due to pumping from the Westside Groundwater Basin.	PSM	LS	The SFPUC will implement Measure 5.6.1 to reduce adverse impacts to the North Westside Groundwater Basin to a less-than-significant level. **Measure 5.6-1, Groundwater Monitoring to Determine Basin Safe Yield:** The SFPUC will continue ongoing groundwater and lake level monitoring programs to determine the safe yield of the North Westside Groundwater Basin in order to avoid overdraft and associated effects including adverse effects on surface water features and seawater intrusion
Impact 5.6-2: Changes in water levels in Lake Merced and other surface water features, including Pine Lake, due to decreased groundwater levels in the Westside Groundwater Basin.	PSM	N/A	The SFPUC will implement Measures 5.6.1 and 5.6-2 to reduce adverse impacts to the North Westside Groundwater Basin to a less-than-significant level. **Measure 5.6-1, Groundwater Monitoring to Determine Basin Safe Yield** – see description above. **Measure 5.6-2, Implementation of a Lake Level Management Plan:** The SFPUC will develop and implement a lake level management plan identifying strategies for altering pumping patterns or lake augmentation to maintain Lake Merced water levels within the desired long-term range.
Impact 5.6-3: Seawater intrusion due to decreased groundwater levels in the Westside Groundwater Basin.	PSM	LS	The SFPUC will implement Measure 5.6.1 to reduce adverse impacts to the North Westside Groundwater Basin to a less-than-significant level. **Measure 5.6-1, Groundwater Monitoring to Determine Basin Safe Yield** – see description above.
Impact 5.6-4: Land subsidence due to decreased groundwater levels in the Westside Groundwater Basin if the historical low water levels are exceeded.	LS	LS	None required.

Table 4.1-4
Summary of Water Supply Impacts and Mitigation Measures – Westside Groundwater Basin

Impact	Significance Determination		Mitigation Measures
	North Westside Groundwater Basin	South Westside Groundwater Basin	
RECREATIONAL AND VISUAL RESOURCES (cont.)			
Impact 5.6-5: Contamination of drinking water due to groundwater pumping in the Westside Groundwater Basin.	PSM	PSM	The SFPUC will implement Measure 5.6.5 to reduce adverse impacts to the North Westside and South Westside Groundwater Basins to a less-than-significant level. **Measure 5.6.5, Drinking Water Source Assessments for Groundwater Wells:** The SFPUC will develop and implement a source water protection program for wells constructed under the Local and Regional Groundwater Projects that are considered vulnerable to contamination on the basis of the drinking water source assessment prepared in accordance with Department of Health Services regulations.
Impact 5.6-6: Drinking water contaminants above maximum contaminant levels and adverse effects of adding treated groundwater to the distribution system.	LS	LS	None required.

Table 4.1-5
Summary of Water Supply Impacts and Mitigation Measures – Cumulative Water Supply

Cumulative Water Supply Impact	Cumulative Impact Significance Determination							Mitigation Measures
	Hydrology	Geomorphology	Surface Water Quality	Groundwater	Fisheries	Terrestrial Biology	Recreation / Visual Quality	
Impact 5.7.2-1: Tuolumne River – Hetch Hetchy Reservoir to Don Pedro Reservoir.	LS	LS	LS	LS	LS	LS	LS	None required.
Impact 5.7.2-2: Tuolumne River – Don Pedro Reservoir to the San Joaquin River.	LS	LS	LS	LS	LS	LS	LS	None required.
Impact 5.7.2-3: San Joaquin River, Stanislaus River, and the Delta.	LS	LS	LS	LS	LS	LS	LS	None required.
Impact 5.7.3-1: Alameda Creek watershed.	N/A	LS	LS	LS	LS	LS	LS	None required.
Impact 5.7.4-1: San Mateo Creek watershed.	LS	LS	LS	LS	LS	LS	LS	None required.
Impact 5.7.4-2: Pilarcitos Creek watershed.	LS	LS	LS	LS	LS	LS	LS	None required.
Impact 5.7.5-1: North Westside Groundwater Basin.	LS							None required.
Impact 5.7.5-2: South Westside Groundwater Basin.	LS							None required.

NOTE: Significance determinations presented in this table assume implementation of all mitigation measures as they are presented in Chapter 5, Section 5.6, and described in Chapter 6.

4.2 Plans and Policies

4.2.1 Overview

This section first describes applicable land use plans and policies and then discusses the project's consistency with those applicable land use plans and policies. The focus is on land use plans and policies of agencies responsible for approving this EIR, namely the San Francisco Planning Commission, the San Francisco Public Utilities Commission (SFPUC), and the San Francisco Board of Supervisors. However, the relevance of the land use plans and policies of other agencies is also discussed.

Relevant resource-specific plans are described in Sections 4.3 through 4.15 (e.g., air quality management plans are discussed in Section 4.9, Air Quality, and the San Joaquin County Multi-Species Habitat Conservation and Open Space Plan is discussed in Section 4.6, Biological Resources).

4.2.2 Regulatory Framework

City and County of San Francisco Plans and Policies

The San Francisco City Charter, along with several other city plans and policies, guide the SFPUC's activities. City and County of San Francisco (CCSF) plans relevant to the proposed project are the San Francisco General Plan, the Accountable Planning Initiative, and the San Francisco Sustainability Plan. The San Francisco General Plan serves as a strategic and long term planning guide for San Francisco. The San Francisco Sustainability Plan addresses the long-term ability of the CCSF to meet the needs of its present citizens without compromising the ability of future generations to meet their needs. While in some cases CCSF land use plans and policies may apply to projects outside of San Francisco, they are primarily applicable to projects within San Francisco's jurisdictional boundaries.

Extraterritorial Lands

Under the San Francisco City Charter, Section 8B.121, the SFPUC has authority over the management, use, and control of extraterritorial lands, that is, properties outside of the San Francisco city limits that the CCSF owns or leases or over which it holds easements. Although the San Francisco General Plan and San Francisco Sustainability Plan were developed for lands within the jurisdictional boundaries of San Francisco, their underlying goals apply to SFPUC projects on extraterritorial lands. Section 8B.121 provides:

> Notwithstanding Charter Section 4.112, Under the San Francisco City Charter, Section 8B.121, the Public Utilities Commission shall have exclusive charge of the construction, management, supervision, maintenance, extension, expansion, operation, use and control of all water, clean water and energy supplies and utilities of the City as well as the real, personal and financial assets, that are under the Commission's jurisdiction or assigned to the Commission under Section 4.132.

California Government Code Section 53090 et seq. provides that the SFPUC receives intergovernmental immunity from the planning and building laws of other cities and counties. The SFPUC, however, seeks to work cooperatively with local jurisdictions where CCSF-owned facilities are sited outside of San Francisco to avoid conflicts with local land use plans and building and zoning codes. Also, the SFPUC is required under Government Code Section 65402(b) to inform local governments of its plans to construct projects or acquire or dispose of its extraterritorial property. The local governments have a 40-day review period to determine project consistency with their general plans. Under this requirement, the cities' or counties' determinations of consistency are advisory to the SFPUC rather than binding.

San Francisco General Plan

The San Francisco General Plan serves as a strategic and long term planning guide for San Francisco and is the comprehensive planning document governing land use decisions within the CCSF. It articulates the community's vision for the future through a description of goals, objectives, and policies that address the unique characteristics of San Francisco. One of the plan's basic goals is the "coordination of the growth and development of the city with the growth and development of adjoining cities and counties and of the San Francisco Bay Region." It contains the following plan elements: Air Quality; Arts; Commerce and Industry; Community Facilities; Community Safety; Environmental Protection; Housing; Recreation and Open Space; Transportation; and, Urban Design. In addition to the 10 plan elements, the San Francisco General Plan also includes 10 area plans that apply to different parts of the city.

The plan elements that are potentially relevant to the proposed project are briefly described below:

Air Quality Element. The objectives and policies of this element promote adherence to air quality regulations, focusing development near transit services, and advocating alternatives to the private automobile with the goal of clean air planning.

Commerce and Industry Element. This element functions as a guide for decisions related to economic growth and change. It addresses general citywide objectives as well as objectives for each of the major sectors of San Francisco's economy with its goals of continued economic vitality, social equity (with respect to employment opportunities), and environmental quality.

Community Safety Element. Protection of human life and property from hazards is the goal of this element. To that end, it discusses the potential for geologic, structural, and nonstructural hazards to affect city-owned structures and critical infrastructure.

Environmental Protection Element. This element encourages the protection of plant and animal life and fresh water sources. It also addresses San Francisco's responsibility of providing a permanent, clean water supply to meet present and future needs, as well as maintaining an adequate water distribution system.

Urban Design Element. The objectives and policies of this element support preserving landmarks and structures with notable historic, architectural, or aesthetic value.

Accountable Planning Initiative

In November 1986, the voters of San Francisco approved Proposition M, the Accountable Planning Initiative, which codified the following eight Priority Policies by adding Section 101.1 to the City Planning Code:

1. Existing neighborhood-serving retail uses shall be preserved and enhanced and future opportunities for resident employment in and ownership of such businesses enhanced.

2. Existing housing and neighborhood character shall be conserved and protected in order to preserve the cultural and economic diversity of our neighborhoods.

3. The City's supply of affordable housing shall be preserved and enhanced.

4. Commuter traffic shall not impede Muni transit services or overburden our streets or neighborhood parking.

5. A diverse economic base shall be maintained by protecting our industrial and service sectors from displacement due to commercial office development, and that future opportunities for resident employment and ownership in these sectors shall be enhanced.

6. The City shall achieve the greatest possible preparedness to protect against injury and the loss of life in an earthquake.

7. Landmarks and historic buildings shall be preserved.

8. Parks and open space and their access to sunlight and vistas shall be protected from development.

San Francisco Sustainability Plan

The San Francisco Sustainability Plan addresses the long-term ability of the CCSF to meet the needs of its present citizens without compromising the ability of future generations to meet their needs. The plan covers the following issue areas: air quality; biodiversity; energy, climate change and ozone depletion; food and agriculture; hazardous materials; human health; parks, open spaces and streetscapes; solid waste; transportation; water and wastewater; economy and economic development; environmental justice; municipal expenditures; public information and education; and risk management. For each topic, there is a set of indicators that are to be used over time to determine whether the CCSF is moving in a sustainable direction in that particular area. It should be noted that while the San Francisco Board of Supervisors endorsed the plan in 1997, it has not committed the City to perform the actions addressed in the plan.

- ***San Francisco Municipal Green Building Program***

- San Francisco's Green Building Program was founded in 1999 when the CCSF adopted the Resource Efficient Building Ordinance, which established green building standards for municipal buildings to increase energy efficiency, conserve CCSF finances, reduce the environmental impacts of demolition, construction, and operation of buildings, and create safe workplaces for CCSF employees and visitors. The ordinance created the inter-departmental Resource Efficient Building (REB) Task Force and charged the San Francisco Department of Environment with implementing the ordinance in partnership with the Department of Public Works and other REB Task Force departments. In 2004, amendments to Chapter 7 of the Environment Code set Leadership in Energy and Environmental Design (LEED) Silver Certification by the U.S. Building Council as the minimum environmental performance requirement for all municipal projects over 5,000 square feet. The REB Task Force assists City departments in compliance with the LEED Silver Certification requirement and helps to determine which projects are applicable for LEED ratings. For all municipal construction projects, including those projects that do not involve buildings and are not required to obtain LEED Silver Certification, the REB Task Force provides recommended best practices and sample specifications for building materials (e.g., recycled content of steel and concrete) (San Francisco Department of the Environment, 2004-2007).

SFPUC Policies

Water Enterprise Environmental Stewardship Policy

The SFPUC adopted the Water Enterprise Environmental Stewardship Policy in 2006. The policy establishes the long-term management direction for land owned by the CCSF, as well as for natural resources affected by operation of the SFPUC water system within the Tuolumne River, Alameda Creek, and Peninsula watersheds. Also addressed by the policy are rights-of-way and properties in urban settings under SFPUC management. The policy includes the following provisions:

- The SFPUC will proactively manage the watersheds under its responsibility in a manner that maintains the integrity of the natural resources, restores habitats for native species, and enhances ecosystem function.

- To the maximum extent practicable, the SFPUC will ensure that all operations of the SFPUC water system (including water diversion, storage, and transport), construction and maintenance of infrastructure, land management policies and practices, purchase and sale of watershed lands, and lease agreements for watershed lands protect and restore native species and the ecosystems that support them.

- Rights-of-way and properties in urban surroundings under SFPUC management will be managed in a manner that protects and restores habitat value where available, and encourages community participation in decisions that significantly interrupt or alter current land use in these parcels.

In addition, the Water Enterprise Environmental Stewardship Policy (SFPUC, 2006) calls for development of the Watershed and Environmental Improvement Program and the specific integration of the policy into the Water System Improvement Program (WSIP) and WSIP facility improvement projects, including the proposed project.

General Land Use Plans and Policies of Other Jurisdictions

The project sites are located in unincorporated San Joaquin County. Both sites are located on extraterritorial lands owned by the CCSF, and thus the SFPUC would not be legally-bound to the policies contained in the San Joaquin County General Plan. Nonetheless, the San Joaquin County General Plan is discussed to the extent that it provides land use planning information for the jurisdiction in which the project is located. This information is relevant to evaluate the impacts of the project with respect to the specific significance criteria under CEQA that require an analysis of the compatibility of a proposed project with certain aspects of local land use plans and policies. These particular significance criteria are listed below along with the location in this document where the reader can find the impact evaluation:

- Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan (analyzed in Section 4.4, Geology, Soils, and Seismicity)

- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance (analyzed in Section 4.6, Biological Resources)

- Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan (analyzed in Section 4.6, Biological Resources)

- Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., conflict with policies promoting bus turnouts, bicycle racks, etc.), or would cause a substantial increase in transit demand that cannot be accommodated by existing or proposed transit capacity or alternative travel modes (analyzed in Section 4.8, Traffic, Transportation, and Circulation)

- Expose people to or generate noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies (analyzed in Section 4.10, Noise and Vibration)

- For a project located within an area covered by an airport land use plan (or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport), expose people residing or working in the project area to excessive noise levels (analyzed in Section 4.10, Noise and Vibration)

- Conflict with existing zoning for agricultural use or a Williamson Act contract[1] (analyzed in Section 4.12, Agriculture Resources)

San Joaquin County General Plan 2010

The San Joaquin County General Plan 2010 (San Joaquin County, 1992) is the comprehensive, long-range public policy document designed to guide the use of private and public lands within the county. It describes the county's vision for its future and provides specific objectives, policies, and implementation actions for community development, public health and safety, and resources. The general plan is divided into three chapters (Community Development, Public Health and Safety, and Resources) that cover the seven mandatory elements required to be in general plans by state law (California Government Code Sections 65302-65303).

The overall intent of the San Joaquin County General Plan is to address the identified key issues confronting the county over the life of the plan, while being adaptable to changing conditions. Those issues are: accommodating rapid population growth; responding to pressures for increased housing while insuring a balancing increase in jobs; minimizing growth impacts on agricultural land; attracting high quality jobs; ensuring adequate water; improving air quality; protecting the Delta; improving the circulation system; paying for infrastructure and services; developing interjurisdictional coordination; and maintaining the quality of life. As stated in the San Joaquin

[1] Under a Williamson Act (Land Conservation Act of 1965) contract, the landowner agrees to limit the use of the land to agriculture and compatible uses for a period of at least 10 years. In return, the land is taxed at a rate based on the agricultural production of the land, rather than its real estate market value.

County General Plan 2010, its overall goal is to "Balance social, environmental, economic, cultural, and aesthetic concerns to provide a quality living environment."

The San Joaquin County General Plan land use designation for both project sites is General Agriculture (A/G). According to the General Plan, the A/G land use designation applies to areas suitable for agriculture outside areas planned for urban development where:

- The soils are capable of producing a wide variety of crops and/or supporting grazing
- Parcel sizes are generally large enough to support commercial agricultural activities
- There exists a commitment to commercial agriculture in the form of Williamson Act contracts and/or capital investments

Typical uses include crop production, feed and grain storage and sales, aerial crop spraying, and animal raising and sales. Additional activities such as mineral resource recovery, dairy canning operations, stockyards, animal feed lots, and sales yards require permits. According to the General Plan, agricultural activities must principally be used for crop production, ranching, and grazing. However, agricultural support activities and non-farm uses are permitted as long as they are compatible with the agricultural operations and satisfy the following criteria:

- The use requires a location in an agricultural area because of unusual site area requirements, operational characteristics, resource orientation, or because it is providing a service to the surrounding agricultural area
- The operational characteristics of the use will not have a detrimental impact on the management or use of surrounding agricultural properties
- The use will be sited to minimize any disruption to the surrounding agricultural operations
- The use will not significantly impact transportation facilities, increase air pollution, or increase full consumption

The San Joaquin County zoning designation for both project sites is AG-160 (General Agriculture). According to the San Joaquin County Development Title (Title 9), the purpose of the AG zone is to preserve agricultural lands for the continuation of commercial agriculture enterprises. The Development Title requires that lots zoned AG-160 be at least 160 acres. Additionally, both sites are also within an agricultural preserve (R-69-C1). The R-69-C1 is a resolution that was passed by the San Joaquin County Board of Supervisors, and it allows properties with an agricultural land use designation to enter into a Williamson Act contract (Griffin, 2007).

Habitat Conservation Plans

Habitat conservation plans provide comprehensive, long-term conservation measures for species listed as threatened or endangered under the California and Federal Endangered Species Acts, or for species that could be listed in the future. Section 4.6, Biological Resources, presents a discussion of the San Joaquin County Multi-Species Habitat Conservation and Open Space Plan (SJMSCP) and addresses plan consistency.

4.2.3 Plan Consistency Evaluation

Approach to Analysis

The evaluation of plan consistency is based on the applicability of relevant land use plans and policies to the proposed project as they relate to:

- The underlying goals of the San Francisco General Plan and Sustainability Plan and the principal goals of the SFPUC Water Enterprise Environmental Stewardship Policy

As stated above, the San Francisco General Plan and Sustainability Plan are primarily applicable to projects located in San Francisco; however, they may also be applicable to projects on SFPUC extraterritorial land.

For these plans, a determination of potential consistency was made as required by Section 15125(d) of the CEQA Guidelines. However, because the policy language found in a land use plan is susceptible to varying interpretations, it is often difficult to determine whether a proposed project is consistent or inconsistent with such policies. Further, because land use plans often contain numerous policies emphasizing differing legislative goals, the project may be "consistent" with a general plan, taken as a whole, even though they may appear inconsistent with specific policies within the plan. The board or commission that enacted the plan or policy generally determines the meaning of such policies; these interpretations prevail if they are "reasonable," even though other reasonable interpretations are also possible. In light of these considerations, the consistency evaluation in this EIR represents the best attempt to advise the decision-makers as to whether the proposed project is consistent with applicable land use plans and policies.

Direct and indirect physical impacts resulting from project implementation are not addressed in this section, but in the appropriate technical sections of the EIR. For example, temporary impacts associated with dust and noise from project construction are addressed in Section 4.9 (Air Quality) and Section 4.10 (Noise and Vibration) of Chapter 4, respectively.

Consistency with San Francisco Plans and Policies

San Francisco General Plan

As described above in Section 4.2.2, the San Francisco General Plan addresses air quality, community protection from geologic and seismic hazards, protection of water resources,

biological resources, and other natural resources, construction-related noise, ambient air quality, and urban design as it relates to protection of historical and visual resources.

Although the project would result in impacts on air quality and natural resources, on the whole, it would mitigate such impacts. Implementation of the project would increase community safety, which would be a beneficial impact. Upgrading the existing disinfection facilities at the Tesla Portal site to meet current seismic, safety/fire, and building code standards would help protect the water system from the effects of earthquakes and other hazards. Moreover, new water treatment facilities at the Tesla Portal site that would meet federal and state requirements for water quality would help reduce the potential for a waterborne outbreak of gastrointestinal illness from *Cryptosporidium*. Additionally, the improvements at the Thomas Shaft site would help reduce the potential for a waterborne outbreak of gastrointestinal illness from *Giardia*. The project would, on the whole, be consistent with the San Francisco General Plan.

The San Francisco General Plan provides general policies and objectives to guide land use decisions. Any conflict between the proposed project and policies that relate to physical environmental issues are discussed in Sections 4.3 through 4.15. The compatibility of the proposed project with San Francisco General Plan policies that do not relate to physical environmental issues will be considered by decision-makers as part of their decision whether to approve or disapprove the proposed project. Any potential conflicts identified as part of the process would not alter the physical environmental effects of the proposed project.

Accountable Planning Initiative

Of the eight priority policies in the Accountable Planning Initiative, only policies six and seven are relevant to the proposed project. Policy six stipulates that the City achieve the greatest possible preparedness to protect against injury and the loss of life in an earthquake. Policy seven states that landmarks and historic buildings be preserved. The other priority policies are not applicable to the proposed project because the project site is not located in the CCSF and would have no effect on the viability of neighborhood-serving retail uses or housing and neighborhood character; increasing commuter traffic on local streets; or, blocking sunlight and views for CCSF parks and open space. Additionally, due to the nature of the proposed project (upgrading of existing water disinfection facilities), it would not affect preservation and enhancement of the city's supply of affordable housing, or displace industrial and service uses due to commercial office development.

With regard to policy six, earthquake preparedness, the proposed facilities are components of the SFPUC's WSIP. One of the primary goals of the WSIP is ensuring the reliability of the regional water system during a seismic event. The replacement of the Tesla Portal Hypochlorite Station with the new Chemical Process Building and Office/Control Building would result in a new chlorination facility that meets current seismic standards, taking the place of an existing chlorination facility that does not meet current seismic standards. This would reduce the vulnerability of the existing facility to earthquakes, as well as facilitating the continued operation of the chlorination facility should an earthquake occur.

With regard to policy seven's mandate to protect historic buildings, the proposed project would not alter or demolish historic resources. In addition, the historic resources identified at the Tesla Portal site would be maintained by SFPUC to prevent deterioration. Furthermore, the project's potentially significant impact of unintentional damage or destruction to historic resources due to the operation of construction equipment and storage of construction materials near the resource would be mitigated to a less-than-significant level by Mitigation Measures 4.7-3a (historical resources protection plan) and 4.7-3b (pre-construction surveys and vibration monitoring).

The proposed project would, on the whole, be consistent with San Francisco's Priority Policies, and would result in a beneficial impact related to earthquake preparedness.

San Francisco Sustainability Plan

The purpose of the San Francisco Sustainability Plan is to address the long-term environmental sustainability of San Francisco. The proposed project would be consistent with the goals of the sustainability plan because it proposes improvements that would increase the reliability of water supply to the city during earthquakes or other situations that could cause substantial damage and/or a system failure and would help reduce the potential for a waterborne outbreak of gastrointestinal illness from *Cryptosporidium* and *Giardia*.

- ***San Francisco Municipal Green Building Program***
- The San Francisco Municipal Green Building Program was developed for the purpose of improving the environmental performance of municipal buildings. The proposed project would be designed, constructed, and operated in accordance with the City's Green Building requirements. The SFPUC would complete and submit LEED checklists to the REB Task Force for the proposed project.

Water Enterprise Environmental Stewardship Policy

The proposed project would not be inconsistent with the underlying goals of the Water Enterprise Environmental Stewardship Policy. Of the potentially significant impacts on natural resources and habitat identified in Section 4.6, mitigation measures described in Chapter 5 identify approaches to reduce impacts to less than significant levels. Overall, the project as proposed would not result in habitat fragmentation or reduce ecosystem function.

Consistency with San Joaquin County Plans and Policies

San Joaquin County General Plan 2010

As described above, the SFPUC is not legally-bound by the land use policies of other local jurisdictions. The determination of project consistency with the local general plan would be made by the pertinent land use jurisdiction following preparation of this project-specific CEQA documentation and notification by the SFPUC pursuant to state law. Nonetheless, this EIR provides a brief analysis of the project's consistency with the San Joaquin County General Plan.

As noted above, on the whole, the intent of the San Joaquin County General Plan is to address the identified key issues confronting the county over the life of the plan, while being adaptable to changing conditions. The identified key issues confronting the county that are applicable to the project consist of: ensuring adequate water; improving air quality; and maintaining the quality of life. Project implementation of seismic, safety/fire, and building code upgrades at the Tesla Portal site would help protect the water system from the effects of earthquakes and other hazards, ensuring adequate water supplies. While project activities would result in impacts on air quality (mostly temporary construction impacts), the project would mitigate such impacts and would not

prevent the county from improving air quality. Finally, a clean, safe water supply is essential to good health and good quality of life. Implementation of the project would help protect the water supplied to LLNL Site 300 from potential contamination with *Cryptosporidium* and *Giardia*, helping to protect the health and maintain the quality of life of employees at the site. In general, the project would be consistent with the San Joaquin County General Plan.

Regarding the project's consistency with San Joaquin County resource protection goals, by preparing this EIR and conducting associated scoping and public outreach efforts, the CCSF has systematically identified the significant environmental impacts associated with project implementation as well as the feasible measures and alternatives to avoid or substantially lessen such effects. The significance criteria used in this EIR correlate with the intent of general plan goals and policies related to protecting the environment. As detailed throughout the remaining sections of Chapter 4, the majority of project impacts are related to construction, and these impacts would be reduced to less than significant levels, either through measures proposed as part of the project or otherwise committed to by the CCSF.

General Agriculture (A/G) Land Use Designation and Zoning

The San Joaquin County General Plan land use designation for both project sites is A/G. According to the General Plan, this designation applies to areas where soils are capable of producing a wide variety of crops and/or supporting grazing and there is a general commitment to agriculture with viable commercial agricultural enterprises. Additionally, according to the General Plan, non-farm uses are permitted in areas with the A/G land use designation if necessitated by their site area requirements or operational characteristics or if the use provides a service to the surrounding agricultural area (e.g., quarry operations). Further requirements that must be met are that the use must not negatively affect the management and operations of surrounding agricultural properties or significantly impact transportation facilities, increase air pollution, or increase full consumption. With the A/G land use designation, agricultural land uses are allowed, and public facilities are permitted; both of which are existing uses at the Tesla Portal site. Furthermore, implementation of the Tesla Treatment Facility would not result in a substantial intensification of use that would increase any potential inconsistencies with agricultural uses. Although there is no grazing lease at the Thomas Shaft site, the A/G land use designation would allow cattle grazing. Similarly, the AG-160 (General Agriculture) zoning of each site retains the option for agricultural land use, but also allows public facilities, such as those at the Tesla Portal and Thomas Shaft sites. Refer to Section 4.12 for a more detailed discussion of the project's potential to conflict with agricultural zoning.

4.2.4 References

City and County of San Francisco (CCSF), 1988. *General Plan*. Amended through 1996.

CCSF, *San Francisco Sustainability Plan*, 1997.

Griffin, Rick, Senior Planner, San Joaquin County, Community Development Department, Personal Communication, April 6, 2007.

SFDE, San Francisco Municipal Green Building Report 2004-2007.

San Francisco Public Utilities Commission (SFPUC), *SFPUC Water Enterprise Environmental Stewardship Policy*, www.sfwater.org, June 27, 2006c.

San Joaquin County, San Joaquin County General Plan 2010, July 1992.

4.3 Land Use and Visual Quality

4.3.1 Setting

Land Use

Tesla Portal Site

The Tesla Portal site, located approximately 7.5 miles south of the City of Tracy, is approximately 52 acres. The majority of the site is undeveloped, consisting of gently rolling hillsides covered by California annual grassland, with some cattle grazing onsite. A smaller, generally flat portion of the site is developed and contains the Tesla Portal Hypochlorite Station among other structures. As described in Chapter 3, the site contains several buildings and various water pipeline infrastructure. Three buildings, a wood-frame building housing the chlorination unit, a pump house, and a watershed keeper's cottage, were constructed in 1936, while two valve houses were added later, one in 1949 and the other in 1963. Located directly southwest of the Tesla Portal Hypochlorite Station is the Tesla overflow shaft, which is 5 feet in diameter and rises approximately 60 feet above ground elevation. Additionally, three 20,000-gallon water tanks are located on a hillside southwest of the shaft and buildings.

Large expanses of undeveloped grass-covered hillsides, scattered trees, occasional rural residential uses (homes, barns, outbuildings, tractors, etc.), utility lines, barbed wire fencing, and animal grazing form the defining features of the land surrounding the site. Agricultural land surrounding the site is used for animal grazing and is similar in nature to the undeveloped portions of the site (undeveloped, gently rolling hillsides covered by California annual grassland). The closest residential structure to Tesla Portal is located approximately 2,500 feet southeast of the project area, off West Vernalis Road. In addition, there are several ranch structures located approximately 750 feet west of the project area. The small, unincorporated community of Chrisman is located approximately 0.75 mile east of the Tesla Portal site. While still rural in character, Chrisman is more developed and built-up than the majority of the area surrounding the project site. A private golf course, the Tracy Golf and Country Club is located just east of Chrisman on the other side of South Chrisman Road. Refer to Figure 4.3-1a (Tesla Portal Existing and Surrounding Land Uses).

Thomas Shaft Site

The Thomas Shaft site, located approximately 4.4 miles southeast of the Tesla Portal site and approximately seven miles southwest of the City of Tracy, consists of approximately 28 acres that are mostly undeveloped and characterized by rolling hillsides covered with grassland and scattered oak trees. Approximately one acre of the site is developed with two facilities, a tunnel and access shaft (built when the Coast Range Tunnel was first installed in the area) and a backup chlorination facility that is used to chlorinate Hetch Hetchy water if adequate chlorination does not occur at the Tesla Portal Hypochlorite Station (refer to Figure 3-1 in Chapter 3, Project Description). Agricultural land uses, consisting of animal grazing, and open space surround the

site. There is a rural residence about 1.25 miles to the northeast of the facility. Lawrence Livermore National Laboratory (LLNL) Site 300 is located at the intersection of Thomas Shaft Road and Corral Hollow Road, about 1.5 miles to the north. LLNL Site 300 contains a variety of office buildings and other structures. Refer to Figure 4.3-1b (Thomas Shaft, Existing and Surrounding Land Uses).

Visual Quality

Tesla Portal Site

The Tesla Portal site is located approximately 0.75 miles southwest of Interstate 580 (I-580) and about 0.75 miles west of the rural unincorporated residential development of Chrisman. Natural, rural qualities characterize the largely undeveloped site, with rolling hills in the south and generally flat grassland in the north. A small cluster of buildings occupies the flat portion of the property. Three water tanks are located on the hillside south of the buildings. The area immediately north, west, and south of the site are generally undeveloped and visually defined by open space used for ranching operations and the rural residential development of Chrisman to the east. Photographs of the existing visual conditions of the Tesla Portal site are provided in Figures 4.3-3a, b, c, d, and e (Tesla Portal Visual Conditions). Figure 4.3-2 (Tesla Portal Viewpoint Locations) shows the locations where the photographs were taken.

Only a small portion of the Tesla Portal site is developed. Existing structures on the site include a manifold structure, the Tesla overflow shaft, caretaker's cottage, caretaker's garage, chlorinator building, pump house/equipment, northwest valve house, southwest valve house, and an office/storage building. The Tesla overflow shaft is 5 feet in diameter and rises approximately 60 feet above ground elevation. The caretaker’s cottage and some of the various other structures are generally similar in terms of design and reflect the California Craftsman style with concrete foundations, featuring concrete stucco-clad walls and double-gabled composition shingle clad roofs. The architectural details include double-gabled roof features, overhanging eaves and decorative knee-brace roof brackets on the gable ends. The gable end peaks feature basket-weave lattice wood vents above the plaster walls. The valve houses reflect the Spanish Revival style, with concrete foundations, concrete stucco-clad walls and clay tile gable roofs. The potential historic qualities of these structures are described in Section 4.7, Cultural Resources.

There is permanent exterior lighting on five existing street lamps on the Tesla Portal site: two near the main gate, one on the power pole at the entrance to the Coast Range Tunnel, one half way up the road towards the main entrance of the facility, one near the back gate, and one on a power pole adjacent to the building that contains the Tesla Portal Hypochlorite Station. In addition, each building has exterior lighting, including motion-sensor lighting, on the buildings over the doors and on the side walls.

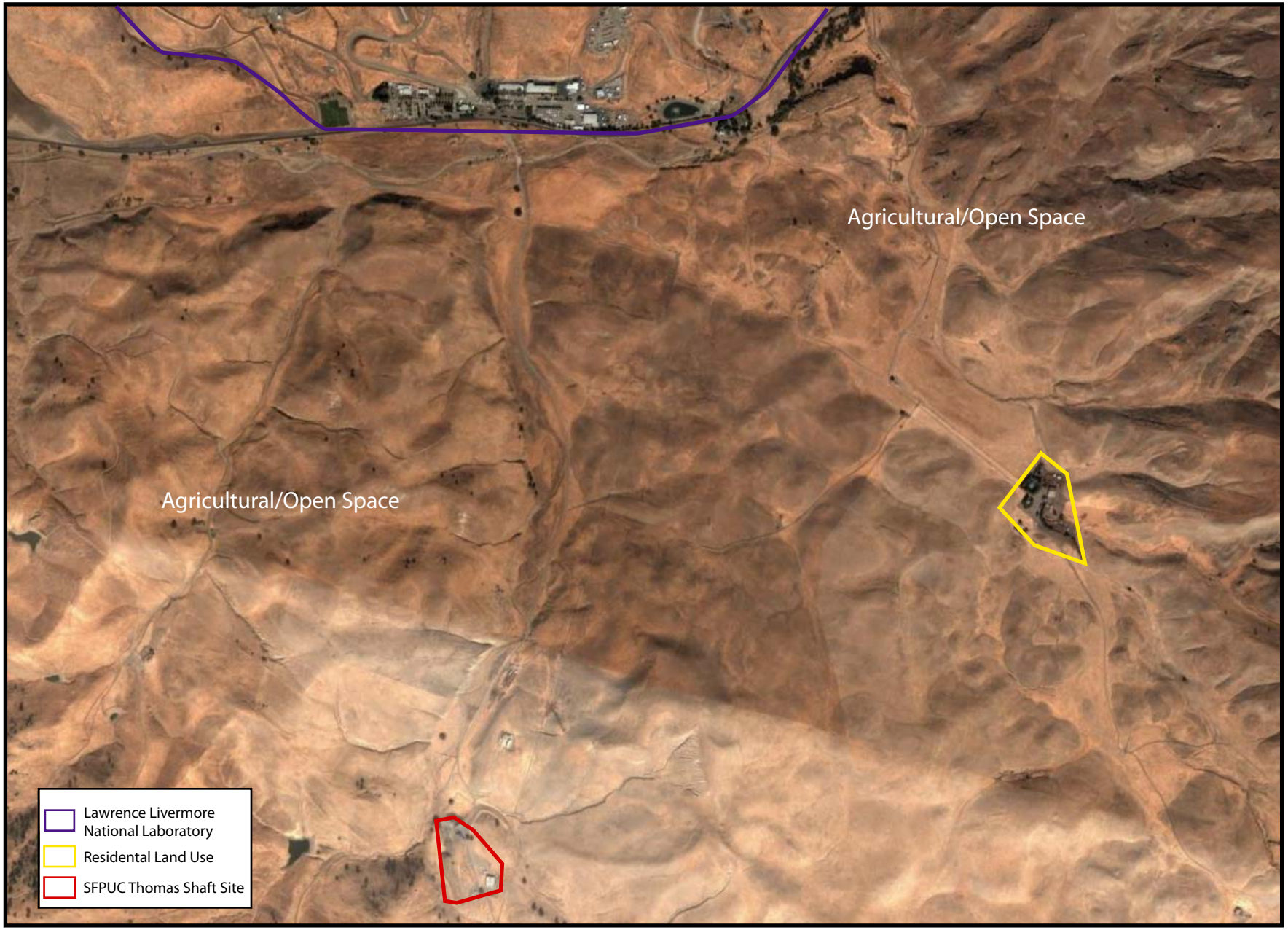
Source: Google Earth

0 1,200 2,400 Feet
APPROXIMATE

SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT EIR

Tesla Portal Existing and Surrounding Land Uses

Figure 4.3-1a



Source: Google Earth

0 1,200 2,400 Feet
APPROXIMATE

SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT EIR

Thomas Shaft Existing and Surrounding Land Uses

Figure 4.3-1b

Viewpoints

A - Looking at ranch structures west of Tesla Portal
B - Looking southwest at existing structures at Tesla Portal
C - View from existing Tesla Portal structures looking northeast
D - Looking southwest from Tesla Portal
E - Looking southwest at Tesla Portal from Interstate 580

Tesla Portal Project Boundary

0 1,500 3,000 Feet
APPROXIMATE

SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT EIR

Tesla Portal Viewpoint Locations

Figure 4-3.2

a. Ranch structures located west of Tesla Portal.

b. Existing Tesla Portal structures, looking southwest.

SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT EIR

Tesla Portal Visual Conditions

Source: Baseline Environmental Consulting, 2006

Figures 4.3-3a & b

c. View from existing Tesla Portal structures, looking northeast. Interstate 580 can be seen in the background.

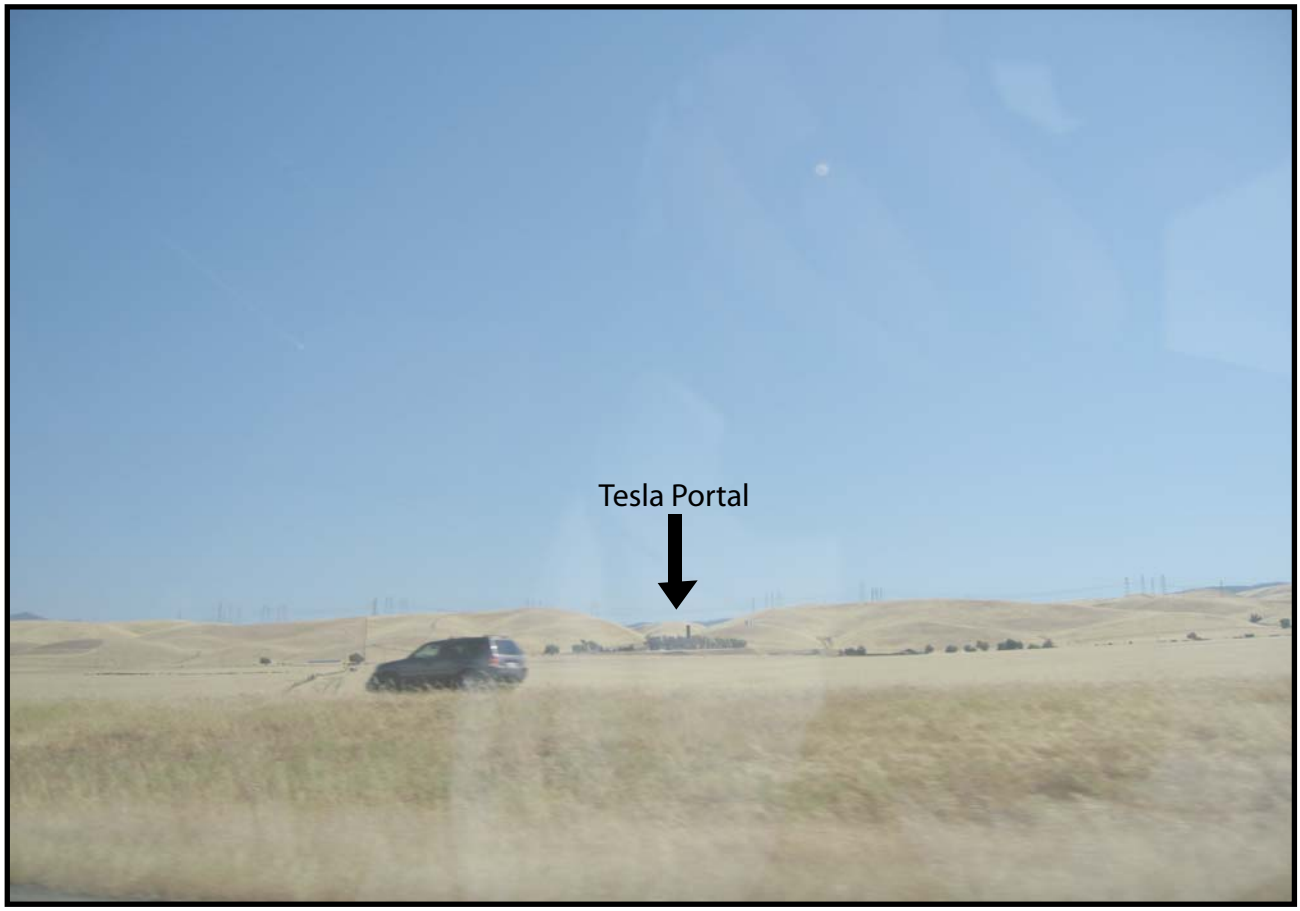
d. Looking southwest from Tesla Portal.

SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT EIR

Tesla Portal Visual Conditions

Source: Baseline Environmental Consulting, 2006

Figures 4.3-3c & d



e. Looking southwest at Tesla Portal from Interstate 580.

SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT EIR

Tesla Portal Visual Conditions

Source: Baseline Environmental Consulting, 2006

Figure 4.3-3e

Contributing to the rural qualities of the site is the existing vegetation, which consists of California annual grassland and non-native trees. There is an artificial wetland area that lies approximately 100 feet west of the existing access road leading up to Tesla Portal. The wetland is approximately 0.308 acres in size and extends 850 feet northwest of the current facilities. There is a row of trees directly north of the existing buildings and California annual grassland north of the trees. The hills south of the existing facilities are covered with California annual grassland as well.

There are two State Designated Scenic Highways located in San Joaquin County. I-580 is an officially designated State Scenic Highway from Interstate 5 (I-5) to the Alameda County line. I-5 is an officially designated State Scenic Highway from the Stanislaus County line to I-580 (California Department of Transportation, 2008). As shown in Figure 4.3-2e, there are distant views of the Tesla Portal site from I-580; however, much of the facility is shielded from view by trees. San Joaquin County General Plan has designated 12 scenic routes throughout the county. Within the vicinity of the Tesla Portal site, the San Joaquin County General Plan identifies I-580 and I-5 from Stanislaus County to the Alameda County line for a length of 16 miles as scenic routes (essentially equivalent to the Caltrans officially designated routes).

Thomas Shaft Site

The Thomas Shaft site and the area immediately surrounding it are characterized by undeveloped, gently rolling hills covered with California annual grassland and occasional oak trees. Approximately one acre of the site is developed and contains the Thomas Shaft Chlorination Facility and associated structures. Areas surrounding the project site are used for cattle grazing. Access to the site is via Thomas Shaft Road, a private road starting at Corral Hollow Road about 1.5 miles north of the site. Contributing to the rural character of the area are a farmhouse, shed, and associated facilities located approximately 1.25 miles northeast of the project site. Photographs of the existing visual conditions of the site are provided in Figure 4.3-4 (Thomas Shaft Visual Conditions).

The Thomas Shaft Chlorination Facility is a concrete structure surrounded by a chain link fence. While no lighting is provided along the existing roadway, there are outdoor light fixtures attached to the building. These lights are used for gate access and to light the doorways leading into the facility.

There are no State Scenic Highways located in the immediate vicinity of the Thomas Shaft site, and the nearest Scenic Highway is a 16-mile portion of I-580 and I-5 between Stanislaus and Alameda counties. San Joaquin County General Plan has designated 12 scenic routes throughout the county. Within the vicinity of the Thomas Shaft site, Corral Hollow Road is a designated scenic route. However, because of the topography of the surrounding area and distance from Corral Hollow Road to the site, the Thomas Shaft facilities are not visible from this scenic road.

Existing chlorination building.

Existing facilities over Thomas Shaft.

SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT EIR

Thomas Shaft Visual Conditions

Source: Garcia and Associates, 2008

Figure 4.3-4

4.3.2 Regulatory Framework

Refer to Section 4.2 (Plans and Policies) for a discussion of the regulatory and planning framework for the proposed project, and analysis of the project's consistency with relevant plans and policies. Information is provided below for other adopted regulations and policies that govern visual quality in the project vicinity.

Visual Quality

California Scenic Highway Program

In 1963, California's Scenic Highway Program was established to protect and enhance the natural scenic beauty of California highways and adjacent corridors, through special conservation treatment. The scenic highway program consists of eligible and officially designated routes. A highway may be designated as *eligible* for listing as a state scenic highway if it offers travelers scenic views of the natural landscape, largely undisrupted by development. Eligible routes advance to *officially designated* status when the local jurisdiction adopts ordinances to establish a scenic corridor protection program and receives approval from the California Department of Transportation (Caltrans).

Scenic Highways Element of the San Joaquin County General Plan

The Scenic Highways Element of the San Joaquin County General Plan was adopted by the Board of Supervisors on October 19, 1978. The purpose of the element is to establish scenic routes in the county and to guide the preservation and enhancement of scenic qualities and natural scenic areas adjacent to and visible from scenic routes.

4.3.3 Impacts

Significance Criteria

The City and County of San Francisco has not formally adopted significance standards for impacts related to land use and visual quality, but generally considers that implementation of a proposed project would have significant impacts to these resources if it were to:

Land Use

- Physically divide an existing community
- Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect (analyzed in Section 4.2, Plans and Policies)
- Have any substantial impact upon the existing character of the vicinity

- Substantially disrupt or displace existing land uses or land use activities

Visual Quality

- Have a substantial adverse effect on a scenic vista including views from a designated scenic highway or road
- Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and other features of the built or natural environment which contribute to a scenic public setting
- Substantially degrade the existing visual character or quality of the site and its surroundings
- Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area or which would substantially impact other people or properties

Areas of No Project Impact

Land Use

As described above, the areas surrounding both sites contain little or no development, and the construction of the proposed improvements and their on-going operation would not physically divide an existing community. These SFPUC facilities are currently used for water system purposes and the facilities would continue to perform their current function once construction is complete. The proposed project would have no impact with respect to this significance criterion.

Visual Quality

The Thomas Shaft site, and therefore, also the project activities proposed at this location, is not visible from any scenic vistas or scenic roadways including Corral Hollow Road. The UV system would be installed within the existing Chlorination Facility building. The new prefabricated building placed over the Thomas Shaft would be constructed out of an eight foot steel frame surrounded by metal siding. The new building would be designed to be visually compatible with the existing facility and would not change the character of the site. Therefore, the project improvements at the Thomas Shaft site would not have construction or operational impacts with respect to this significance criterion.

The Thomas Shaft site is located about 1.5 miles south of Corral Hollow Road and approximately 1.25 miles southwest of the nearest rural residence. Given the distance of the site from Corral Hollow Road and from any residential uses, the project would not degrade the existing visual character or quality of the site or its surroundings and no impact would result. The Thomas Shaft site has existing lighting: however, no additional exterior lighting would be installed at the site. Therefore, the proposed project at Thomas Shaft would not create a new source of light or glare and would have no impact to day or nighttime views. These areas of no impact are not discussed further for the project components at the Thomas Shaft site.

Approach to Analysis

The land use analysis evaluates short-term impacts on existing land uses resulting from temporary construction activity. Construction and operation of the proposed project at Tesla Portal and Thomas Shaft sites would occur within the existing site boundaries. Potential physical environmental effects on surrounding land uses resulting from implementation of this project are addressed in the respective sections of this EIR, including Section 4.7, Cultural Resources; Section 4.8, Traffic, Transportation, and Circulation; Section 4.9, Air Quality; and Section 4.10, Noise and Vibration.

The analysis of visual resources identifies potential temporary and permanent adverse visual impacts that the project can have on scenic vistas, as seen from scenic highways, or on other visual resources. For analysis of impacts on scenic vistas, information was compiled from Caltrans' list of designated scenic highways (California Department of Transportation, 2008).

Land Use

Project consistency with applicable plans and policies is analyzed in Section 4.2, Plans and Policies. The remaining significance criteria are addressed below.

Construction Impacts

Impact 4.3-1: Temporary disruption or displacement of existing land uses during construction (Tesla Portal: LS; Thomas Shaft: LS)

For the purposes of this analysis, a combination of noise, vibration, dust, traffic congestion, and/or access disruption constitutes a temporary land use disruption. As stated above, these potential impacts are evaluated individually in the respective sections of this EIR.

The proposed improvements and construction staging would occur at existing SFPUC facility sites that are currently used for water system purposes, and the facilities would continue to perform their current functions during construction; therefore, construction operations would not significantly or adversely disrupt or displace existing onsite land uses. Furthermore, due to the remoteness of both the Tesla Portal and Thomas Shaft sites, project construction activities would remain isolated from other developed land uses.

Tesla Portal Site

The proposed improvements at the Tesla Portal site would occur within existing site boundaries. It is possible that a combination of construction noise, vibration, dust, traffic congestion and/or access disruption could temporarily affect residential uses near the Tesla Portal site; however, the construction phase would be short-term and temporary, and the surrounding area is open space/grassland, with the nearest residential area 0.5 mile away.

The construction of the improvements at the Tesla Portal site would use an approximately nine-acre, undeveloped grassland area located on the site on both sides of the entrance road for staging. No other equipment and materials staging areas and/or temporary construction easements are anticipated for the construction of the improvements at the Tesla Portal site. Therefore, impacts associated with temporary disruption or displacement of existing land uses during construction would be less than significant.

Thomas Shaft Site

At the Thomas Shaft site, proposed improvements would occur within existing SFPUC site boundaries. Additionally, there is sufficient space at the Thomas Shaft site for equipment and materials staging areas; therefore, there would not be any use of properties adjacent to the site for staging and/or need for temporary construction easements. Therefore, impacts associated with temporary disruption or displacement of existing land uses during construction would be less than significant.

Impact 4.3-2: Temporary impact to the existing character of the vicinity (Tesla Portal: LS; Thomas Shaft: LS)

The area surrounding both project sites is rural in character. Construction activities associated with new development under the proposed project would be confined to a relatively small area on both sites, which would leave the majority of the sites undeveloped and would not have a substantial adverse impact on the existing character of the vicinity. Therefore, a less than significant impact would result.

Operational Impacts

Impact 4.3-3: Substantially impact the existing character of the vicinity (Tesla Portal: LS; Thomas Shaft: LS)

The area surrounding the project sites would remain rural in character after construction is complete. As the project does not propose any changes in the general use of either the Tesla Portal or Thomas Shaft sites and the proposed improvements would be confined to a relatively small portion of each site, with the remainder left as undeveloped open space, project operation would not have a substantial adverse impact upon the existing character of the vicinity. Therefore, a less than significant impact would result.

Visual Quality

Construction Impacts

Impact 4.3-4: Temporary construction-related adverse impacts on scenic vista or scenic resources (Tesla Portal: LS; Thomas Shaft: N/A)

Construction activities typically have only temporary effects on a scenic vista or scenic resource and, therefore, are generally considered to have a less-than-significant impact. However, construction projects that would be located at a site for a year or more could result in construction-related visual impacts.

Work proposed at the Tesla Portal site is scheduled to last for approximately 24 months, and construction activities would consist of excavation, relocation of existing utilities, site grading, structural work, mechanical/process system work, and electrical work. Nighttime lighting of the construction staging and development areas is proposed to provide security during construction, and could also occur during tie-in of the new facilities. Construction staging areas, graded surface, construction materials, equipment and truck traffic would be located approximately 0.75 mile from I-580, a State Designated Scenic Highway and a scenic route designated by San Joaquin County General Plan. Project construction would have a minimal effect on the scenic characteristics of the undeveloped portion of the site where construction staging and development would occur.

As described in Chapter 3, the SFPUC would implement Standard Construction Measure #10 as part of the project, to reduce visibility of staging areas, maintain a clean and orderly site, and nighttime lighting would be directed away from residential areas during construction. Therefore, construction-related visual impacts would be considered less than significant.

Operational Impacts

Impact 4.3-5: Permanent adverse impacts on scenic vistas or scenic resources (Tesla Portal: PSM; Thomas Shaft: N/A)

At the Tesla Portal site, new facilities, including three new buildings, new paved areas and security improvements, (refer to Chapter 3, Project Description), would be constructed northeast of existing structures, on approximately three acres that currently is undeveloped grassland.

There are distant views of the Tesla Portal site from I-580, which is a State Designated Scenic Highway (from I-5 to the Alameda County line), and a scenic route designated by San Joaquin County General Plan, and located approximately 0.75 miles north of the site. Existing views from I-580 of the larger project vicinity generally illustrate a rural setting with undeveloped rolling hills serving as a backdrop to farmland and grazing land with intermittent development comprised of farm structures or other clustered development (e.g., the community of Chrisman, and the

Tesla Portal site). The existing structures at Tesla Portal are somewhat visible from I-580, although much of the facility is shielded from view by trees and located at such a distance that the facilities are not fully visible (refer to Figure 4.3-2c). The proposed buildings would be 12 feet tall (Office and Control Building) and 32 feet tall (Chemical Process Building and UV Disinfection Facility), and likely constructed out of concrete and steel with some glass details. The proposed structures would be located northeast of existing facilities and northeast of the existing screen of trees.

The construction of new buildings could result in potentially significant visual impacts to a scenic resource as viewed from I-580 because the project would increase the onsite concentration of structures, thereby incrementally contributing to an interruption of views of the surrounding rural character and rolling hills. New buildings would be visible from I-580 and the structures would not be shielded from view by trees or any other vegetation. However, this impact would be mitigated through project design, which would require the new structures to be visually compatible with existing adjacent structures. Implementation of Mitigation Measures 4.3-5a and 4.3-5b, require architectural design to be compatible with existing development and landscaping screens (berms or plantings), to ensure that project development would maintain the visual and aesthetic setting of the project site relative to the existing built conditions.

The project proposes improvements to the existing Tesla Portal manifold; however, these improvements would not contribute to the onsite building density, nor would such improvements be visible from offsite locations.

The project would also construct a microwave tower that would extend up to 100 feet in height with two 8-foot-diameter microwave dishes mounted at the top of the tower at the Tesla Portal site. The new microwave tower would be located just north of the three existing water tanks, and would be visible from offsite locations, including I-580. The proposed microwave tower would be visible from a distance but would have three existing 20,000-gallon water tanks, with an elevation of approximately 13 and a half feet as a backdrop, so the tower would not be as noticeable.

Proposed site improvements and site-disturbing activities at the Tesla Portal site would be within areas that contain no trees, rock outcroppings, or other scenic resources. Therefore, with implementation of project mitigation measures, impacts on scenic vistas or scenic resources would be less than significant.

Impact 4.3-6: Substantially degrade the existing visual character or quality of the sites (Tesla Portal: LS; Thomas Shaft: N/A)

The Tesla Portal site is located in a rural environment characterized by water utility operations, ranching operations, grazing and a nearby rural residential area. The majority of the 52-acre site is undeveloped and only 3.2 acres of the site would be developed as a result of the project. The

proposed structures that would be visible from West Vernalis Road include a 14,000-square-foot Chemical Process Building (32 feet in height), a 3,500-square-foot Office/Control Building (12 feet in height), and a 20,000-square-foot UV Building (32 feet in height). Two diesel standby generators are proposed adjacent to the UV Building, two 15,000-gallon above ground diesel fuel tanks are proposed adjacent to the Chemical Process Building, and the existing manifold would be encased with a steel or concrete structure and covered with soil. In addition, a microwave tower would be installed adjacent to the three existing water tanks located on the hillside above the other existing structures on the site.

Although the project would add structures to the site, new facilities would be confined to a relatively small portion of the site, and the remainder of the site would remain as undeveloped open space. Additionally, the project would be designed to be visually compatible with existing facilities. Therefore, although the project would incrementally contribute to on-site development, the project would not substantially degrade the visual character and quality of the site and a less than significant impact would result.

Impact 4.3-7: The proposed project would introduce new sources of light and glare into the project area (Tesla Portal: LS; Thomas Shaft: N/A)

The existing facilities at Tesla Portal contain five street lamps and exterior lighting on buildings including some motion-sensor light fixtures. The proposed lighting system at Tesla Portal would be designed utilizing a minimum number of fixtures with illumination levels based on the recommendations of the Illumination Engineering Society of North America and the guidelines of California Code of Regulations Title 24. Pole mounted high-pressure sodium or metal halide lamps would be used for outdoor areas such as roadways and parking areas. Along new building exterior walls, compact fluorescent or low-wattage metal halide lamp fixtures would be used.

The project proposes new, permanent sources of lighting that could affect nighttime views from the I-580 (0.65 miles north) and the nearby residential area of Chrisman (0.75 miles east). However, given the distance to the nearby highway and residential uses and the proposed design of new exterior lighting, impacts would be less than significant. Additionally, the new structures at the Tesla Portal site would be consistent with the character of the existing structures and would utilize non-reflective building materials; therefore, the exterior surfaces of the proposed buildings would not be a significant source of glare during daytime hours.

4.3.4 References

Baseline Environmental Consulting, *Preliminary Environmental Analysis, Advanced Disinfection Plan, Hetch Hetchy Water and Power, Tesla Portal, 9000 West Vernalis Road, San Joaquin County*, July 2006.

California Department of Transportation, *California Scenic Highway Program*, http://www.dot.ca.gov/hq/LandArch/scenic_highways/scenic_hwy.htm, accessed January, 2008.

Garcia and Associates, *Cultural Resources Inventory and Evaluation Report for the Tesla Portal Disinfection Station and Thomas Shaft Site for the San Joaquin Regional Water Quality Improvement Project,* July 2008a.

San Joaquin County, San Joaquin County General Plan 2010, July 1992.

4.4 Geology, Soils and Seismicity

4.4.1 Setting

Regional and Local Geology

Tesla Portal Site

The Tesla Portal site is located along the western edge of the San Joaquin Valley at the boundary between the Great Valley Geomorphic Province and Coast Ranges Geomorphic Province.[1] Located in central California, the Great Valley Geomorphic Province is approximately 430 miles long and 50 miles wide bounded to the north by the Klamath Mountains and Cascade Range, to the south by the Tehachapi Mountains, to the east by the Sierra Nevada Mountains and to the west by the Coast Ranges. The Great Valley is underlain by alluvial sedimentary deposits of Quaternary and Tertiary age occupying a structural trough more than 30,000 feet thick. This sedimentary sequence is in turn underlain by a basement complex of Mesozoic intrusive igneous rocks and sedimentary and volcanic rocks at various stages of metamorphism and deformation (Norris and Webb, 1976). The Coast Ranges Geomorphic Province extends approximately 600 miles north and south along the California coastline and is comprised mainly of the Franciscan Assemblage of Mesozoic age and marine and continental sedimentary rocks of Cretaceous to Quarternary age.

The San Joaquin Valley is a level, sediment-filled depression, more than 250 miles long and 40 miles wide, that evolved during the Cenozoic age as a result of plate tectonics and sea level changes (Bartow, 1991). The San Joaquin Valley is comprised of marine sedimentary rock that ranges in age from Jurassic to Cretaceous, overlain by Cenozoic to Quaternary continental deposits. The marine sedimentary rock in the region comprises undifferentiated Upper Cretaceous sedimentary rock, and sandstone and shale of the Panoche and Marino Formations. The continental deposits that overlay the marine deposits are comprised of moderately consolidated sedimentary rock and volcanic deposits that outcrop in the foothills along the flanks of the valley. Poorly consolidated alluvial deposits containing gravel, sand, silt, and clay are present on the valley floor. Tesla Portal lies along the western edge of the San Joaquin Valley, where surface soils are comprised mainly of finer-grained alluvium: loams, clay loams and clays derived from the Coast Ranges to the west.

The Tesla Portal site is located on the eastern side of the Coast Ranges within the Tracy Quadrangle (USGS, 1981). The topography at Tesla Portal is relatively flat on the eastern portion of the site where the structures that would comprise the Tesla Treatment Facility are proposed, but becomes steeper west of the existing structures on the site rising from an elevation of approximately 385 feet to 405 feet above mean sea level (feet msl) (MACTEC, 2007). The existing developed portion of the site is located between the 375 and 395 feet msl.

[1] A geomorphic province is an area that possesses similar bedrock, structure, and history.

Thomas Shaft Site

The Thomas Shaft site, approximately 4.4 miles southwest of Tesla Portal, is located in the Diablo Range, on the eastern edge of the Coast Ranges Geomorphic Province where it borders the Great Valley Geomorphic Province. The Diablo Range is underlain by Franciscan Assemblage rocks that originated from oceanic crust accreted to the continental margin, while the Great Valley Geomorphic Province is characterized by a thick sequence of marine and nonmarine sediments. The earliest sedimentary rocks of the Great Valley sequence are approximately the same age as the Franciscan rocks. The Great Valley sequence rocks have been uplifted on the west by upfaulting of the Coast Ranges, so the oldest exposed sedimentary rocks in the sequence tend to be on the west, in contact with the Franciscan rocks, and are younger toward the San Joaquin Valley.

The Thomas Shaft site is underlain by marine sandstone, mudstone, shale, and minor volcanic tuff belonging to the Upper Miocene San Pablo Group, which is locally mainly represented by sandstones of the Cierbo and Neroly Formations. The San Pablo Group was deposited over Middle Miocene marine shales and sandstones belonging to the Monterey Group (called the Monterey Formation west of the San Andreas Fault). The Monterey Group rocks are not exposed in the vicinity of the Thomas Shaft site; instead the San Pablo Group rocks are in fault contact with Franciscan rocks west of the Carnegie Fault.

The Thomas Shaft site is located within the Lone Tree Creek Quadrangle (USGS, 1994), east of the Livermore Valley and on the east-facing side of the Coast Ranges. The site topography is relatively flat and is located at an elevation of approximately 700 feet msl, and surrounded by gently rolling hills, steeper in some locations.

Soils

Soils are formed by the forces of weather and organisms on parent materials, such as rocks or sediments. The physical action of rivers and streams carry and disperse the fragmented material. The resulting soils of an area vary depending on the climate, the number and kind of living organisms, source materials, relief and drainage, and physiochemical changes sometimes due to the acts of man. The combination of these processes determines the physiography and soils of an area.

Problematic soils, including corrosive and expansive soils, can cause damage to structures and buried utilities and can also increase required maintenance. Depending on the degree of corrosivity of subsurface soils, concrete and reinforcing steel in concrete structures and bare-metal structures exposed to these soils can deteriorate, eventually leading to structural failures. Expansion and contraction of expansive soils in response to changes in moisture content can cause differential and cyclical movements that can cause damage and/or distress to structures and equipment.

Corrosivity of soils is commonly related to several key parameters: soil resistivity, presence of chlorides and sulfates, oxygen content, and pH. Typically, the most corrosive soils are those with

the lowest pH and highest concentration of chlorides and sulfates. Cyclic wet/dry conditions can result in a concentration of chlorides and sulfates as well as mechanical action that tends to break down protective corrosion films and coatings on the surface of building materials. High-sulfate soils are also corrosive to concrete and may prevent complete curing, reducing its strength considerably. Low pH and/or low-resistivity soils can corrode buried or partially buried metal structures.

Expansive soils are characterized by their ability to undergo significant volume change (shrink and swell) due to variations in soil moisture content. Changes in soil moisture can result from rainfall, landscape irrigation, utility leakage, roof drainage, and/or perched groundwater.[2] Expansive soils are typically very fine grained with a high to very high percentage of clay.

The soils of San Joaquin County have been characterized primarily for agricultural purposes by the U.S. Department of Agriculture, Soil Conservation Service (SCS) (SCS, 2002). Field work was completed in April 1988 and the areal distribution of soil units was plotted on aerial photographs from the period from 1970 to 1977 at a scale of 1:24,000 (1 inch to 2,000 feet). The following paragraphs discuss SCS interpretations of soils at each of the project sites.

Tesla Portal Site

The area directly east of the Tesla Portal site is underlain by Holocene alluvial fan deposits shed by arroyos draining the Coast Ranges. The material directly north of the existing structures on the Tesla Portal site is fill as much as 25 feet thick, which in turn overlies native alluvium consisting of gravelly sand and silty sand. The fill is believed to be the edge of a large area of excavation material (tunnel muck) placed there during construction of the Coast Range Tunnel. The material appears to be uncompacted and consists of clays and silts of varying consistencies. This material varies from 10 to 25 feet thick at the locations tested (MACTEC, 2007).

Native soils surrounding and underlying the fill at the Tesla Portal site are relatively strong, consisting of stiff to hard silts and clays, and dense sands, and extend to depths in excess of 20 feet below ground surface (bgs). According to the SCS report (2002), soils uphill of the Tesla Portal are classified as the Calla-Carbona complex, with 8 to 30 percent slopes, whereas soils between the portal and the San Joaquin Valley are designated Carbona clay loam, with 2 to 8 percent slopes. Both soil types exhibit slow permeability and high shrink-swell potential. In addition, the Calla-Carbona soils yield rapid runoff and demonstrate a moderate to severe water erosion hazard.

The area south of Tesla Portal is underlain by consolidated sediments that are mapped as late Tertiary (late Pliocene to Miocene) Fanglomerate. This reddish-brown to gray conglomerate, sandstone, and siltstone is composed primarily of detritus from the Franciscan Complex or the Great Valley sequence sedimentary rocks.

[2] Perched groundwater is a local saturated zone above the water table. It typically exists above an impervious layer (such as clay) with limited extent.

Thomas Shaft Site

According to SCS (2002), the vicinity of the Thomas Shaft is underlain by soils of the Alo-Vaquero complex, with 30 to 50 percent slopes. These steep soils are located in mountainous areas. The Alo clays (45 percent of the unit) form on parent material consisting of shales, whereas the Vaquero clays (40 percent of the unit) form on sandstone parent materials. Both soil types exhibit slow permeability, high shrink-swell potential, and severe hazard of water erosion due to rapid rainfall runoff. The remainder of the area is underlain by small zones of Wisflat, Arburua and San Timoteo soils in convex positions near the tops of slopes.

Seismicity

The Alquist-Priolo Earthquake Fault Zoning Act (Alquist-Priolo Act) of March 1973 required the State of California to delineate earthquake fault zones along known active faults in California. The Alquist-Priolo Act further required cities and counties to regulate certain development projects within the zones. A summary of principal provisions of the Alquist-Priolo Act and implications is presented in the California Geologic Survey (CGS) publication of Hart and Bryant (1997), "Fault-Rupture Hazard Zones in California." A major objective of the CGS's continuing fault evaluation and zoning program is to evaluate and update potentially active faults in California for zoning consideration.

A *fault* is defined as a fracture or zone of closely associated fractures along which rocks on one side have been displaced with respect to those on the other side. Most faults are the result of repeated displacement that may have taken place suddenly or by slow creep. A fault is distinguished from those fractures or shears caused by landsliding or other gravity-induced surficial failures (Hart and Bryant, 1997).

A *fault zone* is a zone of related faults that commonly are braided and subparallel, but may be branching and divergent. A fault zone has significant width (with respect to the scale at which the fault is being considered, portrayed, or investigated), ranging from a few feet to several miles (Hart and Bryant, 1997).

Pursuant to the Alquist-Priolo Act, an "*active*" fault is defined by the State of California as a fault that has had surface displacement within Holocene time (e.g., the last 11,000 years). Surface displacements are observable and can be measured either from rock outcrops or within a trench dug across a fault trace. A "*potentially active*" fault is defined as a fault that has shown evidence of surface displacement during the Quaternary (last 1.6 million years), unless direct geologic evidence demonstrates inactivity for all of the Holocene or longer. This definition does not mean that faults lacking evidence of surface displacement are necessarily inactive.

"Sufficiently active" is used to describe a fault where there is some evidence that Holocene displacement occurred on one or more of its segments or branches (Hart and Bryant, 1997).

Subsequent to the passage and implementation of the Alquist-Priolo Act, the SFPUC developed General Seismic Requirements for Design of New Facilities and Evolution and Upgrade of

Existing Facilities (2006). That document adopted three classes of faults to be considered in all SFPUC projects, as follows:

1. Active Faults – Those faults that have had movement within the past 11,000 years.

2. Potentially Active Faults – Those faults that could potentially generate an earthquake, and which have not been proven to have had no movement within the past 11,000 years.

3. Secondary Faults – Possible future displacements in response to a major earthquake on a nearby active fault (sometimes called sympathetic fault displacement). No secondary faults are mapped in the vicinity of the project; accordingly, this terminology is not used in this report.

This nomenclature (active and potentially active) is used in discussions of seismicity in this analysis. The San Joaquin Valley is a relatively seismically quiescent area located between two areas of documented fault activity. The Coast Ranges to the west contain historically active faults that are associated with the San Andreas Fault System, including the Hayward, Greenville, and Calaveras faults (Jennings, 1994a, b). Seismic shaking and potential ground deformations at the project sites (Tesla Portal and Thomas Shaft) are governed by two seismic source areas, as discussed in the following paragraphs.

San Andreas Fault Zone

A region of high seismic activity, the Coast Ranges of western California contain both active and potentially active faults. The USGS 2002 Working Group on California Earthquake Probabilities has evaluated the probability of one or more earthquakes of moment magnitude 6.7 or higher occurring in the San Francisco Bay Area. The study concluded that there is a 62 percent probability that such a major earthquake will strike the San Francisco Bay Area before 2032 (USGS, 2003).

The San Andreas Fault Zone extends nearly the entire length of California and marks the plate boundary between the North American plate to the east and the Pacific plate to the west. The San Andreas is not represented by a single trace, but by a system of faults that diverge from the main fault south of San Jose. Three of the active faults included in the San Andreas Fault System, the Caleveras, Greenville, and Hayward Faults, are within 50 miles of the Tesla Portal and Thomas Shaft sites. The San Andreas Fault was responsible for the Great 1906 San Francisco Earthquake (Magnitude 7.8) and the 1989 Loma Prieta earthquake (Magnitude 6.9). The Hayward, Calaveras, and Greenville faults have been the location of several historic earthquakes.

Coast Ranges-Sierran Block Boundary Seismic Zone

The Coast Ranges-Sierran Block (CRSB) boundary zone, which follows the physiographic boundary between the Coast Ranges and Great Valley Geomorphic Provinces, contains potentially active “blind” faults (Wong et al., 1988). Earthquakes along the boundary between the Coast Ranges and Great Valley Geomorphic Provinces have been noted since the 1892 Vacaville-

Winters earthquake. The most recent large event along this zone is the 1983 Coalinga earthquake, which caused considerable damage in the Coalinga area, approximately 90 miles southeast of the project sites. Upon close examination, geoscientists are of the opinion that the tectonic structure and seismic activity along this seismic zone can be understood as the interaction between the Coast Ranges and the Sierran Block.

The USGS Working Group on California Earthquake Probabilities (WGCEP) has divided the CRSB boundary zone into 14 segments, identified as GV1-GV14. GV7 is defined as containing the Midway/Black Butte Fault on the west and the San Joaquin Fault on the east. The San Joaquin Fault is currently being studied (Unruh and Krug, in preparation) and is now being called the Orestimba Fault (MACTEC, 2007). This nomenclature is being used in this report.

Geologic Hazards

Earthquake Intensity Assessment

Moment or Richter magnitude is a measure of the energy released in an earthquake, and intensity is a measure of the earthquake ground shaking effects at a particular location. Intensity depends on the overall magnitude, distance to the fault, focus of earthquake energy and type of geologic materials below the area. Ground shaking effects can occur hundreds of miles from the earthquake's epicenter. Earthquakes in the Coast Ranges are expected to produce ground shaking in the San Joaquin Valley.

Ground shaking is expressed in terms of the peak ground acceleration, and as spectral acceleration at short (0.2 second) and moderately long (1.0 second) periods, as well as displacement of the ground. Areas that are underlain by bedrock tend to experience less ground shaking than those underlain by unconsolidated sediments such as artificial fill or alluvium. The composition of underlying soils in areas relatively distant from faults can intensify ground shaking. For instance, areas of the San Francisco Bay Area that experienced the worst structural damage during the 1989 Loma Prieta earthquake were not those closest to the fault, but rather those with soils that magnified the effects of ground shaking.

Fault Rupture

The four primary active faults in the San Francisco Bay region that are capable of producing fault rupture are the: San Andreas, Hayward, Northern Calaveras and Greenville (SFPUC, 2006). Fault rupture almost always follows preexisting faults, which are zones of weakness. Rupture may occur suddenly during an earthquake or slowly in the form of fault creep. Sudden displacements are more damaging to structures because they are accompanied by shaking. Fault creep is the slow rupture of the earth's crust. Faults designated as active by the CGS are those that have undergone surface displacement or seismic activity within Holocene times. None of these faults are in the vicinity of the Tesla Portal or Thomas Shaft sites, as listed in Table 4.4-1. Two faults in the western San Joaquin Valley exhibit geologic or geomorphic characteristics suggestive of Holocene or late Pleistocene activity, the San Joaquin (Orestimba) and Midway/Black Butte

faults. The potentially active faults near Tesla Portal and Thomas Shaft sites are listed in Table 4.4-2.

TABLE 4.4-1
ACTIVE FAULTS NEAR TESLA PORTAL AND THOMAS SHAFT SITES

Fault Name	Shortest Distance to Tesla Portal	Shortest Distance to Thomas Shaft	Maximum Earthquake[1]
Calaveras	26 miles	22 miles	7.25
Greenville	12 miles	8 miles	7.25
Hayward	32 miles	28 miles	7.25
San Andreas	54 miles	50 miles	8.20

Source: SFPUC (2006)

Notes: [1] The maximum earthquake magnitude is the strongest earthquake that appears capable of occurring under the currently known tectonic framework, using the Richter scale.

TABLE 4.4-2
POTENTIALLY ACTIVE FAULTS NEAR TESLA PORTAL AND THOMAS SHAFT SITES

Fault Name	Shortest Distance to Tesla Portal	Shortest Distance to Thomas Shaft	Maximum Earthquake[1]
Midway/Black Butte	1.3 miles	2.7 miles	6.3
Carnegie[2]	5.5 miles	1.5 miles	NE
Corral Hollow	5.5 miles	1.5 miles	NE
San Joaquin (Orestimba)	<1 mile	5 miles	7.2
Vernalis	12 miles	8 miles	NE

NE = not evaluated

Source: SFPUC (2006)

Notes: [1] The maximum earthquake magnitude is the strongest earthquake that appears capable of occurring under the currently known tectonic framework, using the Richter scale.

[2] A small portion of the Carnegie Fault may be considered Holocene Active (Carpenter et al., 1991). This fault has not been zoned in accordance with the Alquist-Priolo Act.

Tesla Portal Site

The fault closest to the Tesla Portal site is the San Joaquin (Orestimba) Fault, which marks the structural edge of the Coast Ranges and shows evidence of activity more than 10,000 years ago. This fault extends along the boundary between the Diablo Range and western San Joaquin Valley, and crosses the Tesla Portal site. The San Joaquin Fault is associated with late Pleistocene uplift, tilting, and folding consistent with west-side upthrust or reverse displacement (MACTEC, 2007). This fault is a "blind" structure that, during large earthquakes, produces surface folding rather than surface faulting over a zone about 300 feet wide. In the past, surface uplift, folding and faulting has occurred along the San Joaquin Fault. The Tesla Portal site is located on the up-thrown side of the fault and a large earthquake along the fault would likely cause surface deformation.

Thomas Shaft Site

The Thomas Shaft site is on the eastern edge of the San Andreas Fault system. This area contains a broad region of northwest-trending faults associated with transform faulting at the margin of the North American continental plate. Many of the small faults in the site region have not been active during Quaternary time (the past 1.6 million years). The Midway/Black Butte Fault, just east of the project site, shows no recent activity but has been active during the Quarternary time. The Carnegie-Corral Hollow Fault, starts at approximately 1.5 miles west of the project site and runs northwest. This is the nearest fault with evidence of activity during the past 10,000 years (Holocene time). Thus, this fault is considered active. In addition, the Greenville Fault, approximately 8 miles west of the project site, has been active during the past 25 years. No Holocene faults have been mapped within the project boundaries.

Liquefaction

Liquefaction is a phenomenon in which saturated granular sediments temporarily lose their shear strength during periods of earthquake-induced, strong ground shaking. The susceptibility of a site to liquefaction is a function of the depth, density, and water content of the granular sediments and the magnitude of earthquakes likely to affect the site. Saturated, unconsolidated silts, sands, silty sands, and gravels within 50 feet of the ground surface are the soil types most susceptible to liquefaction. Liquefaction-related phenomena include vertical settlement from densification, lateral spreading, ground oscillation, flow failures, loss of bearing strength, subsidence, and buoyancy effects.

Tesla Portal Site

The soils at the Tesla Portal site are comprised mainly of alluvium such as loams, clay loams, and clays washed from the Coast Ranges. Subsurface conditions at the site, where the project would be constructed, are not susceptible to liquefaction.

Thomas Shaft Site

The Thomas Shaft site is underlain by a thin layer of stiff clayey colluvium (about 5 feet thick), followed by weathered bedrock of the San Pablo Group. According to Olivia Chen Consultants (1998), “the subsurface materials underlying the project area consist of very dense rock like materials which are unlikely to liquefy during a major earthquake.”

Slope Failure

Slope failure involves the downslope displacement and movement of material, either triggered by static (i.e., gravity) or dynamic (i.e., earthquake) forces. Slope stability can depend on a number of complex variables, including the geology, structure, and amount of groundwater, as well as external processes such as climate, topography, slope geometry, and human activity.

Landslides can occur on slopes of 15 percent or less, but the probability is greater on steeper slopes that exhibit old landslide features such as scarps (surface displacement at the head of a landslide), leaning trees, and transverse ridges. Landslides typically occur within slide-prone geologic units that contain excessive amounts of water or are located on steep slopes, or where planes of weakness are parallel to the slope angle (structurally controlled).

Tesla Portal Site

The Tesla Portal site is located at the edge of the gently rolling hills of the Coast Ranges and the proposed structures associated with the Tesla Treatment Facility would be constructed on a relatively flat portion of the site. In a geotechnical report prepared by MACTEC Engineering and Consulting, Inc. (2007), potential landsliding was not identified as a geotechnical issue.

Thomas Shaft Site

The Thomas Shaft site is located in an area with gently sloping terrain, and the potential for landslides is low (CCSF Planning Department, 2007).

Mineral Resources

San Joaquin County contains a variety of mineral resources, including gravel, sand, aggregate, and clay. The principal areas of sand and gravel extraction activity in San Joaquin County are in the southwestern portion of the county in the Corral Hollow Creek alluvial fan. Most natural gas extraction activities in San Joaquin County are located in the vicinity of the Sacramento Delta, which is not near the project sites. Neither of the project sites are located in a Significant Sand and Gravel Aggregate Resource Sector, as designated by the San Joaquin County General Plan 2010 (San Joaquin County, 1992). Many areas of the state have been mapped using the California Mineral Land Classification System to identify areas with known mineral resources. This system provides guidance for identifying Mineral Resource Zones (MRZs) based on four general categories. Both project sites fall into the MRZ-1 category, which are areas where adequate information indicates that no significant mineral deposits are present, or where it is judged that little likelihood exists for their presence (CSMGB, 1983).

4.4.2 Regulatory Framework

Federal

No federal regulations pertaining to geology, soils, and seismicity were identified.

State and Local

California Public Resources Code, 1972 Alquist-Priolo Earthquake Fault Zoning Act (Amended 1994)

The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. In accordance with this Act, the State Geologist established regulatory zones, called "earthquake fault zones," around the surface traces of active faults and published maps showing these zones. Within these zones, buildings for human occupancy[3] cannot be constructed across the surface trace of active faults. Each earthquake fault zone extends approximately 200 to 500 feet on either side of the mapped fault trace because many active faults are complex and consist of more than one branch. There is the potential for ground surface rupture along any of the branches of the fault.

California Public Resources Code, 1990, Seismic Hazard Mapping Act

The Seismic Hazard Mapping Act was passed in 1990 following the Loma Prieta earthquake to reduce threats to public health and safety and to minimize property damage caused by earthquakes. The Act directs the California Department of Conservation to identify and map areas prone to the earthquake hazards of liquefaction, earthquake-induced landslides, and amplified ground shaking. For structures intended for human occupancy, the Act requires site-specific geotechnical investigations to identify potential seismic hazards and formulate mitigation measures prior to permitting most developments designed for human occupancy within the Zones of Required Investigation. Although the project does not include structures for human occupancy, the seismic hazard maps are useful tools for identifying areas with the potential for liquefaction and earthquake-induced landslides.

As of January 2006, 110 official seismic hazard zone maps showing areas prone to liquefaction and landslides had been published in California, and more are scheduled in the future. Most of the mapping has been performed in Southern California and the San Francisco Bay Area. Twenty-two official maps for the San Francisco Bay Area have been released, with preparation of 19 additional maps for San Mateo, Santa Clara, Alameda, and Contra Costa counties in progress or planned. The CGS has no current plans to map San Joaquin County.

Surface Mining and Reclamation Act of 1975

In accordance with the Surface Mining and Reclamation Act of 1975, the state has established a mineral land classification system to help identify and protect mineral resources in areas that are subject to urban expansion or other irreversible land uses that would preclude mineral extraction. Protected mineral resources include construction materials, industrial and chemical mineral materials, metallic and rare minerals, and nonfluid mineral fuels. The Act directs the State Geologist to classify (identify and map) the nonfuel mineral resources of the state to show where economically significant mineral deposits occur and where they are likely to occur based on the

[3] Title 14 of the California Code of Regulations, 3601(e), defines buildings intended for human occupancy as those that would be inhabited for more than 2,000 person-hours per year.

best available scientific data. Nonfuel mineral resources include: metals such as gold, silver, iron, and copper; industrial minerals such as boron compounds, rare-earth elements, clays, limestone, gypsum, salt, and dimension stone; and construction aggregate, which includes sand, gravel, and crushed stone. Many areas of the state have been mapped using the California Mineral Land Classification System to identify areas with known mineral resources. This system provides guidance for identifying Mineral Resource Zones (MRZs) based on these four general categories:

- *MRZ-1*. Areas where adequate information indicates that no significant mineral deposits are present, or where it is judged that little likelihood exists for their presence.

- *MRZ-2*. Areas where adequate information indicates that significant mineral deposits are present, or where it is judged that a high likelihood exists for their presence.

- *MRZ-3*. Areas containing mineral deposits, the significance of which cannot be evaluated.

- *MRZ-4*. Areas where available information is inadequate for assignment to any other zone.

California Building Code

The 2001 California Building Code (CBC) is based on the 1997 Uniform Building Code, with the addition of more extensive structural seismic provisions. The CBC is contained in the California Code of Regulations (CCR), Title 24, or the California Building Standards Code, and is a compilation of three types of building standards from three different origins:

- Building standards that have been adopted by state agencies without change from building standards contained in national model codes

- Building standards that have been adopted and adapted from the national model code standards to meet California conditions

- Building standards, authorized by the California legislature, that constitute extensive additions not covered by the model codes that have been adopted to address particular California concerns

Title 24, Part 2, Volume 2, Chapter 16 of the CCR contains definitions of seismic sources and the procedure used to calculate seismic forces on structures.

SFPUC General Seismic Design Requirements

The San Francisco Public Utilities Commission (SFPUC) *General Seismic Design Requirements* (SFPUC, 2006) set forth consistent criteria for the seismic design and retrofit of all facilities and components of the regional water system. In accordance with these design requirements, every project must have project-specific design criteria based on site-specific geologic and seismic hazards, including fault rupture, ground motions generated by earthquakes (ground shaking), slope instability, liquefaction, and loss of soil strength, and importance of the facility in achieving

water service delivery goals in the event of a major earthquake.[4] The design criteria are based on the referenced codes, standards, and industry publications, but would exceed these requirements for facilities that are located in a severe seismic environment and are needed to achieve water service delivery goals. Covered facilities include: offices, operating centers, water treatment plants, water storage structures, pumping plants, pipelines, tunnels, and related equipment.

4.4.3 Impacts

Significance Criteria

The City and County of San Francisco has not formally adopted significance standards for impacts related to geology, soils, and seismicity, but generally considers that implementation of a proposed project would have a significant impact if it were to:

- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
  - Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault (Refer to Division of Mines and Geology Special Publication 42).
  - Strong seismic ground shaking
  - Seismic-related ground failure, including liquefaction
  - Landslides
- Result in substantial soil erosion or the loss of topsoil
- Be located on geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse
- Be located on expansive soil, as defined in Table 18 1 B of the Uniform Building Code, creating substantial risks to life or property
- Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater
- Change substantially the topography or any unique geologic or physical features of the site

Implementation of the proposed project would have a significant impact related to mineral resources if it were to:

[4] In the General Seismic Design Requirements, the term "major earthquake" is defined as an earthquake of Richter magnitude 7.8 or larger on the San Andreas Fault, 7.1 or larger on the Hayward Fault, or 6.8 or larger on the Calaveras Fault.

- Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state

- Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan

Areas of No Project Impact

As discussed above in the Setting section, there are no mineral resources at the project sites, and the project would have no effect on the availability of such resources. Therefore, the proposed project would have no impact with respect to these significance criteria.

The proposed project would not construct septic tanks or alternative wastewater disposal facilities at the Thomas Shaft site; therefore, this significance criterion is not applicable at the site.

Approach to Analysis

Each of the project components would be constructed in accordance with the SFPUC's *General Seismic Design Requirements* for design of New Facilities and Evaluation and Upgrade of Existing Facilities, which require a site-specific investigation and development of design criteria based on the seismic performance class of the facility and site-specific geologic and seismic hazards, including fault rupture, ground motions generated by earthquakes (groundshaking), slope instability, liquefaction, and loss of soil strength. This section analyzes geology, soils, and seismicity impacts that could occur during construction, and operational impacts associated with expansive or corrosive soils.

Construction Impacts

Impact 4.4-1: Slope instability during construction (Tesla Portal: LS; Thomas Shaft: LS)

Tesla Portal Site

The Tesla Portal site is located in an area characterized by flat to gently rolling topography underlain by geologic formations with a low potential for landslides. Grading at the site associated with the proposed project would be minimal, based on a review of current topographic maps and the footprint of planned construction. With the implementation of SFPUC Standard Construction Measure #2 (which requires a geotechnical study to identify the potential for ground failure) the impact for construction-related landsliding and slope instability is considered less than significant.

Thomas Shaft Site

The Thomas Shaft site, 4.4 miles southwest of the Tesla Portal site, is underlain by marine sandstone, mudstone, and shale of the Upper Miocene San Pablo Group, units not known to be susceptible to landsliding. This characterization is supported by geologic interpretations by Huey

(1948) and California Division of Mines and Geology (1955). Additionally, ground disturbance associated with the proposed project at this site would be restricted to construction of a shallow pipeline. With the implementation of SFPUC Standard Construction Measure #2 (which requires a geotechnical study to identify the potential for ground failure), slope instability is considered less than significant.

Impact 4.4-2: Erosion during construction (Tesla Portal: LS; Thomas Shaft: LS)

Tesla Portal Site

Project construction activities such as backfilling, grading and compaction could remove stabilizing vegetation and expose areas of loose soil that, if not properly stabilized during construction, would be subject to soil loss and erosion by wind and stormwater runoff. The project would require grading and/or excavation, although specific volumes are not available, primarily because the contract would be constructed on a Design Build basis and grading plans have not yet been developed. This could potentially result in erosion during construction. The proposed project would implement SFPUC Construction Measure #3 (onsite air and water quality measures during construction), which requires the implementation of erosion control measures. Because construction at the Tesla Portal site would result in a disturbance of over one acre of land, SFPUC must obtain coverage under the General Permit (for stormwater discharge associated with construction activity) by filing a Notice of Intent (NOI) with the State Water Resources Control Board (SWRCB) Division of Water Quality. The filing would require a Storm Water Pollution Prevention Plan (SWPPP) that would include erosion control and stormwater treatment best management practices (BMPs) to be implemented during and following construction and provide a schedule for monitoring performance. Therefore, erosion impacts during construction at the Tesla Portal site are considered less than significant.

Thomas Shaft Site

Construction activities at the Thomas Shaft site would be restricted to less than one acre and no grading is proposed. Only minimal excavation and backfilling, on the order of 50 cubic yards (cy), is proposed to install a small pipeline and percolation tank. SFPUC Standard Construction Measure #3 which includes the implementation of erosion controls at the construction site, would be required as part of the project. As mentioned above, the proposed project would require a SWPPP that would include erosion control. Erosion impacts during construction are therefore considered less than significant.

Impact 4.4-3: Substantial alteration of topography (Tesla Portal: LS; Thomas Shaft: LS)

Tesla Portal Site

The proposed improvements at the Tesla Portal site would occur on relatively flat portions of the site and cut and fill volumes would be roughly balanced onsite to avoid soil off haul or import. The maximum cut would be about 20 feet at the UV Building. The extent of fill activities would be within the 3 acres that would be graded, except areas that would be excavated for new pipeline or the electrical line for the microwave tower that would be outside the graded area. Assuming that the construction activities will be conducted in accordance with the appropriate recommendations of the site-specific geotechnical report (SFPUC Standard Construction Measure #2), substantial alteration of the topography will be a less-than-significant impact.

Thomas Shaft

No significant excavation would be conducted at the Thomas Shaft site as part of the proposed project. Since only minimal excavation would occur (approximately 50 cy), the impact associated with substantial alteration of the topography is considered less than significant.

Operational Impacts

Impact 4.4-4: Surface fault rupture (Tesla Portal: LS; Thomas Shaft: LS)

Tesla Portal Site

No Alquist-Priolo Earthquake Fault Zones are mapped near the Tesla Portal site. The San Joaquin Fault (now being called the Orestimba Fault), a blind reverse fault, is mapped along the eastern front of the Diablo Range, crossing through the vicinity of the Tesla Portal site (MACTEC, 2007). Much of the area where the proposed structures would be constructed could experience ground tilting (permanent ground deformation) of about two degrees (2°) over a distance of approximately 300 feet as a result of displacement on the San Joaquin Fault during future large earthquakes. However, surface fault rupture has not been documented on this fault.

Although the potential consequences of permanent ground deformation at the Tesla Portal site have not yet been defined, all proposed facilities would be designed and constructed in accordance with the *SFPUC General Seismic Design Requirements* (2006). In addition, as required by SFPUC Standard Construction Measure #2 (seismic and geotechnical studies), the project would incorporate recommendations by project geotechnical reports and would be designed for seismic reliability. Impacts of fault rupture are therefore considered less than significant.

Thomas Shaft Site

The nearest active or potentially active fault to the Thomas Shaft site is the Carnegie-Corral Hollow Fault, which is located about 1.5 miles west of the site. One investigation (Carpenter et al., 1991) indicates Holocene displacement along a short portion of this structure at closed landfill pit 6 on Lawrence Livermore National Laboratory property, which is located more than 1.5 miles north of the Thomas Shaft site. Therefore, a short stretch of the Carnegie-Corral Hollow Fault is considered active by the CGS (Jennings, 1994), although it is not zoned in accordance with the Alquist-Priolo Act. This fault is sufficiently far from the Thomas Shaft site; therefore, it has a low potential for surface displacement and, with implementation of SFPUC Standard Construction Measure #2, (particularly the seismic reliability design component) it is considered less than significant.

Impact 4.4-5: Seismically induced ground shaking (Tesla Portal: LS; Thomas Shaft: LS)

Although there are few active or potentially active faults within the San Joaquin Valley region, and no known active faults that cross either of the project sites, several faults in Northern California are capable of producing a large magnitude earthquake or significant ground shaking in the region. These faults include the San Andreas, Hayward, Calaveras and Greenville Faults. Depending on the level of ground shaking, an earthquake could damage the proposed buildings, pipelines, valves, and control facilities, resulting in a disruption of the proposed project treatment facility capabilities. Damage to the proposed treatment facilities could affect the ability of the SFPUC to provide treated water to its customers. To minimize potential damage to the proposed and existing facilities, the project would be designed and constructed in accordance with the SFPUC *General Seismic Design Requirements.*

Because the project facilities would be designed and constructed as per the SFPUC *General Seismic Design Requirements*, and SFPUC Standard Construction Measure #2, (particularly the seismic reliability design component) impacts related to seismic ground shaking are considered less than significant at both the Tesla Portal and Thomas Shaft sites.

Impact 4.4-6: Seismically induced ground failure, including liquefaction and settlement (Tesla Portal: LS; Thomas Shaft: LS)

Tesla Portal Site

The soils at the Tesla Portal site are comprised mainly of alluvium such as loams, clay loams, and clays washed from the Coast Ranges. Subsurface conditions at the site, where the project would be constructed, are not susceptible to liquefaction. In addition, facilities would be designed to withstand liquefaction and settlement in accordance with the SFPUC *General Seismic Design*

Requirements and SFPUC Standard Construction Measure #2, therefore, impacts related to liquefaction and other seismically induced ground failures are considered less than significant.

Thomas Shaft Site

The Thomas Shaft site is underlain by a thin layer of stiff clayey colluvium (about 5 feet thick), followed by weathered bedrock of the San Pablo Group. According to Olivia Chen Consultants (1998), "the subsurface materials underlying the project area consist of very dense rock like materials which are unlikely to liquefy during a major earthquake." In addition, the proposed facilities at the Thomas Shaft site would be designed and constructed in accordance with the SFPUC *General Seismic Design Requirements* and SFPUC Standard Construction Measure #2 Therefore, the potential for ground failure, including liquefaction and settlement, are considered less than significant.

Impact 4.4-7: Seismically induced landslides or other slope failures (Tesla Portal: LS; Thomas Shaft: LS)

Tesla Portal Site

Proposed structures at the Tesla Portal site would be located on a relatively flat portion of the site, and landslide potential has not been identified as a geotechnical issue (MACTEC, 2007). Additionally, SFPUC Standard Construction Measure #2 (seismic and geotechnical studies), would be implemented, requiring the project to incorporate recommendations by project geotechnical investigations and be designed for seismic reliability. Impacts related to seismically induced landslides or other slope failures are therefore considered less than significant.

Thomas Shaft

The project components at the Thomas Shaft site would be located in gently sloping terrain not considered susceptible to landsliding (CCSF Planning Department, 2007) and SFPUC Standard Construction Measure #2 (seismic and geotechnical studies, particularly the potential for ground failure component), would be required as part of the project. Impacts related to seismically induced landsliding or other slope failures are therefore considered less than significant.

Impact 4.4-8: Have soils incapable of adequately supporting the use of septic tanks (Tesla Portal: LS; Thomas Shaft: N/A)

Tesla Portal Site

A new septic tank and leach field to provide wastewater disposal services to the proposed buildings would be installed at the Tesla Portal site. The septic tank and leachfield would be located to the north of the new facilities beyond the area of the existing fill.

The septic system would be designed based on studies to evaluate the capacity of the native soil for leaching purposes. In addition, SFPUC Standard Construction Measure #2 (seismic and geotechnical studies) would be implemented and includes the characterization of the soils at the project site. The system would be designed in accordance with the results of the studies, therefore this impact is considered less than significant.

Impact 4.4-9: Expansive or corrosive soils (Tesla Portal: PSM; Thomas Shaft: PSM)

Tesla Portal Site

The Tesla Portal site is in an area of potentially corrosive or expansive soil. Native soils found within the project site exhibit a high shrink/swell potential and may exhibit a high risk of corrosion to concrete and uncoated steel. This would be considered a potentially significant impact. As part of SFPUC Standard Construction Measure #2 (seismic and geotechnical studies), a seismic and geotechnical study would be conducted, and recommendations implemented as part of the project. With the implementation of Mitigation Measure 4.4-9, which would characterize the extent of expansive and corrosive soils and incorporate the results of the investigation into the final project design, the impact would be reduced to a less-than-significant level. This impact is therefore potentially significant, mitigable.

Thomas Shaft

The Thomas Shaft site is in an area of potentially corrosive or expansive soil. Native soils found within the project site exhibit a high shrink/swell potential and may exhibit a high risk of corrosion to concrete and uncoated steel, which may be an issue for the new pipeline. The implementation of Mitigation Measure 4.4-9, which requires soil samples be obtained to test for corrosive/expansive characteristics and design features shall be implemented or the pipeline would apply a conservative design approach to address potential corrosivity, would reduce the impact to a less-than-significant level. This impact is therefore potentially significant, mitigable.

4.4.4 References

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4.5 Hydrology and Water Quality

4.5.1 Setting

San Joaquin Region

The proposed project is located in the San Joaquin River Watershed, which has a total drainage area of approximately 15,880 square miles (RWQCB, 2007). The climate in the San Joaquin Valley is arid to semi-arid with dry, hot summers and mild winters. Summer temperatures may exceed 100ºF for extended periods of time, with no precipitation. Winter temperatures are only occasionally below freezing along the eastern margin of the valley in the Sierra Nevada foothills. The valley averages less than 10 inches of annual rainfall (RWQCB, 2006).

The San Joaquin River Watershed contains numerous water bodies (e.g., streams, rivers, and canals). Major water bodies in the region are described below.

San Joaquin River

The San Joaquin River originates from Thousand Island Lake near Mount Ritter, high on the western slopes of the Sierra Nevada. The San Joaquin River drains most of the area from the southern border of Yosemite National Park south to Kings Canyon National Park, making it the second largest river drainage in the state. The river emerges from the foothills at the former town of Millerton; Friant Dam, located on the San Joaquin River in Millerton since 1944, forms Millerton Lake. From the foothills, the river flows west to the trough of the Central Valley, where its major tributaries include the Stanislaus River, Tuolumne River, Merced River, Calaveras River, and Mokelumne River; it then flows north to the Sacramento-San Joaquin Delta. The San Joaquin River is the most notable natural water feature in San Joaquin County, and is approximately 18 miles east of the project sites.

The *Sacramento River and San Joaquin River Basin Plan* (Basin Plan) identifies the existing beneficial uses of the San Joaquin River as irrigation, stock watering, process water for industrial purposes, recreational, and freshwater and wildlife habitats. Municipal and domestic water supply is listed as a potential beneficial use (RWQCB, 2007).

Delta-Mendota Canal

The Delta-Mendota Canal is a 120-mile-long component of the Central Valley Project, a system of irrigation and hydroelectric canals and dams. The Delta-Mendota Canal is used for irrigation water. The canal runs south along the western edge of the San Joaquin Valley and ends at the San Joaquin River near the town of Mendota, just west of Fresno. The Delta-Mendota Canal is located approximately five miles east of the project sites.

The Delta-Mendota Canal is listed in the Basin Plan as having beneficial uses, including municipal and agricultural water supply, recreational, and freshwater habitat (RWQCB, 2007).

California Aqueduct

The California Aqueduct is a concrete-lined aqueduct that transports water from Northern California to Southern California. It is the main water transport structure of the State Water Project and, at nearly 450 miles in length, is the longest water channel in California. The aqueduct, built by the California Department of Water Resources, begins at the Sacramento River Delta and carries water south through the Central Valley, where it often parallels Interstate 5 (I-5). The California Aqueduct is located approximately three miles east of the project sites.

The California Aqueduct is listed in the Basin Plan as having beneficial uses, including municipal and agricultural water supply, and recreational (RWQCB, 2007).

Westside Streams

Ephemeral streams and creeks, which exist only for a short period of time following precipitation, enter the west side of the San Joaquin Valley. These streams and creeks originate on the eastern slopes of the Coast Range (also referred to as the Diablo Range in the vicinity of the project area).

Deep Gulch is located approximately one mile southeast of Tesla Portal. Deep Gulch is an ephemeral stream, and its natural drainage in the valley floor has been altered by man-made water conveyance facilities and roadways.

Corral Hollow Creek is a west side tributary of the San Joaquin River flowing west to east along the south side of Corral Hollow Road. This creek is approximately three miles northwest of the Tesla Portal site and approximately 1.5 miles north of the Thomas Shaft site. The creek is a meandering stream course with a width ranging from 8 to 12 feet (CCSF Planning Department, 2007).

Project Site Hydrology

Tesla Portal Site

The proposed facilities at the Tesla Portal site would be located on the eastern flank of the Coast Range in San Joaquin County. Surface drainages (e.g., Corral Hollow Creek) generally flow towards the east and are not well defined due to small watershed size, infrequent and/or limited precipitation, and seepage.

Stormwater runoff from the site (e.g., from rooftops of existing facilities and other existing impervious surfaces) drains to adjacent undeveloped areas. No surface runoff from the Tesla Portal site or the surrounding area discharges to the California Aqueduct or Delta-Mendota Canal or directly to Corral Hollow Creek. The site also contains an artificially-created wetland area, created from the existing facility discharge, as well as a small, unnamed ephemeral drainage feature. The artificial wetland area is approximately 0.308 acre in size and was observed to have standing water and emergent vegetation during fall 2006 site visits. The wetland delineation report was completed in May 2008 (May & Associates Inc., 2008). The water source for this area is runoff from sampling points at the existing Tesla Portal Hypochlorite Station. This area is

approximately 100 feet from the existing access road. The small, unnamed ephemeral drainage feature is approximately 1.5 feet in width at the location where the work would be performed and flows across the southern portion of the site from southwest to northeast. The ephemeral drainage was dry during site visits in winter and fall 2007 (May & Associates Inc., 2008). The primary flow sources for the ephemeral drainage include direct precipitation and surface runoff from the surrounding hills. A secondary flow source is a spillway that drains overflow water from the SFPUC system. The SFPUC surge shaft periodically releases overflow water from the Coast Range Tunnel at an elevation of 501 feet above sea level into a concrete spillway that drains to the ephemeral drainage. Neither of these two water features are listed in Section 303(d), List of Impaired Water Bodies, of the Clean Water Act, that could be affected by the proposed project at this site.

According to the *Pollution Prevention and Monitoring and Reporting Program* (PPMRP) (WA, 2006), no normally scheduled discharges occur at the Tesla Portal Valve Houses during operation of the San Joaquin Pipeline (SJPL) System. In the event of an unanticipated discharge from the SJPL System at Tesla Portal, it would flow over a large area of land and would likely dissipate and seep into the soil before reaching the nearest waterway.

Thomas Shaft Site

The Thomas Shaft site is also on the eastern flank of the Coast Range and is part of a smaller unnamed sub-watershed in the southeastern portion of the Livermore Valley. The watershed drains to the east and eventually to the San Joaquin River. Similar to the Tesla Portal site, the surface runoff at the Thomas Shaft site currently drains to open areas on the site adjacent to paved surfaces. An unnamed creek tributary, comprised of two streams, flows south to north parallel to Thomas Shaft Road. The streams, which form a tributary to Corral Hollow Creek, do not pass through the proposed project area at the Thomas Shaft site (CCSF Planning Department, 2007). No water bodies listed in Section 303(d), List of Impaired Water Bodies, could be affected by the proposed project at this site.

Groundwater

The proposed project is located in the San Joaquin River Hydrologic Region, one of three regional groundwater basins located in the Central Valley of California. Both the Tesla Portal and Thomas Shaft sites are located near the southern boundary of the Tracy Subbasin, part of the San Joaquin Valley Basin (DWR, 2003).

- The San Joaquin River Hydrologic Region groundwater basin is the source for approximately 30 percent of agricultural and urban water usage annually in the region. Aquifers generally have thicknesses of several hundred feet in the hydrologic region and frequently necessitate well depths of up to 800 feet (DWR, 2003). Unless otherwise designated by the California Regional Water Quality Control Board, all groundwater in the Central Valley region is considered to be suitable or potentially suitable, at a minimum, for municipal and domestic supply, agricultural supply, industrial service supply, and industrial process supply.

Groundwater levels near the proposed projects fluctuate depending on weather conditions and seasonal rainfall, local irrigation, and water levels in creeks. Groundwater recharge at the project

sites is likely to be limited given the prevalence of low permeability and high shrink-swell soils. According to a geotechnical report prepared by MACTEC Engineering for the SJPL System, groundwater was not encountered at the Tesla Portal project site, and is expected to be several hundred feet below the surface (MACTEC, 2007). Groundwater depth at the Thomas Shaft project site is approximately 300 to 350 feet[1] below the ground surface level. Groundwater is not currently used and is not anticipated to be used as a water supply source at either site as part of the proposed project.

Groundwater quality in the southern part of the Tracy Subbasin where the Tesla Portal and Thomas Shaft sites are located, is characterized by calcium-sodium type water. Sulfate-chloride and bicarbonate-chloride are both present in the groundwater as well. Well sampling reported mean concentrations of 463 milligrams per liter (mg/L) of dissolved solids and 1,190 mg/L of Total Dissolved Solids. Elevated levels of chloride, nitrate, and boron occur in the vicinity of the City of Tracy and in the northern and western portions of the sub-basin (DWR, 2003).

Groundwater occurs in confined, unconfined and flowing artesian conditions in the area near the Thomas Shaft site. Groundwater generally flows to the south and southeast in the southeastern and southern parts of the Lawrence Livermore National Laboratory (LLNL) Site 300, located approximately 1.5 miles north of the Thomas Shaft site, and is generally influenced by the underlying bedrock (LLNL, 1999). Monitored since 1981, most of the groundwater contamination identified has remained within the boundaries of LLNL Site 300, with the exception of two trichloroethylene (TCE) plumes, one that extends along the Corral Hollow stream bed and the second that extends approximately 200 feet off of the LLNL Site 300. The plume source is undergoing remediation, and off-site drinking water wells were reported to be unaffected by this contamination in 2005 (LLNL, 2005). Because ongoing remediation of the plume source is occurring, and the affected area is limited to 200 feet off-site from LLNL Site 300, the contamination at Site 300 is not anticipated to affect groundwater at the Thomas Shaft site.

Flooding

Flood insurance rate maps (Community-Panel Numbers 0602990715A and 0602990720A) produced by the Federal Emergency Management Agency (FEMA) (FEMA, 1980a, 1980b) for the project sites and surrounding area indicate that both sites are outside of FEMA-delineated 100-year and 500-year flood hazard zones. According to San Joaquin County's Office of Emergency Services *Dam Safety Plan*, the project sites are not within a Dam Inundation Area (San Joaquin County, 2003b).

[1] Groundwater depth at Thomas Shaft is an estimate based on regional groundwater information (LLNL, 2007). The estimate represents the most conservative elevation figure (i.e. the actual groundwater level could be much deeper) that could be extrapolated given the available information.

4.5.2 Regulatory Framework

Information is provided below for applicable federal, state, and local policies that govern hydrology, groundwater, and water quality in the project vicinity.

Federal

Clean Water Act Section 402

The federal Clean Water Act (CWA) and subsequent amendments, under the enforcement authority of the U.S. Environmental Protection Agency (U.S. EPA) and the U.S. Army Corp of Engineers, was enacted "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The Clean Water Act gave the U.S. EPA the authority to implement pollution control programs such as setting wastewater standards for industry. The act also set water quality standards for surface waters and established the National Pollutant Discharge Elimination System (NPDES) program to protect water quality.

Under Section 402 of the CWA, discharge of pollutants to navigable waters is prohibited unless the discharge is in compliance with an NPDES permit. The U.S. EPA determined that California's water pollution control program has sufficient authority to manage the NPDES program under state law in a manner consistent with the Clean Water Act. Therefore, implementation and enforcement of the NPDES program is conducted through the California State Water Resources Control Board (SWRCB) and the nine Regional Water Quality Control Boards (RWQCBs). These agencies also implement the Waste Discharge Requirements (WDR) Program, which regulates discharges of waste to land under the California Water Code as well as discharges of waste into waters of the state that are outside federal jurisdiction, as defined under the Clean Water Act.

Clean Water Act Section 401

Section 401 of the Clean Water Act provides the SWRCB and the RWQCBs with the regulatory authority to certify, or deny any proposed federally permitted activity that could result in a discharge to surface waters of the state. To certify an activity, these agencies must find that the proposed discharge will comply with state water quality standards, including protection of beneficial uses and water quality objectives. If these agencies deny the proposed activity, the federal permit cannot be issued. This water quality certification will be required for projects involving the discharge of dredged or fill material to Waters of the U.S., as described in Section 4.6, Biological Resources.

State

Porter-Cologne Water Quality Control Act

The RWQCBs regulate water quality under the Porter-Cologne Water Quality Control Act (Porter-Cologne Act) through the regulatory standards and objectives set forth in water quality control plans (referred to as Basin Plans) prepared for each region. The Basin Plans identify

existing and potential beneficial uses and provide numerical and narrative water quality objectives to protect those uses. The Basin Plans also set forth policies to guide the implementation of programs to attain the objectives. The Central Valley RWQCB (Region #5) has regulatory authority over water bodies in the San Joaquin Region. The Central Valley RWQCB adopted its Basin Plan in 1998, and most recently revised the plan in October 2007.

Pursuant to the Porter-Cologne Act, the Central Valley RWQCB is authorized to issue permits known as "waste discharge requirements" to allow for discharge of specified quantities and qualities of waste to land or surface waters. The limitations placed on the discharge are designed to ensure compliance with water quality objectives in the Basin Plan. To obtain a permit, the discharger must submit a Report of Waste Discharge and the requirements of the California Environmental Quality Act (CEQA) must be met. The RWQCB can use this approach to regulate any discharge to surface waters. The discharger would be responsible for providing enough information regarding the chemicals and volumes to be discharged and receiving waters to allow preparation of a permit.

State Implementation of 402 NPDES Permits

As stated above, the NPDES program in California is administered by the SWRCB, with implementation and enforcement by the RWQCBs. The NPDES program, designed to protect surface water quality, is applicable to all discharges to waters of the United States, including storm water discharges associated with municipal drainage systems, construction activities, industrial operations and point sources such as wastewater treatment plant discharges, water conveyance system blow-offs and other discharges to water bodies. In general, the NPDES permit program is designed to control, minimize, or reduce surface water impacts from point source discharges.

Construction Stormwater NPDES Permit

The federal Clean Water Act prohibits discharges of stormwater from construction projects unless the discharge is in compliance with an NPDES permit. The SWRCB has adopted a Statewide General Permit for Stormwater Discharges Associated with Construction Activity (General Permit) that encompasses one or more acres of soil disturbance (SWRCB, 1999). Construction activity includes clearing, grading, excavation, stockpiling, and reconstruction of existing facilities involving removal or replacement. In general, the NPDES stormwater permitting requirements for construction activities require that the landowner and/or contractor submit a notice of intent (NOI) and develop and implement a stormwater pollution prevention plan (SWPPP). The SWPPP includes a site map or maps showing the construction site perimeter, existing and proposed buildings, lots, roadways, stormwater collection and discharge points, general topography both before and after construction, and drainage patterns across the site.

The SWPPP must also specify best management practices (BMPs) that will be used to protect stormwater runoff as well as the placement of those BMPs; a visual monitoring program; a chemical monitoring program for non-visible pollutants to be implemented if there is a failure of BMPs; and a sediment monitoring plan if the site discharges directly to a water body listed as an

impaired water body for sediment. Measures for erosion and sediment control, construction waste handling and disposal, and post-construction erosion and sediment control must also be addressed, along with methods to eliminate or reduce non-stormwater discharges to receiving waters. The SWRCB is in the process of reissuing the Construction General Permit and released a preliminary draft of the new permit on March 2, 2007 (SWRCB, 2007). If adopted, this permit will replace the 1999 Construction General Permit, and, as proposed, may require the permittee to implement additional minimum BMPs as well as specific analytical procedures to determine whether the BMPs implemented on a construction site are: (1) preventing further impairment to waters listed as impaired for sediment or silt due to sediment in stormwaters discharged directly into such waters; and (2) preventing non-visible pollutants in stormwater discharges from construction sites from causing or contributing to exceedances of water quality objectives. In addition, all sites would be required to meet new development and redevelopment performance standards to minimize or mitigate hydromodification impacts. As proposed, the permit allows for a risk-based permitting approach and specifies water quality action levels, numeric effluent levels, and detailed management practices. Under the new permit, the SWPPP must be prepared or have preparation overseen by a qualified SWPPP developer; the SWPPP would be much more limited and would be meant to demonstrate compliance with the detailed permit requirements, with less discretion in how these requirements are met. The permit would also enable public review and hearings on permit applications. The new permit, as proposed, would also establish new procedures for SWPPP preparation as well as public participation in the permit process. According to the SWRCB, a new draft of the Construction General Permit has been released for a second round of public review from March 2008 to June 2008, and is not anticipated to be implemented until fall 2008 at the earliest. In addition, many of the new requirements (including the SWPPP preparation) may not be phased in or implemented until after the permit is approved. (SFPUC personal communication with SWRQCB, January 2008). The new Construction General Permit is expected to have different requirements; however, it is unclear whether it will be in place and applicable by the time of project approval.

Project construction at the Tesla Portal site would disturb more than one acre of soil and, therefore, would be subject to NPDES permitting. The Thomas Shaft site would require less than an acre of soil disturbance and would not be subject to NPDES permitting.

Waste Discharge Requirements General Order for Dewatering and Other Low-Threat Discharges to Surface Waters

Under the terms of a general permit, the Central Valley RWQCB allows the discharge to waters of the United States of certain categories of clean or relatively pollutant-free wastewater posing little or no threat to water quality. The general permit is Order No. 5-00-175, NPDES No. CAG995001, Waste Discharge Requirements General Order for Dewatering and Other Low Threat Discharges to Surface Waters (RWQCB Order No. 5-00-175). The permit covers water supply system discharges provided that they do not contain significant quantities of pollutants and either: (1) the discharge is 4 months or less in duration, or (2) the average dry weather discharge does not exceed 0.25 million gallons per day (mgd). These wastewaters may be produced and treated on a continuous or batch basis (SWRCB, 2000). All pollutants must be properly treated

prior to discharge to ensure continuous compliance with applicable water quality requirements. Chlorine and other constituents normally found in these discharges must be removed to provide protection of downstream beneficial uses, including fish and other aquatic life. Multiple discharges may be considered together as one project. Compliance with RWQCB Order No. 5-00-175 serves as compliance with NPDES permit requirements pursuant to Section 402 of the CWA and amendments thereto. The PPMRP for the Hetch Hetchy water supply system facilities (WA, 2006) is designed to achieve compliance with the requirements of RWQCB Order No. 5-00-175. The PPMRP covers existing discharges of Tesla Portal water, which are expected to seep into the ground or evaporate before reaching surface waters. The proposed project may eliminate this method of discharge by directing blow-offs and process water to the proposed containment basin, unless an unanticipated event occurs. The PPMRP would be revised accordingly.

Statewide General Waste Discharge Requirements for Discharges to Land with a Low Threat to Water Quality

The SWRCB has issued the Statewide General Waste Discharge Requirements for Discharges to Land with Low Threat to Water Quality (Order No. 2003-003-DWQ) to regulate discharges to land that are considered to have a low threat to water quality. Categories of covered discharges include wastes from the installation of borings and wells, clear water discharges, small dewatering projects, and miscellaneous discharges. In accordance with this permit, all dischargers must comply with all applicable Basin Plan provisions, including any prohibitions and water quality objectives governing the discharge. In addition, the discharge of waste may not cause the spread of groundwater contamination. Discharges must be made to land owned or controlled by the discharger, unless the discharger has a written lease or agreement with the landowner.

Similar to the NPDES program, dischargers seeking coverage under this permit must submit an NOI to comply with the terms and conditions of this general permit or a report of waste discharge, fees, a project map, evidence of CEQA compliance, and a discharger monitoring plan. The plan must include a list of all pollutants believed to be present in the discharge, the approximate concentration of pollutants in the discharge, monitoring locations, monitoring frequencies, and a reporting schedule. Discharges to land listed as a hazardous materials site are not eligible for coverage under this general permit. In addition, discharges that could have a significant impact on biological resources, cultural resources, aesthetics, or air quality, or that could significantly alter the existing drainage pattern of a discharge site or surroundings are not eligible for coverage. Other discharges not covered under this permit are those that would significantly physically divide an established community, significantly conflict with any applicable land use plan, policy, or regulation of an agency, or significantly conflict with any applicable habitat or community conservation plan.

At the Tesla Portal site, the water to be discharged to the containment basin would be raw water containing no chlorine, but with a pH adjustment to 9.2. At the Thomas Shaft site, the water discharged through the percolation tank will have chlorine residual from chlorination at Tesla Portal. Both discharges would require coverage under Order No. 2003-003-DWQ.

California Fish & Game Code

The California Department of Fish and Game (CDFG) has jurisdiction over any activity that could affect the bank or bed of any stream that has value to fish and wildlife. If any changes are proposed along a creek or waterway within its jurisdiction, a streambed alteration agreement would be required under California Fish and Game Code Section 1602. Refer to Section 4.6, Biological Resources, for additional information.

Local

Plans and policies of the City and County of San Francisco (CCSF) pertaining to hydrology, groundwater, and water quality apply to the proposed project. Section 4.2 describes the CCSF policies that apply to the proposed project. Because the project sites are in San Joaquin County, local policies apply directly to the project as described below.

San Joaquin County

In San Joaquin County, stormwater management issues, erosion and watercourse protection, and construction-related permits for stormwater and erosion protection are managed through the Department of Public Works.

The San Joaquin County General Plan, Volume 1, Chapter IV – Community Development includes policies concerning wastewater treatment, which at a minimum, require rural developments to have a septic system for wastewater treatment. The Community Development chapter also establishes policies concerning stormwater drainage. The policies require a public drainage system in new developments as well as the consideration of stormwater use for replenishment of the groundwater basin if the water is of safe quality. Volume 1, Chapter VI – Resources of the General Plan also mandates that water quality shall meet the standards necessary for the uses to which the water resources are put and shall be protected and improved where necessary (San Joaquin County, 1992).

Wastewater discharges must comply with the General Requirements for Wastewater Disposal found in San Joaquin County Development Title Chapter 9-1105, Section 9-1105.2, and Chapter 9-1110 (San Joaquin County, 1995). Individual sewage disposal system permitting requirements, as required by Chapter 9-1110, are described in the Environmental Health Department's *Onsite Wastewater Disposal Standards* (San Joaquin County, 2003a). Septic tanks must be at least 100 feet from public wells and 50 feet from all other wells. Similarly, seepage pits and sewage ponds must be at least 150 feet from public wells and at least 100 feet from all other wells. San Joaquin County Ordinance Chapter 9-1125.3 also states that waste shall not be discharged within 150 feet of a waterway, which would require the leachfield to be at least 150 feet away from the artificial wetland.

4.5.3 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to hydrology and water quality, but generally considers that implementation of a proposed project would have a significant impact if it were to:

- Violate any water quality standards or waste discharge requirements
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of preexisting nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted)
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on or off the site
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on or off the site
- Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff
- Otherwise substantially degrade water quality
- Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary, Flood Insurance Rate Map, or other authoritative flood hazard delineation map
- Place within a 100-year flood hazard area structures that would impede or redirect flood flows
- Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam
- Expose people or structures to a significant risk of loss, injury, or death involving inundation by seiche, tsunami, or mudflow

Areas of No Project Impact

Several of these criteria are not applicable to the proposed project, as there either is no potential for the impact to occur, or the applicable environmental resource does not occur within the study area or the area of potential effect. Neither of the project sites is within an area identified as a

100-year flood hazard area, or within a Dam Inundation Area, and no levees or dams are in proximity to the sites. In addition, the project does not propose to construct any new housing. The absence of any oceans, seas, or large lakes in the project vicinities precludes the possibility of inundation by seiche or tsunami. The absence of shallow groundwater at either of the project sites would preclude the need for dewatering during project construction. No depletion of groundwater would take place as neither site includes groundwater pumping activities or uses groundwater as a water supply. Therefore, the proposed project would have no impact with respect to these significance criteria.

At the Thomas Shaft site, proposed project activities include the installation of a percolation tank, a 360-square-foot prefabricated structure, and minor trenching, and no construction activities (e.g., tie-ins) are proposed at this site that would require any discharge of treated water. Therefore, water quality is not anticipated to be degraded as a result of any construction-related discharges of treated water, and the impact would not be applicable. Additionally, the proposed facilities at the Thomas Shaft site would not alter drainage at the site. No new impervious surface would be created as a result of the project; therefore, potential water quality impacts would not be applicable.

Approach to Analysis

The hydrology and water quality analysis evaluates short-term and long-term impacts associated with the potential for water quality degradation and increased erosion, as well as runoff attributed to the construction and operation of the proposed facilities at the Tesla Portal and Thomas Shaft sites. In general, implementation of the proposed project would not have significant direct long-term or short-term effects on the hydrology or water quality of regional and local surface waters, given compliance with existing regulations and established project procedures.

Construction Impacts

Impact 4.5-1: Degradation of water bodies as a result of erosion and sedimentation or a hazardous materials release during construction (Tesla Portal: LS; Thomas Shaft: LS)

Tesla Portal Site

Construction-related erosion could result from alterations in drainage patterns and grading activities, and could increase sedimentation in receiving waters. Sedimentation can lead to a reduction of water quality because sediment can carry nitrogen, phosphorus, and trace metals. The increase in sedimentation could accumulate in the artificial wetland and unnamed ephemeral drainage on the Tesla Portal project site. In addition, the temporary storage of diesel and use of construction equipment could accidentally release construction-related chemicals, such as oil and fuel, which could degrade the water quality of the wetland and unnamed ephemeral drainage on the project site.

Earthwork and grading activities would occur over portions of the project site. Vegetative cover, which acts to stabilize the soil, would be removed from areas where earthwork and grading activities would occur, which would present a threat of soil erosion from soil disturbance by subjecting unpaved and unvegetated areas to the erosional forces of runoff. However, the majority of the Tesla Portal site would remain undeveloped.

The proposed project would include SFPUC Construction Measure #3 (onsite air and water quality measures during construction), which requires the implementation of erosion control measures. Since the Tesla Portal site would result in a disturbance of over one acre of land, SFPUC must obtain coverage under NPDES General Permit (for stormwater discharge associated with construction activity) by filing an NOI that includes the preparation of a SWPPP and a Monitoring Program, with the SWRCB Division of Water Quality. The filing would describe erosion control and stormwater treatment BMPs to be implemented during and following construction and provide a schedule for monitoring performance. These BMPs would serve to control point and non-point source pollutants in stormwater and are a component of the project's SWPPP for construction activities. The SWPPP would include several BMPs for preventing the discharge of other non-point source pollutants besides sediment (such as paint or concrete) to downstream waters. These practices would include a provision requiring the placement of drip pans underneath heavy equipment that is stored overnight to prevent leaks of hydraulic fluids, oil, grease, or fuels from reaching an adjacent waterway.

The SWPPP would also include protection measures for the temporary onsite storage of diesel fuels used during construction, including requirements for secondary containment and berming of the diesel storage area or any chemical storage areas to contain a potential release and to prevent any such release from reaching an adjacent waterway (e.g., artificial wetland or ephemeral drainage). Monitoring would be conducted to ensure that all BMPs are implemented, maintained, and effective.

In addition, the proposed project will implement SFPUC Standard Construction Measure #10, which stipulates that the construction contractor will return the project site to its general pre-construction condition, including regrading the site and revegetating disturbed areas.

Given the relatively small area of impact (disturbed areas) anticipated at the project site, the implementation of SFPUC Construction Measures #3 and #10, compliance with NPDES General Permit requirements, and preparation of a SWPPP, impacts related to the degradation of water bodies as a result of erosion, sedimentation, or hazardous material releases during construction would be less than significant.

Thomas Shaft Site

Proposed project construction would be conducted on less than one acre, and would include only minor trenching. Construction activities would not be conducted near any surface water feature and would not require coverage under the NPDES General Permit. The proposed project would include SFPUC Construction Measures #3 and #10, which would incorporate erosion control

measures as necessary and return the project site to its general pre-construction condition. Therefore, impacts related to the degradation of water bodies as a result of erosion, sedimentation, or hazardous materials releases during construction at the Thomas Shaft site would be less than significant.

Impact 4.5-2: Degradation of water quality due to construction-related discharges of treated water (Tesla Portal: LS; Thomas Shaft: N/A)

Tesla Portal Site

The construction and installation of new facilities at the Tesla Portal site have the potential to discharge treated water. In particular, the installation of two new valve vaults and valve houses at the site could potentially discharge large volumes of water from the existing SJPLs. However, construction activities related to the tie-in at the Tesla Portal valve houses would be planned to coincide with and be completed within the planned shutdown period from January to February. Therefore, there would be no discharge associated with the project, because work is scheduled during this shutdown period and SJPLs involved would not be in service. This impact would be less than significant.

Operational Impacts

Impact 4.5-3: Degradation of water quality and increased flows due to discharges to surface water or groundwater during operation (Tesla Portal: LS; Thomas Shaft: LS)

Tesla Portal Site

The new Tesla Treatment Facility would contain three 16,000-gallon sodium hypochlorite tanks, three two 10,000-gallon fluoride tanks, two 12,500-gallon carbon dioxide (CO_2) tanks, and various treatment chemicals. A spill control system would be installed and implemented to prevent discharge of chemicals to surface water, groundwater, or wetlands.

The new septic tank and leachfield to the east of the new buildings would be designed to comply with county ordinances and wastewater disposal standards addressing minimum distances between waste discharges and surface water. The tank and leachfield would be at least 150 feet from waterways per San Joaquin County ordinance Chapter 9-1125.3. Because the proposed tank and leachfield would be in compliance with these regulations, any discharge impacts to nearby waterways would be minimized and this impact would be less than significant.

During operation, the proposed Tesla Treatment Facility would be expected to require miscellaneous discharges related to maintenance or emergencies, similar to existing conditions. Currently, these discharges at the existing Tesla Portal site are covered under the PPMRP in

accordance with RWQCB Order No. 5-00-175. Discharges from the existing site are anticipated to have a residual chlorine level ranging from 2.0 to 0.75 mg/L. Any discharge from the existing site must sheet flow over a relatively flat field, during which chlorine would dissipate. Residual chlorine is anticipated to dissipate quickly with exposure to light, increased temperature, and agitation. All or most of the water is expected to infiltrate into the ground or evaporate before reaching the nearest waterway, an un-named tributary of Deep Gulch, approximately three-quarters mile away (WA, 2006). Water from blow-offs at the new facility is anticipated to have quality similar to the existing discharge. The water would be discharged via the proposed percolation and evaporation from the 90,000-gallon containment basin (percolation pond). The basin would be lined with riprap to capture released water for grit removal and periodic maintenance, which entails a blow-off on the order of 10,000 gallons three times per month. These discharges would require coverage under SWRCB Order No. 2003-003-DWQ.

The groundwater is not anticipated to be affected by percolation because the groundwater level at Tesla Portal is expected to be several hundred feet below ground surface (bgs) (MACTEC, 2007). Consequently, the discharged water is not anticipated to decrease the quality of groundwater. Therefore, this impact would be less than significant.

Thomas Shaft Site

The proposed project includes the construction of a percolation water tank with an approximate capacity of 2,500 gallons at the Thomas Shaft site. The tank would contain approximately 12 to 18 inches of crushed rock at the bottom rather than being sealed to allow percolation of process water. The process water used for sampling chlorine residual, pH, and turbidity of water at the Thomas Shaft site would be discharged through this tank. This discharge would be covered under SWRCB Order No. 2003-003-DWQ, which would require compliance with all applicable Basin Plan provisions and discharge to land owned or controlled by SFPUC. Compliance with Order No. 2003-003-DWQ also requires dischargers to submit an NOI to comply with the terms and conditions of this general permit or a report of waste discharge, fees, a project map, evidence of CEQA compliance, and a discharge monitoring plan.

At the Thomas Shaft site, the percolation of the process water has the potential to affect groundwater quality. However, the groundwater level is at a depth of approximately 300 to 350 feet bgs, and process water would not percolate to a depth as great as 300 bgs. Therefore, impacts from the Thomas Shaft facilities discharges would be less than significant.

Impact 4.5-4: Degradation of water quality as a result of alteration of drainage patterns or an increase in impervious surfaces (Tesla Portal: LS; Thomas Shaft: N/A)

Tesla Portal Site

Construction of the proposed project would result in the alteration of existing drainage patterns and would result in the conversion of approximately 3 acres of pervious surface area to impervious surface area. This amount of new impervious surface area is considered a minor increase given the amount of surface area that would remain pervious on the 52-acre project site. Nevertheless, the increase of impervious surfaces with resultant higher peak flow runoff rates and velocities could result in onsite and offsite erosion, and an incremental increase in runoff volume and related stormwater pollutants is anticipated.

During the life of the proposed project, non-point source pollutants would be the primary contributors to potential water quality degradation. Non-point source pollutants would be washed by rainwater from roadways and rooftops into onsite drainage networks (e.g., in the form of sheet flow runoff from paved surfaces) and eventually to a discharge point such as the site's unnamed ephemeral drainage or the artificial wetland feature. Potential non-point source pollutants include oil, grease, and heavy metals from automobiles, and petroleum hydrocarbons from fuels.

At the Tesla Portal site, SFPUC and its contractors would be required to implement SFPUC Construction Measure #10, which requires the return of each project site to the general condition that existed prior to construction. This would include regrading the site and revegetating disturbed areas, which would ensure that drainage patterns are not altered in a way that could cause erosion or sedimentation. In addition, the proposed project facilities at the Tesla Portal would be required to implement permanent erosion control measures in compliance with applicable water quality regulations (e.g., the General Permit). Additionally, post-construction stormwater controls would be implemented and maintained, as specified in the project site's SWPPP. Given the water quality management features described above, impacts at the Tesla Portal site related to increases in surface runoff, stormwater pollutants, and the potential for onsite and offsite erosion would be less than significant.

4.5.4 References

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4.6 Biological Resources

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4.6.1 Setting

Habitats

Plant communities for the project sites are classified according to a combination of classification systems, including the Preliminary Descriptions of the Terrestrial Natural Communities of California (Holland, 1986) and A Manual of California Vegetation (Sawyer and Keeler-Wolff, 1995). A description of the habitats/vegetation located on the Tesla Portal and Thomas Shaft project sites is provided below and illustrated in Figure 4.6-1, Tesla Portal Vegetation Map, and Figure 4.6-2, Thomas Shaft Vegetation Map.

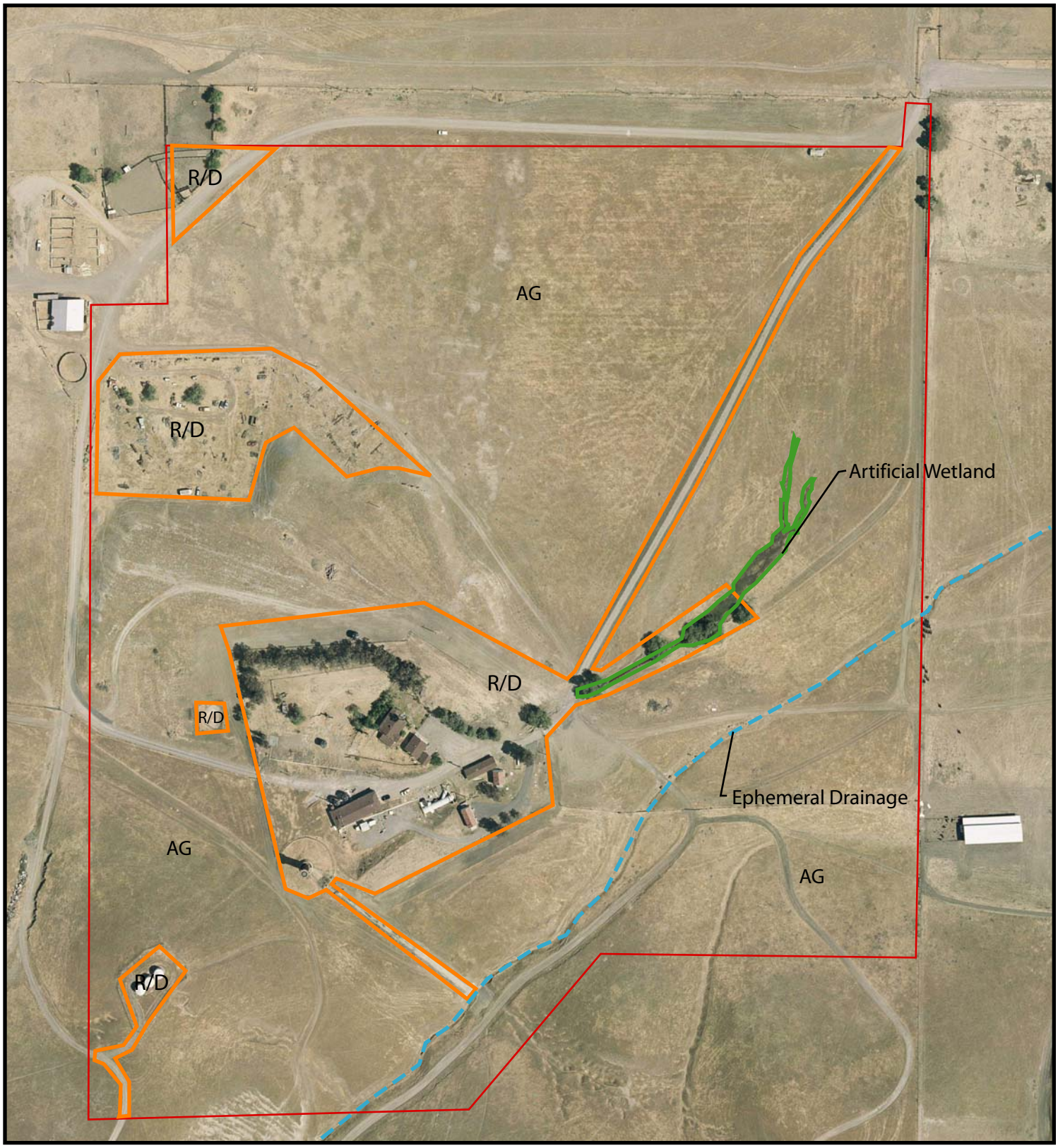
California Annual Grassland

California annual grassland is the predominant natural community at the project sites. At the Tesla Portal site, there is approximately 42 acres of California annual grassland, and about 25.6 acres of California annual grassland at the Thomas Shaft site. This natural community is dominated by non-native annual grasses such as soft chess *(Bromus hordeaceous)*, Italian ryegrass *(Lolium multiflorum)*, wild oats *(Avena fatua)*, ripgut brome *(Bromus diandrus)*, foxtail barley *(Hordeum murinum)*, and weedy annual and perennial forbs including as storksbill *(Erodium* spp.*)*, wild radish *(Raphanus sativus)*, charlock *(Sinapis arvensis)*, and cut leaved geranium *(Geranium dissectum)* (Sawyer and Keeler-Wolf, 1995). The majority of the California annual grassland in the study area[1] is somewhat disturbed/ruderal in character, perhaps due to past land use practices.

Ruderal/Disturbed Areas

Ruderal and disturbed areas are common in the project areas. Ruderal habitat is defined as a habitat where disturbance is sustained but where there is no intentional substitution of vegetation. At the Tesla Portal site, approximately 9.4 acres is ruderal or disturbed, and 2.4 acres at the Thomas Shaft site is ruderal or disturbed. These areas have been substantively disturbed over time such that native vegetation is either completely lacking, or is ruderal in nature. Disturbed areas include dirt and gravel roads, paved surfaces, and graded areas. Weedy species observed in

[1] The project "study area" refers to the area surveyed in the biological resources surveys conducted for this project. At the Tesla Portal project site, the study area is the same as the property boundary. The Thomas Shaft study area includes the Thomas Shaft facility, as well as the immediately adjacent lands.



Source: SFPUC, 2004

Project Boundary — Ephemeral Drainage — Artificial Wetland AG = California Annual Grassland

R/D = Ruderal/Disturbed Habitat

0 250 500 Feet

APPROXIMATE

SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT EIR

Tesla Portal Vegetation Map

Figure 4.6-1

Source: Google Earth

AG = California Annual Grassland R/D = Ruderal/Disturbed

Not To Scale

SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT EIR

Thomas Shaft Vegetation Map

Figure 4.6-2

these areas include fennel *(Foeniculum vulgare)*, Italian thistle *(Carduus pycnocephalus)*, wild radish *(Raphanus sativus)*, and bristly ox tongue *(Picris echioides)*.

Artificial Wetland

There is an artificial wetland area in the upland habitat at the Tesla Portal site that is approximately 0.308 acre in size. It was created and is currently sustained by water from the existing Tesla Portal Hypochlorite Station facility and has no downstream connection to a drainage or waterbody. The wetland is dominated by a wide variety of hydrophytic vegetation such as rabbitsfoot grass *(Polypogon monspeliensis)*, umbrella sedge *(Cyperus esculentus)*, cudweed *(Gnaphalium* sp.*)*, Baltic rush *(Juncus balticus)*, dallis grass *(Paspalum dilatatum)*, cocklebur (*Xanthium strumarium)*, willow herb (*Epilobium* spp.*)*, and narrow leaved cattail *(Typha angustifolia)*. Pacific chorus frogs *(Pseudacris regilis)* were observed in the wetland during the 2007 site assessment. A wetland delineation of the artificial wetland area at the Tesla Portal site was verified by the U.S. Army Corps of Engineers (USACOE) in 2001 (LSA, 2001). The wetland delineation verified that the artificial wetland is a non-jurisdictional feature. A follow-up wetland delineation and evaluation was conducted in 2007 by May & Associates and, based on observed field condition; it was again determined to be a non-jurisdictional wetland that was created in an upland pursuant to Section 404 of the Clean Water Act. This wetland is maintained by an artificial water source (i.e., water discharges from the existing Tesla Portal Hypochlorite Station for water quality testing) and does not have any natural hydrologic connection to a traditionally navigable waterway.

Since the wetland is supported by artificial water sources and was created in an upland, and has been used primarily as a result of water treatment purposes it is also unlikely that the feature would be considered jurisdictional "Waters of the State" pursuant to the State Regional Water Quality Control Board's definition of such features (i.e., isolated wetlands) under the Porter Cologne Water Quality Control Act. However, the wetland's non-jurisdictional status pursuant to this state authority is considered preliminary at this time. Regardless, this artificial wetland does provide habitat values to dependent plant and wildlife species such as a year-round source of drinking water in an otherwise arid valley and, therefore, is considered a sensitive biological resource. The artificial wetland may also provide habitat for a variety of other wetland-associated species and, because it is within a grassland community, can be particularly important. A variety of wetland-associated birds, including red-winged blackbirds, marsh wren, and several species of waterfowl and other waterbirds could also use the site for food and cover.

Ephemeral Drainage

There is also an ephemeral drainage that is approximately 5 to 10 feet wide (measured from top-of-bank to top-of-bank) in the southwest end of the Tesla Portal site. However, within the proposed project construction area, the drainage averages 1.5 feet in width, and flows from the southwest to the northeast across the site. Approximately 1,420 linear feet of the ephemeral drainage is found on the Tesla Portal site. The ephemeral drainage was dry during the May & Associates' February 2007 reconnaissance survey, as well as during the wetland delineation conducted in September 2007. The primary hydrologic sources for the ephemeral drainage

include direct precipitation and surface runoff from the surrounding hills. An emergency spillway also leads to the ephemeral drainage within the study area, and there is evidence immediately below the spillway indicating that some flow has entered the ephemeral drainage. The upper end of the ephemeral drainage is shown on a United States Geological Survey (USGS) map as a blue line stream; however, field observations do not indicate flow of sufficient volume or duration to support this mapping designation in the study area.

At its downstream end near West Vernalis Road, water collecting in the ephemeral drainage is channeled under West Vernalis Road through a road culvert, and then diverted into a roadside ditch. The roadside ditch has no downstream connection to a drainage or water body, and water entering into the ditch is likely to sheet-flow into a nearby field, across from the Chrisman residential subdivision adjacent to Stearman Court (refer to Figure 4.3-1a).

Vegetation in the ephemeral drainage is predominantly upland grasses. Dominant species include soft chess *(Bromus hordeaceous)*, hare barley *(Hordeum murinum)*, and wild oats (*Avena fatua)*, with occasional forbs such as turkey mullen *(Eremocarpus setigerus)* and vinegar weed *(Tricostema lanceolatum)* present during summer months. The native shrub, gumplant *(Grindelia camporum* ssp. *parviflorum)* occasionally occurs in and near the channel bottom. Vegetation within the ephemeral drainage is very similar to that found in the adjacent upland grassland habitats, suggesting that the period that water is present is likely of a very short duration.

The Wetland Delineation concluded that the ephemeral drainage is not a jurisdictional "Waters of the United States" feature pursuant to Section 404 of the Clean Water Act because it is an isolated water body (i.e., lacks a connection to a downstream waterway, does not appear to be used for intrastate recreation or commerce, or is a tributary and are directly connected to such areas). The ephemeral drainage is, however, considered a potential jurisdictional "Waters of the State" because its upstream extent, although outside of the study area, was mapped as a blue line stream on USGS topographic maps. SFPUC is working with the regulatory agencies to determine the State's jurisdiction over the drainage. Further, although this is an isolated drainage feature, it does convey natural flow for part of the year. Because water is present for a very short duration, vegetation is similar to the surrounding grassland community, and there are no unique features associated with the drainage. Wildlife use of the ephemeral drainage is likely similar to the surrounding grasslands.

Sensitive Natural Communities

Sensitive natural communities in the San Joaquin Region are found in areas of extensive natural habitat, such as the eastern and western foothills of the San Joaquin Valley, and near the San Joaquin River floodplain. Sensitive natural communities known to occur in the greater San Joaquin County Region include: Valley needlegrass grassland and pine bluegrass grassland, Northern hardpan vernal pool, Alkali meadow, Coastal and valley freshwater marsh and various riparian communities. None of these sensitive natural communities were identified on the project sites.

Special Status Species

For the purposes of this EIR, special-status species and sensitive communities are defined as follows:

- Plants and wildlife that are listed or proposed for listing as threatened or endangered or rare (for plants) under the California Endangered Species Act (Fish and Game Code 1992 Sections 2050 et seq.; 14 CCR Sections 670.1 et seq.) and/or the Federal Endangered Species Act (50 CFR 17.11 for wildlife; 50 CFR 17.12 for plants; and various notices in the Federal Register [FR] for proposed species)
- Plants and wildlife that are candidates for possible future listing as threatened or endangered under the Federal Endangered Species Act (50 CFR 17.12 for plants; 61 FR 7591, February 28, 1996 for wildlife) and under the State Endangered Species Act
- Plants and wildlife that meet the definition of rare or endangered under CEQA (14 CCR Section 15380), but are not included on state or federal endangered species lists
- Plants occurring on List 1A, List 1B, and List 2 of the California Native Plant Society's (CNPS) Inventory of Rare and Endangered Plants of California. The California Department of Fish and Game (CDFG) recognizes that Lists 1A, 1B, and 2 of the CNPS inventory contain plants that, in the majority of cases, would qualify for state listing, and the CDFG requests their inclusion in EIRs, as necessary
- Communities designated by the CDFG as significant natural communities
- Wildlife that is designated as "Species of Special Concern" by the CDFG
- Wildlife that is a "fully protected" species under the California (Fish and Game Code, Sections 3511, 4700, 5050 and 5515)
- Animals on the Special Animals list maintained by the CDFG

Special Status Plant Species

A total of 48 special-status plants were initially evaluated for potential to occur within the vicinity of the project sites, based on proximity to known occurrences (CNDDB 2006, USFWS 2007) and on results of 2003 botanical surveys conducted at Thomas Shaft by Weiss and Associates (Weiss Associates, 2003), 2004 botanical surveys at Thomas Shaft conducted by Tetra Tech (Tetra Tech 2004a), and the 2006 surveys of Tesla Portal (URS-ATS Joint Venture, 2008; May & Associates, 2008a). Refer to Appendix C, Special-Status Plant Species Initially Evaluated, for more detailed information regarding the special-status plant species initially considered.

Special-status plant species were assessed for potential to occur based on similarity of habitats present at the project sites to the habitats known to support the species and surveys conducted on the Thomas Shaft site and the Tesla Portal site (Tetra Tech, 2004a; URS-ATS Joint Venture, 2008). The project sites support habitat with potential to support 17 of the 48 sensitive plant species considered. Plant species considered with potential to occur at one or both sites are listed

in Table 4.6-1, Special Status Plant Species Potentially Found Onsite[2]. Despite the presence of suitable habitat at the project sites, no special-status plant species were detected at either the Tesla Portal site or the Thomas Shaft site during site surveys (Weiss Associates, 2003; Tetra Tech, 2004a; URS-ATS Joint Venture, 2008; May & Associates, 2008a, Tetra Tech 2008). One special-status species, Mt Diablo cottonweed, was observed along the access road leading to the Thomas Shaft site, but is not located within the project footprint or construction staging area (Weiss Associates, 2003). The remaining 31 special-status plant species originally considered were determined unlikely to occur because the project sites lack suitable habitats to support them. Specifically, the project area lacks the following habitats and site conditions:

- Vernal pools and seasonal wetlands
- Alkaline soils, seasonal alkaline wetlands, alkaline playas, or chenopod scrub
- Riverine habitats including, creeks, streams, canals, and other permanent waterways
- Sloughs, riverbanks, marshes (freshwater or brackish) and swamps
- Oak woodlands
- Riparian woodlands
- Chaparral
- Coniferous forests, closed-cone pine forests, pinyon-juniper woodlands, upland broadleaf coniferous forests and redwood forest

TABLE 4.6-1
SPECIAL-STATUS PLANT SPECIES POTENTIALLY FOUND ONSITE

Plant Species Common Name	Legal Status Federal/State/CNPS	Potential for Occurrence		Comments
		Thomas Shaft	Tesla Portal	
Alkali milk vetch	SC/-/1B	P	P	Sites lack alkali soils. None found during rare plant surveys.
Bent-Flowered fiddleneck	-/-/1B	P	P	None found during rare plant surveys.
Beaked clarkia	SC/-/1B	P	P	None found during rare plant surveys.
Big tarplant	SC/-/1B	P	P	None found during rare plant surveys.
Brittlescale	SC/-/1B	P	P	Sites lack alkali soils. None found during rare plant surveys.
Diamond-petaled California poppy	SC/-/1B	P	P	None found during rare plant surveys.
Heartscale	SC/-/1B	P	P	Sites lack alkali soils. None found during rare plant

[2] Note Table 4.6-1 differs from Table C-1 presented in Appendix C. Table C-1evaluates special-status plant species within the vicinity of the project sites. Although special-status plant species in Table C-1 may have potential to occur in the vicinity of the project sites, it does not necessarily indicate that species are present on either site. Table 4.6-1 evaluates those species which have potential to occur on the project sites.

TABLE 4.6-1
SPECIAL-STATUS PLANT SPECIES POTENTIALLY FOUND ONSITE

Plant Species Common Name	Legal Status Federal/State/CNPS	Potential for Occurrence Thomas Shaft	Potential for Occurrence Tesla Portal	Comments
				surveys.
Large flowered fiddleneck	FE/SE/1B	P	P	None found during rare plant surveys.
Lemmon's jewelflower	-/-/1B	P	P	None found during rare plant surveys.
Mt. Diablo cottonweed	SC/-/2	P	P	None found during rare plant surveys. Population nearby at Thomas Shaft roadway project.
Rayless ragwort	-/-/2	P	N	Sites lack chaparral and cismontane woodlands. None found during rare plant surveys.
Recurved larkspur	SC/-/1B	P	P	Sites lack cismontane woodlands and clay soils. None found during rare plant surveys.
Round leaved filaree	-/-/2	P	P	Sites lack clay soils. None found during rare plant surveys.
Showy Indian clover	FE/-/1B	P	P	None found during rare plant surveys.
Showy madia	SC/-/1B	P	P	None found during rare plant surveys.
San Joaquin spearscal	SC/-/1B	P	P	Sites lack alkali soils, chenopod scrub and alkali wetlands. None found during rare plant surveys
Succulent owl's clover	FT/SE/1B	P	P	None found during rare plant surveys. Sites lack vernal pools.

Federal
- FE Endangered
- FT Threatened
- SC Federal Species of Concern

State
- SE Endangered
- ST Threatened
- SSC Species of Special Concern
- FP Fully Protected

California Native Plant Society (CNPS) Categories
- 1A Plants presumed extinct in California
- 1B Plant species considered rare, threatened, or endangered in California and elsewhere
- 2 Plant species considered rare, threatened, or endangered in California but more common elsewhere
- 4 Plants of Limited Distribution- A Watch List

Occurrence Information
- N = Not likely to occur
- C = Confirmed presence of the species in the project study area
- P = Potential to occur based on habitat suitability

Special Status Wildlife Species

A total of 36 special-status wildlife species were initially evaluated for potential to occur on or within the vicinity of the Tesla Portal and Thomas Shaft sites. The Tesla Portal and Thomas Shaft sites support suitable habitat for 18 of the 36 special-status wildlife species, and of the 18 species with suitable habitat present at the sites, seven special-status wildlife species are either reported to

occur onsite (Tetra Tech, 2004b, c, d, e, and f); or were directly observed onsite during the 2003 field surveys (Weiss, 2003) or the 2006-2007 May & Associate's site assessment. The 36 special-status wildlife species initially evaluated as well as the species with suitable habitat present at the project sites are presented in Appendix C, Special-Status Wildlife Species Initially Evaluated. Several of these species have low potential to occur on the project sites due to marginal habitat conditions.

Of the 36 special-status wildlife species originally considered, 18 species were determined unlikely to occur at the project sites for one or more of the following reasons:

- Project study area lacks suitable habitat characteristics
- Project study area supports degraded or low quality habitat
- Habitat within the project study area is not unique within the larger landscape, and the species has a limited distribution
- Project area is outside the known range of the species

The project sites contain suitable foraging and/or breeding habitat for 18 special-status wildlife species known to occur, or with potential habitat present at the project sites. Table 4.6-2, Special Status Wildlife Species Potentially Found Onsite[3], illustrates the special status wildlife species and/or habitat potentially found on the project sites.

Eight of the 18 special-status wildlife species have potential to breed within the project sites, including the California horned lark, Swainson's hawk, white-tailed kite, burrowing owl, San Joaquin pocket mouse, San Joaquin whipsnake, San Joaquin horned lizard and San Joaquin kit fox. Raptor species (e.g., prairie falcon, white-tailed kite, northern harrier, Swainson's hawk, ferruginous hawk, golden eagle and burrowing owl) that are known or have potential to forage on the sites are not known to nest onsite. Further, with the exception of several mature pepper trees and the eucalyptus trees bordering existing structures at the Tesla Portal site, suitable raptor nesting habitat (i.e., large trees and snags) is largely absent within the project sites and is limited on lands immediately surrounding the Thomas Shaft and Tesla Portal sites.

The following discussion details the presence or absence of special status wildlife species on the project sites, as well as the presence or absence of suitable foraging and/or breeding habitat for special status wildlife species on the sites:

California Red-Legged Frog and California Tiger Salamander. Neither the Thomas Shaft or Tesla Portal sites support potential breeding habitat for the California red-legged frog or California tiger salamander. The artificial wetland on the Tesla Portal site is considered unsuitable as a potential breeding location for either species due to the high level of disturbance,

[3] Note Table 4.6-2 differs from Table C-2 presented in Appendix C. Table C-2 evaluates special-status wildlife species within the vicinity of the project sites. Although special-status wildlife species in Table C-2 may have potential to occur in the vicinity of the project sites, it does not necessarily indicate that species are present on either site. Table 4.6-2 evaluates those species which have potential to occur on the project sites.

TABLE 4.6-2
SPECIAL STATUS WILDLIFE SPECIES POTENTIALLY FOUND ONSITE

Wildlife Species Common/Scientific Name	Legal Status Federal/State	Potential for Occurrence Thomas Shaft	Potential for Occurrence Tesla Portal	Potential Wildlife Use
California red-legged frog	FT/SSC	N (B)	N (B)	Marginal aestivation habitat in grasslands – low potential for occurrence.
California horned lizard	SC/SSC	P (B) (F)	P (B) (F)	Potentially occurs in grasslands.
California tiger salamander	FT/SSC	N (B)	N (B)	Marginal aestivation habitat in grasslands – low potential for occurrence.
San Joaquin whipsnake	SC/SSC	P (B) (F)	P (B) (F)	Low potential in grasslands.
Pallid bat	-/SSC	P (F)	P (F)	Potential foraging in grasslands.
Townsend's big-eared bat	SC/SSC	P (F)	P (F)	Potential foraging in grasslands.
Mastiff bat	SC/SSC	P (F)	P (F)	Potential foraging in grasslands.
San Joaquin pocket mouse	SC/-	P (B) (F)	P (B) (F)	Potential foraging in grasslands.
San Joaquin kit fox	FE/ST	P (B) (F)	P (B) (F)	Marginal breeding and foraging habitat in grasslands – low potential for occurrence.
Golden eagle	-/SSC and FP	C (F)	P (F)	Foraging in grasslands.
Ferruginous hawk	SC/SSC	P (F)	C (F)	Foraging in grasslands.
Swainson's hawk	-/ST	N	P (B) (F)	Potential foraging in grasslands and nesting at Tesla site.
Northern harrier	SC/SSC	C (F)	C (F)	Foraging in grasslands.
White-tailed kite	-/FP	P (F) N (B)	C (F) P (B)	Foraging in grasslands and nesting at Tesla Portal site.
Prairie falcon	-/SSC	C (F)	P (F)	Foraging in grasslands.
Burrowing owl	SC/SSC	N	P (B) P (F)	Potential breeding and foraging in grasslands.
California horned lark	-/SSC	P (B) (F)	P (B) P (F)	Potential breeding and foraging in grasslands.
Tricolored blackbird	SC/SSC	P (F)	C (F)	Foraging in grasslands.

Federal
- FE Endangered
- FT Threatened
- SC Federal Species of Concern

State
- SE Endangered
- ST Threatened
- SR Rare
- SSC State Species of Concern
- FP Fully Protected Species

Occurrence Information
- N = Not likely to occur
- C = Confirmed presence of the species in the Project Study Area
- P = Potential to occur based on habitat suitability
- (F) = Foraging (B) = Breeding

particularly from cattle grazing, shallowness of the depression and restricted capacity to retain appropriate water depth for a sufficient period of time. In addition, there are no suitable breeding ponds for either species in the immediate vicinity of either project site. However, the project sites are within the range of both species and both sites support grassland or ruderal grassland communities that could potentially provide subterranean aestivation habitat. This determination is based on the possible occurrence of breeding ponds within one to two miles of each site, which is generally regarded as the maximum distance that either species is likely to travel between breeding ponds and upland aestivation sites. Although surveys were not conducted on neighboring lands outside the immediate vicinity of the project sites, a brief review of aerial photos indicates that there are stock ponds within one to two miles of both project sites. However, both species are considered very unlikely to occur on either site due to the following conditions:

- Both project sites are highly disturbed. Vegetation and soil conditions on the Tesla Portal site are damaged due to extensive overgrazing. The project footprint at the Thomas Shaft site has been graded and is significantly disturbed.
- There is no suitable aquatic breeding habitat on or in the immediate vicinity of either project site. While there is a large stock pond within approximately 0.25 miles of the Thomas Shaft site and two small stock ponds within approximately one mile of the Tesla site, the stock ponds are not considered suitable breeding habitat because they have been reported in the past to support fish and bullfrogs that are known to prey on frog larvae (Tetra Tech, 2004c, 2004d).
- The footprints of both sites are very small relative to the surrounding landscape and the availability of potential grassland aestivation habitat.
- CNDDB records indicate that the closest California red-legged frog occurrence is approximately 3.5 miles northwest from the Tesla Portal site and 5.5 miles from the Thomas Shaft.
- CNDDB records indicate that the closest California tiger salamander occurrence is approximately 3 miles northwest from the Tesla Portal site and 5 miles from the Thomas Shaft site.

Therefore, the potential for use of either site by aestivating California red-legged frogs or California tiger salamanders is considered very low.

San Joaquin Whipsnake and California Horned Lizard. Suitable breeding and foraging habitat for the San Joaquin whipsnake and California horned lizard is considered present at both project sites. However, the potential for occurrence of these species is considered unlikely due to the following conditions:

- Both project sites are highly disturbed. Vegetation and soil conditions on the Tesla Portal site are damaged due to extensive overgrazing. The project footprint at the Thomas Shaft site has been graded and is significantly disturbed.

- The footprints of both project sites are very small relative to the surrounding landscape and the availability of potential grassland habitat.

- There are no records of either species occurring on or in the vicinity of either project site (the nearest occupied habitat for either species is Corral Hollow, which is 1.5 miles away), and none were observed during surveys of the project sites.

Therefore, the potential of occurrence of the San Joaquin whipsnake and California horned lizard at the project sites is considered low.

San Joaquin Kit Fox. The San Joaquin kit fox is considered to have potential to occur on both project sites. While this species is very rare in this area in its northern range,[4] both project sites occur within its known range. CNDDB records indicate that the closest San Joaquin kit fox occurrence is approximately 0.25 mile north- northwest of the Tesla Portal site and 1.25 miles from the Thomas Shaft site. Grassland habitats at both sites have evidence of ground squirrel activity (which San Joaquin kit fox often use as dens) and are, therefore, considered potentially suitable for this species. Although the project sites are within the designated range of the species and habitat conditions are suitable, occurrence potential is considered low because of the extreme rarity of the species in the region, the degraded habitat conditions on both sites, and the proximity to human disturbances from the existing facilities at both sites.

San Joaquin Pocket Mouse. CNDDB records indicate that the closest San Joaquin pocket mouse occurrence is more than 3 miles from the Tesla Portal site and over 1 mile from the Thomas Shaft site. Both project sites are within the known range of the San Joaquin pocket mouse and both sites contain suitable, but degraded, breeding and/or foraging annual grassland habitat. Thus, while there is potential for the San Joaquin pocket mouse to be present onsite, because of the degraded habitat conditions and the availability of higher value habitat outside the project areas, the potential for occurrence is considered low.

Pallid Bat, Townsend Bat and Mastiff Bat. The project sites do not contain potential breeding or roosting habitat for any special status bat species. Furthermore, the closest special-status bat occurrence is more than 10 miles from both the Tesla Portal site and the Thomas Shaft site Nevertheless, each species could potentially forage in the grasslands at the Tesla Portal and Thomas Shaft sites.

Burrowing Owl. Although the presence or absence of burrowing owls has not been confirmed in the vicinity of the Tesla Portal site, the site supports suitable nesting and foraging habitat for this species. However, no burrowing owls or active burrows have been detected during any of the project surveys. Nonetheless, suitable rodent dens and holes were detected as present at both sites that are suitable to support burrowing owl breeding activity at Tesla Portal. Suitable habitat for this species was also initially considered present at the Thomas Shaft site (Tetra Tech, 2004b),

4 The northern range of the San Joaquin kit fox refers to the area northwest of the City of Tracy.

but with follow-up inspection of the site, it is considered unlikely to support this species because the canyon is too steep and narrow; burrowing owls occur in some coast ranges habitat – such as within the Altamont Pass area, but typically in areas that are more flat and open than the Thomas Shaft site (May & Associates, 2008a).

Swainson's Hawk. The Tesla Portal project site is within the range of the state-listed Swainson's hawk. The project site supports suitable grassland foraging habitat and adjacent eucalyptus trees that could be used for nesting. Therefore, Swainson's hawk may potentially nest and forage adjacent to or on the Tesla Portal site. Swainson's hawk is not likely to occur at the Thomas Shaft site because the species requires generally flat, open landscapes for nesting and foraging. The steep, narrow canyon where the Thomas Shaft site is located is not suitable for Swainson's hawk nesting or foraging. CNDDB records indicate that the closest Swainson's hawk occurrence is approximately 5.5 miles east of the Tesla Portal site and 4 miles from the Thomas Shaft site.

White-tailed Kite. Both project sites are within the range of the white-tailed kite. CNDDB records indicate that the closest white-tailed kite occurrence is more than 10 miles from both the Tesla Portal site and Thomas Shaft site. This species could potentially nest in the pepper or eucalyptus trees at the Tesla Portal site. It has been confirmed that this species forages at the Tesla Portal site (May and Associates, 2008a). In addition, the white-tailed kite may also forage in the grasslands at the Thomas Shaft project site.

Special-Status Raptor Species (Ferruginous Hawk, Golden Eagle, Prairie Falcon and Northern Harrier). While none of these special-status raptors have potential to nest on either project site, each species is known or has potential to forage on both project sites. CNDDB records do not include occurrence information for special-status raptor species, therefore, distances to known occurrences are not reported.

Tricolored Blackbird. Foraging habitat for tricolored blackbirds is present at both project sites, and tricolored blackbirds are known to forage at the Tesla Portal site (May and Associates, 2008a). This species is not known to breed at either site due to the lack of suitable breeding habitat. CNDDB records indicate that the closest tricolored blackbird occurrence is approximately 4.5 miles south-southeast of the Tesla Portal site and approximately 3 miles from the Thomas Shaft site.

California Horned Lark. The presence of California horned lark has not been confirmed at either the Tesla Portal or Thomas Shaft site. However, based on the similarity of habitat onsite to those known to support the species, potential for occurrence is considered high. California horned lark has potential to breed and forage at the Thomas Shaft project site and at the Tesla Portal project site. CNDDB records indicate that the closest California horned lark occurrence is approximately 1 mile east of the Tesla Portal site and 0.5 miles from the Thomas Shaft site.

4.6.2 Regulatory Framework

Special-Status Species and Other Species of Concern

Federal Endangered Species Act

The Federal Endangered Species Act (FESA) (16 USC 1530 et seq.), was created to provide protections for species that are in danger of becoming extinct. Section 9 of the FESA prohibits the "take" (i.e., killing, harassing, or habitat destruction of) federally-listed species, which is regulated by the U.S. Fish & Wildlife Service (USFWS) and the National Marine Fisheries Service. Take of listed species that is incidental to an otherwise lawful activity under Section 10 of the FESA, is allowed if a project proponent completes a Habitat Conservation Plan (HCP) for that species (16 USC 1539). An HCP accompanies a permit application to "take" a certain number of threatened and endangered species or acres of their habitat over a certain period of time, and demonstrates that the permit applicant will compensate for the taking so as to achieve "no net reduction" in the species' chances for survival.

The USFWS also publishes a list of candidate species for listing. Species on this list receive special attention from federal agencies during environmental review, although they are not otherwise protected under FESA. The candidate species are those for which the USFWS has sufficient biological information to support a proposal to list as endangered or threatened. The proposed project contains potential habitat for federally listed endangered or threatened species and, therefore, would be subject to the requirements of the FESA.

The San Joaquin County Multi-Species Habitat Conservation and Open Space Plan (SJMSCP) has been approved by the USFWS and the CDFG and it covers San Joaquin County, including the project sites. As described in more detail below, the adopted SJMSCP provides for third-party project proponents like the SFPUC to obtain coverage under Section 10 of the FESA for any projects within the plan study area that comply with the SJMSCP requirements.

California Endangered Species Act

Under the California Endangered Species Act (CESA), the CDFG has the responsibility for maintaining a list of threatened and endangered species (California Fish and Game Code Section 2070). The CDFG also maintains a list of candidate species, which are species that the CDFG has formally noticed as being under review for addition to either the list of endangered species or the list of threatened species. The CDFG also maintains lists of "species of special concern," which are animal species whose populations have diminished and may be considered for listing if declines continue. An agency reviewing a proposed project under CEQA must determine whether any state-listed endangered or threatened species may be present in the project area and determine whether the project will have a potentially significant impact on such species. Similar to FESA, the CESA prohibits take of a listed species, which is regulated by the CDFG.[5] Actions otherwise prohibited under CESA can be authorized under the state's Natural Community Conservation Planning Act (Fish and Game Code Sections 2800–2840), which includes a process that is

[5] Note that CESA's definition of "take" is somewhat less stringent than the federal definition under FESA.

analogous to a Section 10 HCP. Specifically, if the species is listed by CESA, and a proposed project would result in impacts, an incidental take permit pursuant to Section 2081 of the Fish and Game Code would be necessary. The CDFG will issue an incidental take permit only if:

- The authorized take is incidental to an otherwise lawful activity
- The impacts of the authorized take are minimized and fully mitigated
- The measures required to minimize and fully mitigate the impacts of the authorized take are roughly proportional in extent to the impact of the taking on the species; maintain the project applicant's objectives to the greatest extent possible; are capable of successful implementation; and adequate funding is provided to implement the required minimization and mitigation measures and to monitor compliance with, and the effectiveness of, the measures

The proposed project contains plant and wildlife species that are listed under CESA. Similar to the federal process, the SJMSCP provides incidental take coverage for state-listed species under CESA. As described in more detail below, the SJMSCP would provide authorization for potential impacts from these projects. Regardless, impacts to CESA listed species would be considered a significant impact under CEQA.

California Native Plant Protection Act

The California Native Plant Protection Act (Fish and Game Code Sections 1900–1913) and the Natural Communities Conservation Planning Act provide guidance on the preservation of plant resources; these two acts underlie the language and intent of Section 15380(d) of the CEQA Guidelines. Vascular plants listed as rare or endangered by the CNPS (2001), but which have no designated status or protection under federal or state endangered species legislation, are defined as follows:

- List 1A: Plants presumed extinct
- List 1B: Plants rare, threatened, or endangered in California and elsewhere
- List 2: Plants rare, threatened, or endangered in California, but more numerous elsewhere
- List 3: Plants about which more information is needed – a review list
- List 4: Plants of limited distribution – a watch list

In general, plants appearing on CNPS List 1A, 1B, or 2 are considered to meet the criteria of Section 15380 of the CEQA Guidelines. Additionally, plants listed on CNPS List 1A, 1B, or 2 also meet the definition of Section 1901, Chapter 10 (Native Plant Protection Act) and Sections 2062 and 2067 (CESA) of the California Fish and Game Code. The project sites have been surveyed for the presence of plants that are listed by the CNPS and, therefore, any impact to these special status plants would be considered a significant impact under CEQA.

Other Statutes, Codes and Policies Affording Limited Species Protection

Migratory Bird Treaty Act

The federal Migratory Bird Treaty Act (MBTA) (16 USC, Section 703, et. seq.) prohibits killing, possessing, or trading in migratory birds, except in accordance with regulations prescribed by the Secretary of the Interior. This act encompasses whole birds, parts of birds, and bird nests and eggs. For projects that would not result in the direct mortality of birds, the MBTA is generally interpreted in CEQA analyses as protecting active nests of all species of birds that are included in the "List of Migratory Birds" published in the Federal Register in 1995. The MBTA would apply to this project because both project sites have potential habitat (foraging and /or breeding) for birds listed under the MBTA. Therefore, potential impacts to migratory birds would be considered a significant impact under CEQA.

State MBTA

Similar to the federal MBTA, Section 3503 of the California Fish and Game Code makes it unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by this code or any regulation made pursuant thereto.

Section 3503.5 states that it is "unlawful to take, possess, or destroy any birds in the order Falconiformes or Strigiformes (birds of prey) or to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by this code or any regulation adopted pursuant thereto." These sections of the California Fish and Game Code would apply to this project because the project sites contain potential nesting habitat for birds and, impacts to a nest or egg would be a significant impact under CEQA.

Federal and State Provisions Applying to Wetlands

For jurisdictional purposes, there are two definitions of a wetland, one adopted by federal agencies and another adopted by the State of California. Both definitions are presented below.

Federal Wetland & Waters of the United States Definition. Wetlands are a subset of "Waters of the United States" and receive protection under Section 404 of the Clean Water Act. The term "Waters of the United States,"[6] as defined in Code of Federal Regulations (33 CFR 328.3[a]; 40 CFR 230.3[s]), includes:

1. All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide.

[6] Based on the Supreme Court ruling in Solid Waste Agency for Northern Cook County v. USACOE (531 U.S., 159 (2001) concerning the Clean Water Act jurisdiction over isolated waters (January 9, 2001), non-navigable, isolated, intrastate waters are no longer defined as waters of the United States based solely on their use by migratory birds. Jurisdiction of non-navigable, isolated, intrastate waters may be possible if their use, degradation, or destruction could affect other waters of the Unites States, or interstate or foreign commerce. Jurisdiction over such other waters should be analyzed on a case-by-case basis.

2. All interstate waters including interstate wetlands. (Wetlands are defined by the federal government [CFR, Section 328.3(b)] as those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.)

3. All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mud flats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce including any such waters which are or could be used by interstate or foreign travelers for recreational or other purposes; or from which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or which are used or could be used for industrial purposes by industries in interstate commerce.

4. All impoundments of waters otherwise defined as waters of the United States under the definition.

5. Tributaries of waters identified in paragraphs (1) through (4).

6. Territorial seas.

7. Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (1) through (6).

8. Waters of the United States do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other federal agency, for the purposes of the Clean Water Act, the final authority regarding Clean Water Act jurisdiction remains with the U.S. Environmental Protection Agency.

Wetlands are specifically delineated using the Wetland Delineation Manual USACOE 1987 and, in California, the Supplement for the Arid West Region. However, these wetlands may not be federally jurisdictional if considered isolated from other Waters of the U.S. The Supreme Court's 2001 decision in *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers* (SWANCC) found that certain "isolated" wetlands and other waters are not within federal jurisdiction under the Clean Water Act.

Regulation of Activities in Wetlands. The regulations and policies of various federal agencies (e.g., USACOE, United States Environmental Protection Agency [U.S. EPA]) mandate that the filling of wetlands be avoided unless it can be demonstrated that no practicable alternatives exist. The USACOE has primary federal responsibility for administering regulations that concern waters and wetlands. In this regard, the USACOE acts under two statutory authorities: the Rivers and Harbors Act (Sections 9 and 10), which governs specified activities in "navigable waters," and the Clean Water Act (Section 404), which governs specified activities in waters of the United States, including wetlands. The USACOE requires that a permit be obtained if a project proposes

to place structures within navigable waters and/or discharges dredged or fill material into waters of the United States below the ordinary high-water mark in nontidal waters. The U.S. EPA has provided the primary criteria for evaluating the biological impacts of USACOE permit actions in wetlands.

California Wetland Definition. California has adopted the Cowardin et al. (1979) classification system to define wetlands. For purposes of this classification, wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes[7] (at least 50 percent of the aerial vegetative cover); (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year (Cowardin et al., 1979).

Under normal circumstances, the federal definition of wetlands requires all three wetland identification parameters to be met, whereas the Cowardin definition requires the presence of at least one of these parameters.

- The state's authority to regulate activities in wetlands and waters at the project sites resides primarily with the California Regional Water Quality Control Board (RWQCB), which regulates construction in waters of the United States and waters of the state, including activities in wetlands, under both the Clean Water Act and the State of California's Porter-Cologne Water Quality Control Act. RWQCB must certify that a USACOE permit action meets state water quality objectives (Section 401, Clean Water Act). In response to the SWANCC Supreme Court decision, the SWRCB issued a guidance for the protection of these waters previously within the USACOE's jurisdiction. The RWQCB now takes the lead role in regulating impacts to "isolated" waters that are no longer within federal jurisdiction. These waters are still considered "Waters of the State" pursuant to the Porter-Cologne Water Quality Control Act.

The CDFG is also authorized under the Fish and Game Code, Sections 1600–1607, to develop mitigation measures and enter into a streambed alteration agreement with applicants proposing a project that would obstruct the flow or alter the bed, channel, or bank of a river or stream in which there is a fish or wildlife resource, including intermittent streams and ephemeral streams (i.e., those flowing briefly during and immediately following storm events).

San Joaquin County

The Resources Element of the San Joaquin County General Plan includes provisions on protecting and improving the County's vegetation, fish and wildlife resources and to provide undeveloped open space for nature studies, protection of endangered species and preservation of wildlife habitat. The Resources Element of the General Plan applies to the project since construction of the proposed project could impact special-status plant and/or wildlife species, as well as sensitive biological resources (e.g., riparian and wetland habitat) in San Joaquin County.

[7] The USFWS has developed the following definition for hydrophytic vegetation: "plant life growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content" (Cowardin et al., 1979).

The following policies in the Resource Element of the San Joaquin General Plan are applicable to the proposed project:

Policy 1. *Resources of significant biological and ecological importance in San Joaquin County shall be protected. These include wetlands; riparian areas; rare and threatened and endangered species and their habitats as well as potentially rare or commercially important species; vernal pools; significant oak groves and heritage trees.*

Policy 2. *No public action shall significantly diminish the wildlife and vegetative resources of the County; cumulatively significant impacts shall be avoided.*

Policy 3. *No net loss of riparian or wetland habitat or values shall be caused by development.*

Policy 6. *Development projects which have the potential to destroy wetlands shall not be permitted, unless*:

(a) no suitable alternative sites exist for the land use, and the land use is considered necessary to the public.

(b) there is no degradation of the habitat of numbers of any rare, threatened, or endangered plant, animal species as a result of the project; and

(c) habitat of superior quantity and superior or comparable quality will be created or restored to compensate for the loss.

Policy 16. *Replacement vegetation generally shall be native vegetation. Landscaping with native trees and shrubs shall be encouraged in urban areas to provide suitable habitat for native wildlife, particularly in proposed open space uses of future development.*

In addition to the policies outlined in the San Joaquin General Plan, the Development Title of San Joaquin County (1995) provides regulations that serve the public health, safety, and general welfare, as well as to implement the policies of the County's General Plan. Division 15, Natural Resources Regulations, mandates that the County develop regulations that would protect trees, riparian habitat, wetlands and waterways. However, regulations have not yet been developed and adopted by San Joaquin County.

Chapter 9-1505, Trees, in the Natural Resources Regulations, protects native oak trees, heritage oak trees, and historical trees in San Joaquin County. Removal of any of these trees requires a discretionary approval from the County, requires the replacement of any impacted trees, and outlines development constraints when construction activities are in proximity of protected trees. Chapter 9-1505 would not be applicable to the proposed project because the project sites do not contain oak trees, heritage oak trees or historical trees.

Chapter 9-1510, Riparian Habitat, protects and preserves the County's riparian habitat. An action that would have the potential to destroy, eliminate, or degrade riparian habitat would require a discretionary approval from the County. The regulation mandates mitigation requirements for the loss of riparian habitat, as well as institutes a natural bank buffer for riparian habitat. Chapter 9-1510 would not be applicable to the proposed project because the project sites do not contain riparian habitat.

Conservation Planning

San Joaquin County Multi-Species Habitat Conservation and Open Space Plan

The San Joaquin County Multi-Species Habitat Conservation and Open Space Plan (SJMSCP) provides a strategy for conserving open space while addressing the need to convert open space to non-open space uses, protecting agricultural resources, preserving property rights and providing for the long-term management of plant, fish and wildlife species, especially special-status species. A Joint Powers Authority/Technical Advisory Committee (JPA/TAC) implements the SJMSCP.

The SJMSCP covers all of San Joaquin County. Permit holders under the SJMSCP include San Joaquin County, the cities of Escalon, Lodi, Manteca, Stockton, Lathrop, Ripon, and Tracy, the San Joaquin Council of Governments (SJCOG), and others. The SJMSCP is designed to provide a regional approach to mitigating development impacts on the 97 listed and non-listed plant, fish, and wildlife species covered by the SJMSCP and compensating for the conversion of open space to non–open space uses. The SJMSCP provides incidental take authorization for covered projects that implement certain approved incidental take mitigation measures (ITMMs) and, if applicable, provides compensation for habitat losses through the collection of fees that are used to preserve habitats elsewhere. Mitigation measures developed for the proposed project are based on the standard SJMSCP ITMMs, although some have been altered given the magnitude or extent of the potential impact and the features of the project site.

The mitigation ratios and fees are determined based on the following four land cover types:

- Multipurpose open space lands
- Agricultural land
- Natural lands
- Vernal pools

Although the SFPUC is not a signatory to the SJMSCP, the project sites are within the SJMSCP study area, and the proposed projects are considered SJMSCP Covered Activities, which means that the SFPUC may obtain incidental take coverage under the SJMSCP for potential impacts to covered species after consultation with the JPA/TAC. The SFPUC has participated in the SJMSCP process on another project in San Joaquin County (the Thomas Shaft Roadway Improvement Project). The proposed project would participate in the SJMSCP as part of its required mitigation for impacts to aquatic habitat, natural lands and to obtain any necessary incidental take coverage for federally- and state- listed species.

4.6.2 Impacts

Significance Criteria

The City and County of San Francisco has not formally adopted significance standards for impacts related to biological resources, but generally considers that implementation of the proposed project would have a significant impact if it were to:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFG or USFWS
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the CDFG or USFWS
- Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act and as protected under the Porter-Cologne Water Quality Control Act (including but not limited to marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites
- Have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, or substantially reduce the number or restrict the range of an endangered, rare or threatened species
- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance
- Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan

Areas of No Project Impact

Several of these criteria are not applicable to the proposed project, as there either is no potential for the impact to occur, or the applicable environmental resource does not occur within the study area or the area of potential effect. The project would not conflict with the SJMSCP because the proposed project is considered a "covered activity," which means that the SFPUC may obtain incidental take coverage under the SJMSCP for potential impacts to covered species after consultation with the JPA/TAC. Impacts from the proposed project would be sufficiently small and would not preclude implementation of the SJMSCP, or protection of the covered species. The project would also be consistent with the ITMMs in the SJMSCP. The project sites do not contain oak trees, heritage oak trees or historical trees, and therefore would not conflict with the San Joaquin County regulation protecting such resources, nor would the project conflict with other known local or regional policies or ordinances protecting biological resources. Moreover,

implementation of the proposed project would not interfere with the movement of migratory fish or wildlife species or with an established migratory corridor, as no movement corridors were identified on either project site. Therefore, the proposed project would have no impact with respect to these significance criteria.

The Thomas Shaft project site does not contain wetland or aquatic resources; therefore, the project would not have any effect on such resources.

Approach to Analysis

The biological resources analysis evaluates potential short-term and long-term impacts associated with special status species, as well habitat modification attributed to the construction and/or operation of the proposed Thomas Shaft and Tesla Portal facilities. In general, implementation of the proposed project would not result in significant direct long-term or short-term effects on biological resources of regional and local surface waters, given compliance with existing regulations and established project procedures, and the implementation of mitigation measures outlined in this section.

Construction Impacts

Impact 4.6-1: Impacts on wetlands and aquatic resources (Tesla Portal: PSM; Thomas Shaft: N/A)

The Tesla Portal site does not contain any natural wetlands or other Waters of the United States that are under the jurisdiction of the USACOE pursuant to the Clean Water Act of 1972 (May & Associates, 2008b). In addition, according to the SFPUC coordination with the RWQCB, it is likely that the artificial wetland would not be considered a Water of the State as defined by the Porter-Cologne Water Quality Control Act. Regardless of agency jurisdiction, this EIR treats the artificial wetland as an important biological resource that may be affected due to changes in project operations (refer to Impact 4.6-4 below).

The ephemeral drainage is considered a Water of the State under the Porter Cologne Water Quality Control Act and California Fish and Game Code, Sections 1600–1607.

Installation of the pipeline (e.g., trenching) where it crosses the ephemeral drainage at the Tesla Portal site would temporarily affect less than 0.001 acre of the site's ephemeral drainage. Project construction could result in minor temporary degradation of the ephemeral drainage's bed and bank, as well as affect the down stream portions of the ephemeral drainage by increasing sedimentation and erosion. These impacts would be considered potentially significant. Impacts to the ephemeral drainage would be subject to the RWQCB's jurisdiction and review, and potentially a 1602 *Streambed Alteration Agreement* from CDFG. Mitigation Measures 4.6-1a and 4.6-1b require the payment of a fee to the SJMSCP for the replacement of habitat that would be equal to that of the temporary loss of <0.001 acre of ephemeral drainage, as well as the implementation of best management practices (i.e., fencing, erosion control and re-contouring of

the impact area) that would reduce impacts to the ephemeral drainage to a less than significant level.

Impact 4.6-2: Impacts on sensitive habitats, common habitats, and heritage trees (Tesla Portal: PSM; Thomas Shaft: LS)

Tesla Portal Site

Temporary impacts resulting from construction staging and other construction-related activities at the Tesla Portal project site would result in impacts to 11.716 acres of California annual grasslands, <0.001 acre of ephemeral drainage, and 0.846 acre of ruderal/disturbed habitat. Ruderal/disturbed habitat at the Tesla Portal site does not support important natural resources or functions and, therefore, the project construction impacts would be less than significant with respect to this habitat. Additionally, no heritage trees would be impacted by construction-related activities at the project site.

Temporary impacts to California annual grasslands and aquatic habitat would contribute to the degradation of natural habitat in the region and could result in the potential permanent loss of habitat. Mitigation Measures 4.6-1a, 4.6-1b and 4.6-2 (participation in the SJMSCP, implement Best Management Practices and returning the site to pre-project conditions) would reduce potential temporary construction impacts to less than significant. Ruderal/disturbed habitat at the Tesla Portal site does not support important natural resources or functions and, therefore, the loss would not result in a significant impact.

Thomas Shaft Site

Temporary construction at the Thomas Shaft project site would result in impacts to 0.110 acre of ruderal/disturbed habitat. No trees would be impacted by construction-related activities at the project site. Ruderal/disturbed habitat at the Thomas Shaft site does not support important natural resources or functions and, therefore, the loss during project construction would not result in a significant impact.

Impact 4.6-3: Impacts on special-status species – direct mortality and/or habitat effects (Tesla Portal: PSM; Thomas Shaft: PSM)

No special status plants were observed at either the Tesla Portal or Thomas Shaft sites. One species, the Mt. Diablo cottonweed, was observed along the access road leading to the Thomas Shaft site, but is not located within the project footprint and staging area at this site; therefore, it would not be impacted by the proposed project. Sensitive plant species are considered unlikely to occur because the project sites lack suitable habitats to support them. Therefore, the proposed project would not result in significant impacts to special status plant species.

Implementation of the proposed project could result in significant impacts to special-status wildlife species with potential to occur in the Tesla Portal and Thomas Shaft project sites. Eighteen special status species with potentially suitable habitat could be present at one or both of the project sites, and six of these special-status wildlife species were either reported to occur onsite or were directly observed (as shown on Table 4.6-2). Project construction could result in temporary loss of foraging and/or breeding habitat for some or all of the special status species known to occur, or with potential habitat present at the project sites.

Mitigation Measure 4.6-1a requires the SFPUC to participate in the SJMSCP and implement incidental take mitigation measures (ITMM)s, to mitigate for impacts on special-status species, thus reducing impacts on biological resources to a less than significant level. SFPUC will adopt all applicable ITMMs and mitigation measures for each species described below that have been identified in the SJMSCP and other measures that have been agreed upon by the SFPUC and the JPA/TAC. A discussion of potential impacts on sensitive and regulated wildlife species, as well as proposed mitigation measures follow:

California Red-Legged Frog and California Tiger Salamander. The potential for use of either project site by aestivating California red-legged frogs or California tiger salamanders is considered very low, and the potential for construction activities (e.g., grading, excavation and/or vegetation removal) resulting in a take of either species is considered negligible. Impacts would be less than significant.

San Joaquin Whipsnake and California Horned Lizard. The project sites contain potential breeding and/or foraging habitat for the San Joaquin whipsnake and the California horned lizard. The proposed project's construction related activities would temporarily reduce the amount of suitable breeding and/or foraging habitat onsite and could result (although unlikely) in the take of one or both of the special-status species. Mitigation Measures 4.6-3a and 4.6-3b would reduce potential impacts to a less than significant level. Measures include a worker awareness program, preconstruction surveys and SFPUC's participation in the SJMSCP that would contribute to the acquisition and preservation of land that is used by the San Joaquin whipsnake and the California horned lizard. If the species are discovered on either of the project sites, additional ITMMs will be formulated by the SJMSCP Technical Advisory Committee (TAC) and approved by the Joint Powers Authority (JPA) with concurrence of the regulatory agencies (CDFG and/or USFWS) representatives. Approved ITMMs may consist of preconstruction surveys, avoidance techniques and/or buffer areas that would reduce impacts to a less than significant level

San Joaquin Kit Fox. The San Joaquin kit fox is also considered to have potential, although unlikely, to occur on both project sites. Construction at the project sites would temporarily reduce the amount of potential breeding and/or foraging habitat onsite and may result in the take of this listed species. Implementation of Mitigation Measures 4.6-3a and 4.6-3c would reduce potential impacts to a less-than-significant level. Mitigation Measure 4.6-3c requires the SFPUC's participation in the SJMSCP and contribution to the acquisition and preservation of land that is used by the San Joaquin kit fox. In addition, SFPUC will adopt all applicable ITMMs that have been identified in the SJMSCP, such as conducting pre-construction surveys and monitoring dens.

San Joaquin Pocket Mouse. The project sites contain suitable breeding and/or foraging habitat for the San Joaquin pocket mouse. Although the overall potential for impacts on this species is considered low, construction activities at the project sites would temporarily reduce the amount of suitable habitat for the species onsite, and may result in potential take. Potential impacts would be reduced to a less than significant level with implementation of Mitigation Measures 4.6-3a and 4.6-3d requiring a worker awareness program, preconstruction surveys, and buffer areas. Mitigation would reduce impacts to a less than significant level.

Pallid Bat, Townsend Bat and Mastiff Bat. The project sites contain foraging habitat for the Pallid, Townsend and Mastiff bats. The proposed project's construction activities would result in the temporary reduction of foraging habitat onsite for these special status bat species. However, given the relatively small size of each project and the lack of direct impacts to bat roosting sites, potential impacts would be less than significant.

- *Burrowing Owl*. The Tesla Portal project site supports suitable habitat (breeding and foraging) conditions for burrowing owls. Construction activities at the Tesla Portal site would temporarily reduce the amount of breeding and foraging habitat onsite and may result in take of this special-status species. Implementation of Mitigation Measures 4.6-3a, 4.6-3e, 4.6-3f, and 4.6-3g would reduce potential impacts to a less than significant level. Mitigation Measure 4.6-3a requires the SFPUC to implement a worker awareness program. Mitigation Measures 4.6-3e, 4.6-3f, and 4.6-3g require the SFPUC adopt all applicable ITMMs related to burrowing owls that have been identified in the SJMSCP. The ITMMs include preconstruction surveys and eviction of birds from the project site prior to ground disturbance or construction activities.

Swainson's Hawk. The Tesla Portal project site is within the range of the state-listed Swainson's hawk and supports suitable grassland foraging and breeding habitat (nesting). Construction activities would temporarily reduce the overall amount of breeding and/or foraging habitat onsite, and may result in the take of the species. In addition, construction activities (e.g., noise and/or vibration) may result in the disturbance of nesting pairs, which can lead to abandonment of active nests and possible take of the species, therefore, resulting in a potentially significant impact. Potentially significant impacts associated with nesting Swainson's hawks would be reduced to a less than significant level with implementation of Mitigation Measures 4.6-3a and 4.6-3h, which requires a worker awareness program and preconstruction surveys, as well as any additional SJMSCP ITMMs.

White-Tailed Kite. Both project sites are within the range of the white-tailed kite and contain potential foraging habitat. White-tailed kite are known to forage at the Tesla Portal project site. Breeding habitat for the species is also found on the Tesla Portal site. Construction activities would temporarily reduce potential foraging and breeding habitat and may result in the take of the special status species. Furthermore, construction activities (e.g., noise and/or vibration) could disturb breeding pairs, which could result in nest abandonment and possible take of this species. Potential for impacts on nesting white-tailed kite would be reduced to a less than significant level with implementation of Mitigation Measures 4.6-3a and 4.6-3i, SJMSCP ITMMs requiring a

worker awareness program, and preconstruction surveys during nesting season or whenever white-tailed kites are identified onsite.

California Horned Lark and Northern Harrier. The California horned lark and northern harrier have potential to nest and forage on both project sites. Construction at the sites would temporarily reduce the overall amount of potential nesting and foraging habitat onsite and could result in the take of the special status species. Mitigation Measures 4.6-3a and 4.6-3j, implementation of a worker awareness program, and SJMSCP ITMMs requiring a 500-foot setback from nesting areas during ground-disturbing activities would reduce potential impacts on breeding and foraging California horned lark and northern harrier habitat to a less-than-significant level.

- *Other Special-Status Raptor Species (Golden Eagle, Ferruginous Hawk and Prairie Falcon).* Each special status raptor species is known or has potential to forage on both project sites. The proposed construction activities would temporarily impact potential foraging and breeding habitat of special-status raptor species. The temporary loss of the small amount of habitat (11.716 acres of grassland), from the project would not substantially affect overall habitat availability in the area or affect foraging behavior of these species or use of the surrounding area. Therefore, the temporary loss of a small amount of disturbed grassland habitat is considered negligible. Impacts would be reduced to less than significant with implementation of Mitigation Measures 4.6-3a, 4.6-3i, 4.6-3-j, 4.6-3k and 4.6-3l, requiring a workers awareness program and SJMSCP ITMMs for each species.

- *Tricolored Blackbird.* Foraging habitat for tricolored blackbirds is present at both project sites, and tricolored blackbirds are known to forage at Tesla Portal. Construction activities at the project sites would temporarily reduce the overall amount of tricolored blackbird foraging habitat onsite. However, given that suitable foraging habitat is so widespread in the region surrounding the project sites, impacts would be minimal and localized. Therefore, the temporary loss of foraging habitat for tricolored blackbirds is considered minor. Impacts would be less than significant.

Operational Impacts

Impact 4.6-4: Impacts on wetlands and aquatic resources (Tesla Portal: PSM; Thomas Shaft: N/A)

Implementation of the proposed project at Tesla Portal would discontinue the discharge of water from the analyzer equipment to the artificial wetland. This would result in the permanent loss of 0.308 acre of artificial wetland. The artificial wetland has little natural water source other than natural runoff and discharges from the Tesla Portal facility; therefore, the long-term effect of this action would be loss of most or all of the artificial wetland. Although the artificial wetland does not appear to have jurisdictional status under either the USACOE or the RWQCB regulations, the loss of the artificial wetland is considered potentially significant pursuant to CEQA because of its habitat value. Implementation of the project would result in the loss of wetland functions and

values (i.e., the only year-round source of water in the project area and surrounding valley bottom), and would substantially degrade or diminish habitat values for dependent plant and wildlife species.

Mitigation Measure 4.6-1a requires participation in the SJMSCP for the replacement of habitat that would be equal to that of the permanent loss of 0.308 acre of artificial wetland; therefore, the impact would be reduced to a less than significant level.

Impact 4.6-5: Impacts on sensitive and common habitats (Tesla Portal: LS; Thomas Shaft: LS)

Implementation of the proposed project at the Tesla Portal site would result in the permanent loss of approximately 3.2 acres of California annual grassland and 0.308 acre of artificial wetland. (Impacts associated with the loss of 0.308 acre of artificial wetland at the Tesla Portal site are addressed above, under Impact 4.6-4.) Implementation of the proposed project at the Thomas Shaft project site would result in the permanent loss of 0.008-acre ruderal/disturbed habitat.

Loss of California annual grasslands would contribute incrementally to the statewide loss of this type of habitat. However, given the abundance of similar grassland habitats in the immediate area and adjacent to the project sites and the relatively small amount of habitat loss, impacts associated with this project would be less than significant, as the loss of California annual grassland at the project sites is not expected to substantially reduce this resource overall. The proposed project would not substantially degrade the function of this habitat type in the local context of the project sites, and would not result in severe habitat fragmentation. Ruderal/disturbed habitat at the Thomas Shaft project site does not support important natural resources or functions and, therefore, the loss would not result in a significant impact.

Impact 4.6-6: Impacts on special-status species – direct mortality and/or habitat effects (Tesla Portal: LS; Thomas Shaft: LS)

Implementation and operation of the proposed project would not result in the direct mortality of any special status wildlife or plant species. However, implementation and operation of the proposed project would result in the permanent reduction of special-status wildlife foraging and/or breeding habitat. In total, the proposed project (Tesla Portal and Thomas Shaft) would convert 3.2 acres of California annual grasslands and 0.008 acre of ruderal habitat into a developed area. The project would result in the permanent loss of breeding and/or foraging habitat to all of the 18 special-status wildlife species with potential to be present on either project site (refer to Table 4.6-2). However, given the abundance of higher quality special-status species habitat in the proximity of the project sites, as well as the relatively small size of the proposed project footprints, impacts would be less than significant.

4.6.4 References

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4.7 Cultural Resources

This section is based on two technical reports prepared by Garcia and Associates (GANDA) in March 2008: *Archaeological and Cultural Resources for the Tesla Portal Disinfection Station and Thomas Shaft Site for the San Joaquin Regional Water Quality Improvement Project* (archaeological/architectural resources technical report) and *Paleontological Resources Technical Report and Survey at the Tesla Portal Disinfection Station and Thomas Shaft Facility for the San Joaquin Regional Water Quality Improvement Project* (paleontological resources technical report).

4.7.1 Setting

Paleontological Setting

Regional Geology

The regional geology of the Tesla Portal and Thomas Shaft sites is described in Section 4.4, Geology, Soils, and Seismicity. Both project sites are located on geologic formations that are likely to contain fossils and, therefore, are considered sensitive for paleontological resources. Pleistocene alluvium and Miocene marine sandstones of the San Pablo Group have high paleontological sensitivity. Franciscan Complex sandstones are also known to contain fossil resources, while Pliocene fanglomerates have an undetermined paleontological sensitivity. Paleontological resources within this area consist of the fossilized remains of plants and animals, including vertebrates (animals with backbones) and invertebrates (e.g., starfish, clams, ammonites, and coral marine).

Paleontological Sensitivity of the Project Areas

Fossil localities (locations where paleontological resources have been documented) are near both the Tesla Portal and Thomas Shaft sites. Five paleontological sites exist within a one-mile radius of the Thomas Shaft site and two paleontological sites exist within a one-mile radius of the Tesla Portal site, one of which exists within the Tesla Portal project area. Six localities are recorded within 5 miles of the Tesla Portal site and 15 localities are recorded within 5 miles of the Thomas Shaft site (BNHM, 2007). Eight vertebrate fossils have been discovered at the six localities within 5 miles of the Tesla Portal site and 226 vertebrate fossils have been encountered at the 15 localities within 5 miles of the Thomas Shaft site. One of the fossil localities within 5 miles of the Tesla Portal site was recorded during the original construction of the Hetch Hetchy Aqueduct, and is known by that name (BNHM, 2007). This fossil locality yielded an ancient camel skull of the genus *Camelops*. Another fossil locality less than 5 miles north of the Tesla Portal site yielded a very important Type specimen of a Jurassic Ichthyosaur (BNHM, 2007).[1] Fossils encountered within 5 miles of the Thomas Shaft site consist of a number of terrestrial vertebrate taxa from many different groups of mammals and reptiles, including the early horse genera *Nannipus* and *Hipparion* (Stirton, 1939).

[1] A Type specimen is used as a standard to determine if similar specimens belong to the same species.

Archaeological/Prehistoric Period Setting

Archaeological resources may be prehistoric, historic, or both. This discussion of prehistoric archaeological chronology addresses cultural patterns in the project area vicinity from the time when the first recorded artifacts were deposited to the time of European contact. Historic archaeological resources, starting with the Contact Period, are discussed below under "Historical Period Setting."

Chronology and Prehistory of the Region

In attempts to develop a chronology for the San Joaquin Valley, archaeologists have been confronted with numerous challenges for the past 100 years. Archaeologists have faced difficulties in documenting and analyzing the archaeological record due to the level of destruction of surface archaeological sites as a result of agricultural practices, levee building, erosion, and extensive looting.

In the early 1970s, Fredrickson (1973) proposed three basic periods for the Central Valley region: the Paleo-Indian Period, the Lower, Middle and Upper Archaic periods, and the Emergent Period. Rosenthal et al. (2007) have refined these time periods based on newly calibrated radiocarbon dates, given below. The following is a brief discussion of the basic periods of the Central Valley region:

- Paleo-Indian. The Paleo-Indian Period (11,550 to 8550 cal B.C.) has a relatively faint archaeological footprint. The oldest site is the southern San Joaquin Valley at the Witt site of Tulare Lake. Human bone tested from this site yielded dates of 11,379 to 15,802 radiocarbon years before present. Archaeological material from this time period has either been eroded away or buried by alluvial deposits. No sites of this antiquity are known to exist within the project vicinity (Rosenthal et al., 2007).

- Lower Archaic. The Lower Archaic Period (8550 to 5550 cal B.C.) economy emphasized mobile foraging. Artifacts found at sites include handstones, milling slabs, and various cobble tools that indicate a reliance on plant resources. Relationships between foothill and valley floor archaeology have not been explored for this early period, as there is a scarcity of archaeological evidence regarding valley archaeology from the Lower Archaic and Early Middle Archaic time periods.

- Middle Archaic. More distinct cultural adaptations for the valley floor and foothills are visible in sites dating to the Middle Archaic Period (5550 to 550 cal B.C.). Artifact assemblages for the foothill tradition are composed of flaked stone dart points and cobble tools similar to those of the Lower Archaic. Tabular pendants, incised slate, and perforated stone plummets are rare but have wide distribution. Middle Archaic sites are also characterized by rock-filled hearths and ovens, and "cairn capped" graves. The beginnings of other technologies—such as cordage, twined basketry, basketry awls, simple pottery, and other baked clay objects, stone plummets, bird bone tubes, and shell beads—appear in the Middle Archaic.

- Upper Archaic. During the Upper Archaic Period (550 cal B.C. to cal A.D. 1100), the technologies that existed in the Middle Archaic became highly specialized. This is evidenced by new types of tools, as well as by widely traded goods like saucer- and saddle-shaped *Olivella* beads, *Haliotis* ornaments, obsidian biface "roughouts," and ceremonial blades. The Native population focused on economies that included seasonally available resources that could be harvested and processed in large quantities, such as acorns.

- Emergent. The Late or Emergent Period (further divided into Lower and Upper), ranges from as early as cal A.D. 1100 to the time of European settlement, or the late 1700s. Intensive fishing, hunting, and harvesting of acorns and small hard seeds typify this period. A general increase in population and settlements, a more regularized exchange system, and an increase in evidence of ceremonialism characterize the period. Distinctive artifacts in the Central Valley during this period include small notched points that are indicative of the introduction and spread of bow-and-arrow usage, bone awls used in basketry, clay effigies, elaborately incised bone whistles, flanged soapstone stone pipes, and occasional pottery.

Ethnography and Contact Period – Native American Populations

At the time of European contact, Native American groups who spoke the Yokuts and Ohlone languages inhabited eastern Livermore Valley and the western San Joaquin region. The area around the Tesla Portal site was likely occupied by either the Luecha (an Ohlone subgroup) or the Cholvons (a Yokuts subgroup, also referred to as the Chulamni), while the area that now surrounds the Thomas Shaft site was home to the Luecha. The Luecha spoke both Ohlone and Yokuts language variants (Milliken, 1995, 2002).

The combined territory of the Ohlone-speaking people, also known as the Costanoans, extended along the coast from the current day locations of the Golden Gate Bridge in the north to just beyond Carmel in the south, and as much as 60 miles inland. The Ohlone are a linguistically defined group speaking eight different but related languages. The Ohlone were politically organized by tribelet, which consisted of one or more villages and camps within a territory generally designated by geographic features. Tribelet population ranged from about 50 to about 500 persons (Levy, 1978:485). The Ohlone were hunter-gatherers and relied on acorns and seafood and certain terrestrial plants and animals as staple foods. They also exploited a wide range of other foods, including various seeds (the growth of which was promoted by controlled burning), buckeye, berries, roots, land and sea mammals, waterfowl, reptiles, and insects.

The combined territory of the Yokuts-speaking people comprised approximately 250 miles extending down the San Joaquin River to the foot of the Tehachapis and east from the Fresno River to the adjacent foothills of the Sierra Nevada. The Yokuts are commonly categorized into three cultural-geographical types: the Southern Yokuts, Northern Yokuts, and Foothill Yokuts. Northern Yokuts were politically organized by tribelet, each having a designated territory. A tribelet comprised one or more villages and camps within a territory generally designated by geographic features. Tribelets commonly had 200-250 members. The Northern Yokuts were hunter-gatherers and relied on acorns and salmon as staples. They exploited a range of aquatic

birds, including geese and ducks, due to their close proximity to rivers and streams (Wallace, 1978).

Historical Period Setting

In 1542, Juan Sebastian Cabrillo was the first of the exploring Europeans to sail along the California coast. During the next 125 years, the Native Americans had sporadic contact with European explorers. The Portolá expedition left San Diego on July 14, 1769, becoming the first Europeans to explore by land what is now California (Browning, 1992). The goal of this expedition was to explore the new territory and to find worthy locations for establishing Franciscan missions; along the way they rediscovered the Bay of Monterey, described by sailors a hundred years earlier. Several accounts of this expedition exist including those of Fray Juan Crespi (Bolton, 1971), Miguel Costansó (Browning, 1992), and Pedro Fages (Priestley, 1937). Mission Pass, northeast of Mission San Jose, was the starting point of an old Spanish trail, the "Camino del las Buenos Ayres" which later became El Camino Viejo. The expedition of Juan Bautista de Anza and Fray Pedro Font in 1776 used this route, camping in "El Arroyo de los Buenos Aires" near the location of the present-day Tesla Portal site.

As the Spanish began to establish missions, the Yokuts were relocated to Mission San Jose, Mission San Francisco, and Mission San Juan Bautista, while populations of Ohlone were brought into Mission Santa Clara and Mission San Jose. These missions embarked on a campaign to convert the local Native Americans to Catholicism and a European style of farming and labor. Native population numbers were reduced at least eighty percent during this period due to the introduction of European diseases and the dramatic change in their lifestyle, both of which contributed to the destabilization of their remaining social structures. It is likely that by the time of secularization of the Missions circa 1830, there were no functioning tribal groups left within the project areas.

Following secularization of the Missions, representatives of the Mexican government distributed very large land grants to various individuals, who developed cattle ranches. The lands in the San Joaquin Region were divided into the Rancheria del Rio Estanislao, Rancho El Pescadero, Rancho del Puerto, Rancho Orestimba, and Thompson's Rancho. These huge ranchos were later sold and resold in increasingly smaller parcels and later were turned to farming uses. The project sites, however, were not located on or near any land grants. While the Thomas Shaft area has an extensive history, the Tesla Portal site remained comparatively undeveloped until the Coast Range Tunnel excavations relating to the Hetch Hetchy aqueduct began in 1927. In 1846, the first Americans arrived at Corral Hollow, near the present-day location of the Thomas Shaft site. They were a group of emigrants who had separated themselves from the ill-fated Donner-Reed party. Corral Hollow was so named for a horse corral that the leader of this group, Captain Charles Imus, had built in 1847 as part of his plan to capture wild horses. In 1850, a tavern called the Zink House opened at Corral Hollow, providing food and drinks to the forty-niners. The famous hunter Grizzly Adams arrived in Corral Hollow to hunt animals, especially bears, in 1854.

The first coal mine in California began operation in 1856 at the Corral Hollow coal fields near the Tesla location. The Tesla Coal Mine opened in 1897. Corral Hollow coal was shipped to Stockton

for local industry, and local availability influenced the Central Pacific Railroad to convert its engines from wood to coal. However, the advent of oil burning locomotives and industrial machinery depressed the price of coal. After a fire destroyed the coal bunkers and briquette factory in Stockton, the mines closed in 1905. The quartz-rich sands found in the area also had industrial value. These were shipped to Stockton via a railroad line built by the Alameda and San Joaquin Railroad Company, which became the Western Pacific in 1903, to what, at the time, was the only operating glass manufacturer on the west coast. The clay beds in Corral Hollow fostered the birth and growth of the town of Carnegie, on the LLNL Site 300 property across from Corral Hollow Road from the Thomas Shaft roadway entrance. The Carnegie Brick and Pottery Company produced brick and clay sewer pipe from 1903 to 1909, and the company town of Carnegie was built to supply and shelter workers and their families. A catastrophic flood in 1911 brought about the end to most of the activity, other than sheep herding.

While the Thomas Shaft area has some evidence of historic activity, the Tesla Portal site was rather undeveloped until the Coast Range Tunnel excavations relating to the Hetch Hetchy aqueduct began.

Hetch Hetchy Water System

The Hetch Hetchy System is part of the larger San Francisco Water System, which is comprised of the City and County of San Francisco distribution system, the Peninsula system, and the Alameda Creek system. The San Francisco Water System dates back to the Gold Rush of the mid-1800s. During this time period, the population of San Francisco boomed with an influx of fortune seekers. However, because the city is located on a semi-arid peninsula with very little access to fresh water, the existing water supply proved to be inadequate. At that time, water was imported in barrels, and sold at exorbitant prices to San Franciscans. In 1856, the city established the San Francisco Water Works by an official city order. Several other companies competed with the San Francisco Water Works, which ultimately failed. One competitor, the privately owned Spring Valley Water Company, soon came to dominate the city's water distribution with several sources of water supply coming into the city from various dams and reservoirs (Hundley, 2005).

The City of San Francisco undertook the Hetch Hetchy water system as a major part of the movement to wrest control of the water supply from the Spring Valley Water Company. The effort began in 1890, when the Tuolumne River was surveyed as a potential water source for San Francisco and the Hetch Hetchy Valley as a potential reservoir site. Beginning in 1903, San Francisco sought permission from successive federal secretaries of the interior to build a dam in the Hetch Hetchy Valley and to use other federal lands in Yosemite National Park and Stanislaus National Forest to deliver the water to the Bay Area. After a series of denials, Secretary of the Interior James R. Garfield finally granted the request in 1908. However, following this grant of right of way, the presidential administration changed twice and successive roadblocks to the city's procurement of Tuolumne River water ensued, culminating with the recommendation of Secretary of the Interior Franklin Lane that the City of San Francisco seek congressional approval for the Hetch Hetchy permit (Hundley, 2005).

The renowned hydraulic engineer, John R. Freeman, was hired by the city while it was negotiating with the federal government for access to Hetch Hetchy Valley water. Freeman prepared a report that outlined the city's need for this water. The report was instrumental in pushing the project through the approval process. Freeman's report called for the delivery of 160 million gallons per day (mgd) from Hetch Hetchy to San Francisco, with the prospect of increasing that amount to 400 mgd, an amount sufficient to serve the entire Bay Area. Freeman promoted the "urban destiny" of the Bay Area and compared the development of San Francisco's Hetch Hetchy system to the water systems that supported the industrial and population of other major metropolitan areas (URS-ATS Joint Venture, 2008).

- The Sierra Club, along with San Joaquin Valley farmers and the Spring Valley Water Company, contested the damming of the Tuolumne River. Opposition to construction of the Hetch Hetchy project came from a variety of interests. Understandably, the Spring Valley Water Company opposed this project, which effectively ended its role as the utility company supplying San Francisco with its municipal and domestic water (SFPUC, 1949). The Hetch Hetchy project was designed to transmit electrical power to San Francisco from a power plant at Moccasin. A politically charged conflict over this electric power and associated revenue pitted public power advocates against the privately financed electric power industry. Opposition came from electrical power generating companies like PG&E and Great Western Power Company (GWP), two utilities that served San Francisco and the Bay Area at the time. These private power companies opposed the competing generation and sale of electricity by public agencies, which was a provision of the Raker Act. CCSF planned to acquire PG&E and GWP's distribution systems within its service area, but between 1927 and 1941 the public consistently rejected bond issues required to fund their acquisition; allegedly, this opposition to the bond measures was largely funded by PG&E (Hundley, 1992; Sayles, 1985). The CCSF's agreements to have PG&E (which had acquired GWP in the 1930s) wheel its power through the company's existing transmission and distribution systems for delivery to San Francisco agencies, and its purchase of city power for resale, caused a longstanding controversy between the federal government, public power advocates, and the CCSF. An eight-year campaign was waged to thwart the project. However, the opponents were ultimately defeated in 1913 with congressional approval of the Raker Act. The Raker Act provided the City of San Francisco a congressional grant of right-of-way, construction, and use privileges in Hetch Hetchy Valley, which ultimately allowed the Tuolumne River to be dammed and the valley flooded. After passage of the Raker Act, the gigantic Hetch Hetchy undertaking began in earnest. During construction of the Hetch Hetchy system, the city finally completed the long process of acquiring Spring Valley Water Company (Hundley, 2005).

Michael O'Shaughnessy, San Francisco's city engineer from 1912 to 1934, is perhaps the most prominent name associated with the development of the Hetch Hetchy water and power system. O'Shaughnessy was the chief engineer of the Hetch Hetchy project and realized the completion of the San Francisco Water System and the methods for obtaining water from the Sierra Nevada. O'Shaughnessy was responsible for devising the design and function of the water system. O'Shaughnessy also had many of the state's best engineers in his work force (SFPUC, 2005).

The Hetch Hetchy system was a huge engineering accomplishment that overcame many challenges and involved not only building a 167-mile-long aqueduct, but also involved constructing multiple dams, reservoirs, conduits and valvehouses to transport water from high in the mountains down to the coastal city of San Francisco near sea level. There were also powerhouses and other features related to a limited hydroelectric power delivery system. Facilities within the Hetch Hetchy water transmission system were engineered and located to maintain a gravitational flow of water from Hetch Hetchy Reservoir to the San Francisco Bay Area. The entire project was completed in 1938 (SFPUC, 2005).

The construction of the Coast Range Tunnel began in 1927 and was completed in 1934. It is the final leg of the journey for Sierra Nevada waters before they reach the San Francisco Bay Area extending between the Tesla Portal and the Alameda East Portal. SJPL No. 1 was constructed in 1932 as part of the original plan for the San Francisco regional water system. SJPL No. 2 was constructed between 1948 and 1953. The two pipelines were always considered part of the original system plan. In conjunction with the construction of SJPL No. 2, the Southwest Valve House was constructed in 1950 and is located within the Tesla Portal facility.

The Tesla Portal Hypochlorite Station Facility, constructed in 1936-1937, is the primary disinfection system for all waters emanating from the Hetch Hetchy Aqueduct. The original components of the Tesla Portal Hypochlorite Station included the Coast Range Tunnel, the Tesla Portal Structure, and four buildings constructed in the Craftsman style, including the Caretaker's Cottage, the Caretaker's Garage, the Chlorinator Building, and the Pump House.

The original components of the Thomas Shaft site included a tunnel and access shaft, constructed when the Hetch Hetchy Aqueduct was first installed.

Paleontological Resources

No paleontological resources were discovered at either the Tesla Portal site or the Thomas Shaft site during the site reconnaissance (GANDA, 2008b). However, the paleontologically sensitive geologic units, consisting of late Pleistocene alluvium, Miocene San Pablo Group sandstones, and late Mesozoic Franciscan Complex sediments, were identified in or adjacent to both sites. As noted earlier, numerous fossil resources have been discovered within 5 miles of each site.

Prehistoric and Historic Archaeological Resources

No prehistoric or historic archaeological resources were identified at either the Tesla Portal site or Thomas Shaft site during field surveys (GANDA, 2008a). Furthermore, there are no previously recorded prehistoric resources at either site. A cultural resources investigation in 1981 at the Lawrence Livermore National Laboratory (LLNL) Site 300, the southern boundary of which is approximately 1.5 miles north of the Thomas Shaft site, resulted in the identification of 24 cultural resources, including prehistoric rock shelters with associated midden, bedrock mortars, chert lithic scatters, a portion of the Carnegie town site (State Historic Landmark #740), and other isolated historic materials.

Historic Architectural Resources

The Tesla Portal and Thomas Shaft project sites contain potentially significant historic architectural resources including the San Joaquin Pipelines (SJPLs) Nos. 1, 2, and 3, the ten structures on the Tesla Portal site, and the Thomas Shaft facility. These resources, as well as details regarding their eligibility as a historical resource, are presented below. The discussions about eligibility and significance as historical resources are based on the National Register of Historic Places (NRHP) and California Register of Historical Resources (CRHR) criteria, described in Section 4.7.2.

San Joaquin Pipelines No. 1 and No. 2

The SJPLs No. 1 and No. 2 are part of the SFPUC's SJPL System that conveys water across the San Joaquin Valley. SJPLs No. 1 and No. 2 run east-west, connecting the Foothill Tunnel at the Oakdale Portal to the east with the Coast Range Tunnel at the Tesla Portal to the west. The SJPLs are located underground or aboveground and supported on concrete piers.

SJPL No. 1 was constructed in 1932 as part of the original plan for the San Francisco regional water system. A portion of the SJPL No. 1 falls within the Tesla Portal site.

SJPL No. 2 was constructed between 1948 and 1953. Although SJPL No. 2 was constructed over two decades later in 1953, it was deemed a necessary addition to the water system as soon as SJPL No. 1 was completed in 1932, and the two pipelines were always considered part of the original system plan. Similar to SJPL No. 1, a portion of SJPL No. 2 falls within the Tesla Portal site.

Significance and Integrity: SJPLs No. 1 and No. 2 were an integral part of the San Francisco water system design and appear to be significant under NRHP Criterion A and CRHR Criterion 1 at the local level due to their association with first municipally-owned water system for the City of San Francisco. The new system provided a vastly more reliable and purer water supply transmitted from a distant mountain source. In addition, SJPLs No. 1 and No. 2 are historically significant, because they helped resolved the long standing water shortage issue in the Bay Area, facilitated the San Francisco's break from private water companies and was designed to meet demand as far into the future as could be envisioned at the time.

SJPL No. 1 appears to be eligible for listing at the local level under NRHP Criterion C and CRHR Criterion 3 for the innovative engineering techniques used by the Youdall Company during its construction (URS-ATS Joint Venture, 2008). SJPL No. 2 does not appear to be eligible under this criterion because it does not represent a significant engineering evolution or a design innovation.

SJPLs No. 1 and No. 2 appear to retain good integrity including materials, workmanship and design. Routine maintenance of SJPLs No. 1 and No. 2 would not be considered to be significant enough to alter their integrity, have not been moved, and have retained their association with the historic water system. Therefore, SJPLs No. 1 and No. 2 appear eligible for the NRHP and CRHR (URS-ATS Joint Venture, 2008).

San Joaquin Pipeline No. 3

SJPL No. 3, the largest of the three pipelines, is located parallel to SJPLs No. 1 and No. 2. SJPL No. 3 was built in 1968 as an improvement to the existing water system and to provide additional capacity to the SJPL System.

Significance and Integrity: SJPL No. 3 does not convey the historic significance of the San Francisco water system in the same manner as SJPLs No.1 and No. 2. Additionally, SJPL No. 3 does not have an association with the initial development of the San Francisco water system, or the historically significant Michael O'Shaughnessy or Joseph Freeman. Furthermore, SJPL No. 3 is less than 45 years old and, therefore, does not appear to possess the exceptional importance required to meet NRHP Criteria Consideration G for recently constructed resources. Therefore, SJPL No.3 does not appear eligible for the NRHP or the CRHR (URS-ATS Joint Venture, 2008).

Tesla Portal Facility

The Tesla Portal Facility is comprised of 11 structures: the Tesla Portal Manifold Structure, the Caretaker's Cottage, the Caretaker's Garage, the Chlorinator Building, the Pump House/Equipment, Northwest Valve House #1, Southwest Valve House #2, an Office/Storage Building, and three water tanks. These structures as well as their potential eligibility as a historic resource are presented below (see Section 4.7.2, Regulatory Framework, for an explanation of CRHR Criteria). The Coast Range Tunnel is located west of the Tesla Portal Manifold Structure and is a separate resource from the Tesla Portal Facility.

Tesla Portal Manifold Structure: The Tesla Portal Manifold Structure is a section of pipe that was originally completed and connected to the Coast Range Tunnel in 1933; it comprises a 10.5-foot diameter steel manifold where three pipelines join and enter the Coast Range Tunnel. From a historic resources perspective, the Tesla Portal Structure is defined as that portion of the Coast Range Tunnel and ancillary pipe and fittings that are visible above ground, downstream of the SJPLs. It channels water from the SJPLs into the Coast Range Tunnel. The manifold appears to be of more recent construction, and was probably replaced in 1968 during the construction of SJPL No. 3. A steel overflow/surge shaft rises approximately 60 feet from the hillside adjacent to the manifold. This shaft was built in successive steps with each pipeline between 1932 and 1967.

The Caretaker's Cottage: The Caretaker’s Cottage (constructed in 1936) is a one-story, wood-frame California Craftsman style residence with a concrete foundation, featuring concrete stucco-clad walls and a double-gabled composition shingle clad roof. The architectural details of the Caretaker’s House echo those found on the equipment building and chlorination facility building, the composition shingled, double-gabled roof features overhanging eaves and decorative knee-brace roof brackets on the gable ends. The gable end peaks feature basket-weave lattice wood vents above the plaster walls. The Caretaker’s House underwent renovations circa 1963. All windows were replaced with aluminum one-over-one, double-hung windows or aluminum two-light slider windows, and iron security grilles have been placed in front of all of the windows and doors. Many of the windows have been boarded up with plywood coverings. The original wood and glass paneled doors have been removed and replaced with modern doors, security grilles and plywood coverings. A projecting gable door hood was installed over the entrance door on the north façade. There are two shed additions on the rear south elevation.

The Caretaker's Garage: The Caretaker’s Garage (constructed in 1936) is a one-story, wood-frame, Craftsman style garage with a concrete foundation, featuring concrete stucco-clad walls and composition shingle covered gable roof. The gable roof features overhanging eaves with decorative knee-brace brackets at the gable ends. Two sets of double-leaf tongue-and-groove paneled doors that swing in on the north façade are below a centered decorative beveled wooden vent opening. The east, west, and south elevations feature a fixed eight-light wood window, and centered decorative beveled wooden vent openings are located on the north and south elevations. A molded stucco cornice is located under the eave line. A low water table is located at the base of the walls.

The Chlorinator Building: The Chlorinator Building (constructed in 1936) is a one-story wood-frame Craftsman style building with a concrete foundation, featuring concrete stucco-clad walls and an asphalt shingle hip roof with partial gable ends. In 1967, this building received an addition/extension to the east façade concurrent with the construction of SJPL No. 3 (Busby, 2000). The east façade originally featured a 10-foot-deep concrete loading dock with stairs located on the southern end, which was removed. A modern, aluminum roll-up garage door presently fills the northern portion of the east façade. The north and south façades originally featured three large steel frame, multi-pane windows corresponding to the tank storage room and now feature five windows. Lastly, the 18-inch-tall water table has been removed, and two lean-to additions are now located on the west and south façades (SFPUC, 1936).

In addition, three small sheds are located just south of the Chlorinator Building. The western-most building is the smallest and has a rectangular plan with a gable roof. The central building is rectangular in plan and clad in vertical wood board. It has a shed roof that overhangs slightly on its north façade, which also has a solitary door. The eastern most building has a square plan with a flat roof. It is constructed of metal and has a set of metal double doors on its north façade.

The interior of the Chlorinator Building was originally divided into two rooms. A Chlorine Machine Room occupied the western end of the building, and the larger Tank Storage Room occupied the eastern end of the building. A wall with a glazed, paneled door, wooden stairs, and four fixed, multi-pane, wood-sash windows separated the rooms. The building currently houses sodium hypochlorite metering pumps, chlorine residual analyzers, and both the interior and exterior storage tanks. Many exterior pipes and wires are attached to the exterior walls of the building and two storage tanks used to store a liquid form of chlorine are located adjacent to the west elevation.

The Pump House/Equipment Building: The Pump House/Equipment Building (constructed in 1936) is a one-story, wood frame rectangular-shaped Craftsman style building with a concrete foundation, featuring concrete stucco-clad walls and a composition shingle clad gable roof. The gable roof features overhanging eaves and a molded wood cornice with projecting knee-brace brackets under the eaves on the gable ends. The original building, dating from 1936-1937, features a symmetrically placed center paneled door with flanking steel-framed windows with nine-lights (with opaque wire-glass) on the north façade. The original south elevation featured two symmetrically placed steel framed windows with nine-lights of opaque wire-glass. In 1967, this building received two additions/extensions to the east and west, concurrent with the construction of SJPL No. 3 (Busby, 2000). The east end gable elevation features a centered beveled wooden vent opening. A low water table is located at the base of the walls. There are exposed pipes and vents on the exterior walls, and the windows on the additions feature modern security grilles.

Northwest Valve House: Constructed in 1963 in conjunction with SJPL No. 3 (Busby, 2000), the Northeast Valve House is a one-story, one-room, wood frame Spanish Revival style, rectangular-shaped building with a concrete foundation, featuring concrete stucco-clad walls and a clay tile gable roof. The west façade features one steel frame window with eight-lights of wire-glass and a

decorative security grille adjacent to concrete steps leading to a two-panel steel door. The east elevation features a single eight-light steel frame window with a decorative security grille. A 1-2-foot-high molded water table is located at the base of the walls. A molded stucco cornice runs under the roofline. The end bays feature round decorative tile ventilation apertures. A raised stucco panel above the entrance door has no lettering, although other valve houses throughout the water system have been inscribed with lettering that reads "San Francisco Hetch Hetchy Water" and the construction date.

Southwest Valve House: Constructed circa 1950 in conjunction with SJPL No. 2 (Busby, 2000), the Southwest Valve House is a one-story, one-room, wood frame Spanish Revival style, rectangular-shaped building with a concrete foundation, featuring concrete stucco-clad walls and a clay tile gable roof. The symmetrically-placed steel frame windows with eight-lights of wire-glass and decorative security grilles flank a two-panel steel door on the east façade. The west elevation features two symmetrically-placed steel frame windows with eight-lights of wire-glass and decorative security grilles. A 1-to-2-foot-high molded water table is located at the base of the walls. A molded stucco cornice is located under the roofline. The end bays feature round decorative tile ventilation apertures. A raised stucco band above the entrance door with incised lettering reading "San Francisco Hetch Hetchy Water Supply 1950" has been covered over with stucco. Three projecting metal valve structures protrude perpendicularly from the east facade and west elevation.

Office/Storage Building: Constructed between 1963 and 1967, the Office/Storage Building is a one-story, wood frame Craftsman style square-shaped building with a concrete foundation, featuring concrete stucco-clad walls and an asphalt shingle gable roof. The gable roof features overhanging eaves with decorative knee-brace brackets on the gable ends. Replacement aluminum slider windows with two-lights are located in the centered window openings on the east, west and south elevations. A through-the-wall air conditioning unit is on the east elevation.

Water Tanks: There are three 20,000-gallon water storage tanks located on a hill southwest of the Surge Shaft above the Tesla Portal facility. Tank No. 1 and Tank No. 2 were constructed in 1936. Tank No. 3 was constructed in 1950. All three water tanks are painted with aluminum paint, and the site is surrounded by a locked chain-linked fence.

Significance and Integrity: Historical research and evaluation of the Tesla Portal site, as a whole, resulted in the recommendation that the facility does not appear to be eligible for the NRHP and CRHR due to its lack of significant engineering structures, and its lack of integrity and/or the lack of significance of individual buildings and structures within the site. Had the Tesla Portal facility retained sufficient integrity to its inferred period of significance (1933-1953), it would have been eligible for the CRHR.

One individual resource within the complex, the Southwest Valve House, appears to meet NRHP Criterion A and CRHR Criterion 1, with a period of significance of 1950 to 1953 and given its association with the development of the San Francisco water system (URS-ATS Joint Venture, 2008). This period of significance corresponds to the period of expansion and improvement of the

SJPL System, concluding with the completion of SJPL No. 2 in 1953. The Southwest Valve House retains a high level of integrity, given that it retains its original plan, massing and cladding. In addition, the Southwest Valve House retains its integrity of design, materials, workmanship and location. Although structures have been constructed and/or modified in proximity to the valve house, the new or modified structures do not significantly detract from the valve house's historical setting. Therefore, the Southwest Valve House appears eligible for the NRHP and CRHR.

The other structures on the Tesla Portal site including the Tesla Portal Manifold Structure, the Caretaker's Cottage, the Caretaker's Garage, the Chlorinator Building, the Pump House/Equipment, Northwest Valve House, the Office/Storage Building, and the Water Tanks were found not to be eligible for either the NRHP or CRHR. These structures are not eligible for the NRHP or CRHR because they either are less than 45 years old, lack integrity, and/or lack historical significance.

Thomas Shaft Facility

The Thomas Shaft site includes a modern building, other recently constructed or installed tanks, pumps, valves, part of a wide gravel-covered road, and the two original Thomas Shafts, the construction shaft and the vent shaft, with depths of 350 and 300 feet, respectively (Shaw pers. comm., 2008). No historic architectural resources were identified at the Thomas Shaft site.

There are a total of five "access" or construction shafts associated with the Coast Range Tunnel: Thomas, Mitchell, Mocho, Valley, and Indian Creek (SFPUC, 2005). These five shafts were built during the years 1927-1933, with most construction occurring during 1928, and vary in depth from 254 to 823 feet (SFPUC, 2005). Along with the four portals, they provided 14 faces from which material could be excavated. At the bottom of each shaft, a crosscut had to be driven at right angles to the aqueduct, 95 feet to the centerline of the first tunnel to be dug and 80 feet to the parallel tunnel planned for the future. From the north end of each crosscut, the aqueduct tunnel was driven in both directions (City and County of San Francisco, 2007). The Thomas Shaft construction shaft is 350 feet deep, 50 feet deeper than the Thomas Shaft ventilation shaft to allow for the use of "muck trolleys" in the construction of the tunnel. The surface area around the Thomas Shaft construction shaft has modern pipes on the interior and exterior, placed by LLNL Site 300 in 1987 and the early 1990s (Shaw pers. comm., 2008). The only above-ground portion of the shaft is a very low white cover, which is not original.

The Thomas Shaft ventilation shaft is 300 feet deep and was used for ventilation and pressure relief from about 1932 through c. 1995-2000 (Shaw pers. comm., 2008) when the new facility was built and likely altered it. Recent modifications have resulted in the alteration of the ventilation shaft original function. The ventilation shaft is now used for water sampling and occasional water treatment with sodium chloride (Shaw pers. comm. 2008). The ventilation shaft is located on the southeast side of the exterior facility under the "tank cover," which is not original. The tank cover was placed over the ventilation shaft after construction of the new chlorination facility. The ventilation shaft was once maintained in a separate building. This building no longer exists (Shaw pers. comm. 2008).

A field survey conducted in 2004 for the SFPUC's Thomas Shaft Roadway Improvement Project resulted in the identification of one historic-period resource, more than 50 years old that was within the roadway improvement project's APE (Marken, 2007). The site was given the field designation S-01 and consisted of six cement foundations and an excavation bucket. The foundations and machinery identified were considered to be associated with the excavation of the original Thomas Shaft. S-01 is located approximately 50 feet from the proposed project at the Thomas Shaft site.

Significance and Integrity: The two original Thomas Shafts are each estimated 2-by 2-foot openings in the ground that extend approximately 300 and 350 feet beneath the surface. The construction of the large modern building and facilities and the lack of association and historic setting indicate that the shafts are not potentially eligible for listing in the CRHR. The Thomas Shaft facility's period of significance is 1928-1930, when it was constructed. The location of the Thomas Shaft original facility is nearly unrecognizable from its original setting, and almost all of the original, historic facilities, structures, and features have been altered or removed.

The Thomas Shaft facility does not appear to be eligible under the NRHP Criterion A (events) or the CRHR 1 (events). The shafts were built to aide in the construction of the Coast Range Tunnel which is associated with the building of the larger Hetch Hetchy system and later used as access points along the tunnel. Along the shafts are components of the Coast Range Tunnel, the Thomas Shaft has played a minor role in the delivery of water through the tunnel and only has potential significance as on of may contributing elements of the Coast Range Tunnel, if the tunnel itself was considered a historical resource. However, this resource does not have importance for its association with the delivery of Hetch Hetchy water and, therefore, they are not directly associated with the Hetch Hetchy system.

The Thomas Shaft facility does not appear to be eligible under the NRHP Criterion B (person) or CRHR 2 (person). Research indicates that the Thomas Shaft facility has no direct association with any significant person (GANDA, 2008a).

The Thomas Shaft facility does not appear to be eligible under the NRHP Criterion C (architecture/workmanship) or CRHR Criterion 3 (architecture/workmanship). The shafts are utilitarian shafts that were constructed to aid in the construction of the Coast Range Tunnel and its maintenance, and as such, they exhibit no exemplary style, craftsmanship, construction techniques, or engineering, and are not the work of a master architect or engineer.

The Thomas Shaft facility does not retain integrity as physical alteration is apparent and modern modifications have also changed the actual function of the shafts from their original use. The Thomas Shaft facility maintains integrity of location, as the shafts have not been moved. However, the design, workmanship, materials, feeling, and setting have been altered and compromised since most of the original materials of the shafts have been altered and the shafts are no longer serving the same function. In summary, features at the Thomas Shaft project site are not eligible under any of the NRHP or CRHR criteria.

4.7.2 Regulatory Framework

Federal

National Historic Preservation Act of 1966 (16 U.S.C. 470)

The National Historic Preservation Act (NHPA) was enacted to encourage the preservation and wise use of the country's historic resources, and establishes the policy of the U.S. Government regarding historic preservation. The Act defines historic preservation to include "the protection, rehabilitation, restoration and reconstruction of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, or culture." The Act includes several key provisions, including the establishment of the National Register of Historic Places.

National Register of Historic Places

The NHPA authorizes the Department of the Interior to establish, maintain, and expand the National Register of Historic Places (National Register or NRHP). The National Register, which is maintained by the National Park Service (NPS), is a compilation of cultural resources that have been nominated and accepted as having historic, architectural, archaeological, engineering, or cultural significance, at the national, state, or local level.

The majority of "consensus determinations" of NRHP eligibility occur when properties are evaluated by a State Historic Preservation Officer (SHPO) in conjunction with federal environmental review procedures. Formal eligibility determinations also occur when properties are nominated to the NRHP, but are not listed due to owner objection. The criteria for determining eligibility have been developed by the NPS. In general, structures and features must meet at least one of the National Register criteria, usually be at least 50 years old, and retain sufficient historic integrity to convey their significance. Furthermore, a property that is significant under one or more of the National Register criteria must also be associated with an important historical context and be significant within that historical context.

Although this is a CEQA-only project, the architectural resources are evaluated using both NRHP and CRHR criteria, as a professional standard. A cultural resource's historical significance is determined using the NRHP Criteria for Evaluation at 36 CFR 60.4, which states that the quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and

- Criterion A: that are associated with events that made a significant contribution to the broad patterns of our history
- Criterion B: that are associated with the lives of persons significant to our past
- Criterion C: that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values; or that represent a significant and distinguishable entity whose components may lack individual distinction

- Criterion D: that have yielded or are likely to yield information important to prehistory or history

Further, to qualify for the NRHP, a resource must retain sufficient historic integrity to convey its significance. Although the evaluation of integrity is sometimes a subjective judgment, it must always be grounded in an understanding of the resource's physical features and how they relate to its significance. The seven aspects of integrity, as listed in National Register Bulletin 15 (NPS, 2002), are:

1. Location (the place where the historic property was constructed or the place where the historic event occurred)

2. Design (the combination of elements that create the form, plan, space, structure, and style of a property)

3. Setting (the physical environment of a historic property)

4. Materials (the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property)

5. Workmanship (the physical evidence of the crafts of a particular culture or people during any given period of history or prehistory)

6. Feeling (a property's expression of the aesthetic or historic sense of a particular period of time)

7. Association (the direct link between an important historic event or person and a historic property)

Archaeologists generally evaluate archaeological resources using Criterion D, based on their potential to yield information. Criterion D emphasizes the importance of the information encompassed in an archaeological site rather than its inherent value as a surviving example of a particular architectural type or its historical association with an important person.

If a cultural resource is determined to be eligible for inclusion to the NRHP, then it is automatically eligible for the California Register of Historical Resources (CRHR; see below). If a resource does not meet the NRHP criteria, it may still be eligible under the CRHR.

State

California Environmental Quality Act

The California Environmental Quality Act (CEQA) Statute and Guidelines include procedures for identifying, analyzing, and disclosing potential adverse impacts on historical resources, which are resources listed in or formally determined eligible for the National Register, the California Register, or local registers. CEQA requires agencies that have projects that include discretionary actions, such as financing or approval of public or private projects, to assess the effects of the project on historical resources. If a project may result in significant effects on historical resources, alternative plans or mitigation measures must be considered.

CEQA defines a historical resource as a resource that meets any of the following criteria:

- A resource listed in, or determined to be eligible for listing in, the National Register of Historic Places or California Register of Historical Resources.

- A resource included in a local register of historical resources, as defined in Section 5020.1(k) of the Public Resources Code, unless the preponderance of evidence demonstrates that it is not historically or culturally significant.

- A resource identified as significant (e.g., rated 1-5) in a historical resource survey meeting the requirements of Public Resource Code Section 5024.1(g) (Department of Parks and Recreation Form 523b), unless the preponderance of evidence demonstrates that it is not historically or culturally significant.

- Any object, building, structure, site, area, place, record, or manuscript which a lead agency determines to be historically significant or significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California, provided the determination is supported by substantial evidence in light of the whole record. Generally, a resource is considered "historically significant" if it meets the criteria for listing on the California Register of Historical Resources (CEQA Guidelines Section 15064.5(a)), described below.

- A resource that is included on a local register to be historically or culturally significant even though it does not meet the other four criteria listed here (e.g., Article 10 of the San Francisco Planning Code).

Also considered a historical resource under CEQA are unique archaeological resources. CEQA Guidelines (Section 21083.2(g)) define a unique archaeological resource as a resource that meets any of the following criteria:

- Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information.

- Has a special and particular quality such as being the oldest of its type or the best available example of its type.

- Is directly associated with a scientifically recognized important prehistoric or historic event or person.

Human remains are considered a separate category of cultural resource. The CEQA Guidelines (Section 15064.5(g)) describe the steps to be taken if human remains are accidentally discovered. In the event of accidental discovery or recognition of any human remains in any location other than a dedicated cemetery, the following steps should be taken:

(1) There shall be no further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent human remains until:

A. The coroner of the county in which the remains are discovered must be contacted to determine that no investigation of the cause of death is required, and

B. If the coroner determines the remains to be Native American:

1. The coroner shall contact the Native American Heritage Commission within 24 hours.

2. The Native American Heritage Commission shall identify the person or persons it believes to be the most likely descended from the deceased Native American.

3. The most likely descendant may make recommendations to the landowner or the person responsible for the excavation work, for means or treating or disposing of, with appropriate dignity, the human remains and any associated grave goods as provided in Public Resources Code Section 5097.98, or

(2) Where the following conditions occur, the landowner of his authorized representative shall rebury the Native American human remains and associated grave goods with appropriate dignity on the property in a location not subject to further subsurface disturbance.

A. The Native American Heritage Commission is unable to identify a most likely descendent or the most likely descendant failed to make a recommendation within 48 hours after being notified by the commission.

B. The descendant identified fails to make a recommendation; or

C. The landowner or his authorized representative rejects the recommendation of the descendant, and the mediation by the Native American Heritage Commission fails to provide measures acceptable to the landowner.

California Register of Historical Resources

The California Register of Historical Resources (California Register or CRHR) is a statewide program that is similar to the National Register . It consists of a compilation of cultural resources that are significant within the context of local, California, or national history, but not necessarily history germane to other states. All resources listed in or formally determined eligible for the National Register are also eligible for the California Register, as are properties designated under municipal or county ordinances. A resource is eligible for listing in the California Register if it meets any of the following criteria for listing at the local, state, or national level and retains integrity:

1. Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage.

2. Is associated with the lives of persons important to our past;

3. Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values;

4. Has yielded, or may be likely to yield, information important in prehistory or history (Public Resources Code, Section 5024.1, Title 14 CCR, Section 4852).

The California Register's definition of integrity and its special considerations for certain properties differ slightly from the National Register. Integrity is defined as "the authenticity of a historical resource's physical identity evidenced by the survival of characteristics that existed during the resource's period of significance" (California Office of Historic Preservation, 2006). The period of significance is the date or span of time within which significant events transpired, or significant individuals made their important contributions. Simply put, the resources must retain enough of their historic character or appearance to be recognizable as historical resources and to convey the reasons for their significance. A resource that has lost its historic character or appearance may still have sufficient integrity for the California Register if, under Criterion 4, it maintains the potential to yield significant scientific or historical information or specific data. The California Register's special considerations (i.e., CRHR eligibility for non-standard properties) for certain property types are limited to: (1) moved buildings, structures, or objects; (2) historical resources achieving significance within the past 50 years; and, (3) reconstructed buildings.

California Public Resources Code

California Public Resources Code Section 5097.5 prohibits excavation or removal of any "vertebrate paleontological site, or any other archaeological, paleontological, or historical feature, situated on public lands, except with the express permission of the public agency having jurisdiction over such lands." Public lands are defined to include lands owned by or under the jurisdiction of the state or any city, county, district, authority, or public corporation, or any agency thereof. Section 5097.5 also states that any unauthorized disturbance or removal of archaeological, historical, or paleontological materials or sites located on public lands is a misdemeanor. Section 30244 requires reasonable mitigation for impacts on paleontological resources that occur as a result of development on public lands.

Section 5097.98 of the California Public Resources Code prohibits obtaining or possessing Native American artifacts or human remains taken from a grave or cairn, and sets penalties for such acts. Additionally, Section 5097.98, as amended by Assembly Bill 2641, includes the following provisions:

(a) Whenever the commission receives notification of a discovery of Native American human remains from a county coroner pursuant to subdivision (c) of Section 7050.5 of the Health and Safety Code, it shall immediately notify those persons it believes to be most likely descended from the deceased Native American. The descendants may, with the permission of the owner of the land, or his or her authorized representative, inspect the site of the discovery of the Native American human remains and may recommend to the owner or the person responsible for the excavation work means for treatment or disposition, with appropriate dignity, the human remains and any associated grave goods. The descendants shall complete their inspection and make their recommendation within 48 hours of their notification by the

Native American Heritage Commission. The recommendation may include the scientific removal and nondestructive analysis of human remains and items associated with Native American burials.

(e) Whenever the commission is unable to identify a descendant, or the descendant identified fails to make a recommendation, or the landowner or his or her authorized representative rejects the recommendation of the descendants and the mediation provided for in subdivision (k) of Section 5097.94 fails to provide measures acceptable to the landowner, the landowner or his or her authorized representative shall re-inter the human remains and items associated with Native American human remains with appropriate dignity on the property in a location not subject to further subsurface disturbance.

City and County of San Francisco

Planning Code Article 10

Article 10 of the San Francisco Planning Code describes procedures regarding the preservation of sites and areas of special character or special historical, architectural, or aesthetic interest or value, such as officially designated city landmarks and buildings included within locally designated historic districts.

Planning Department, CEQA Review Procedures for Historic Resources

The San Francisco Planning Department prepared the CEQA Review Procedures for Historic Resources (Draft, March 31, 2008, subject to change; also referred to as San Francisco Preservation Policy Bulletin No. 16) to provide direction and guidance for the environmental review of historical resources. San Francisco Preservation Policy Bulletin No. 16 provides direction to determine whether the potential property fits the definition of an "historical resource" as defined in the CEQA Statutes and Guidelines. Three categories of properties are defined as follows:

Category A.

- Category A.1. Resources listed in or formally determined to be eligible for the California Register

- Category A.2. Resources listed on adopted local registers, and properties that have been determined to appear eligible, or may become eligible, for the California Register.

Category B. Properties requiring further consultation and review.

Category C. Properties determined not to be historical resources, or properties for which the city has no information indicating that the property is a historical resource.

4.7.3 Impacts

Significance Criteria

The City and County of San Francisco has not formally adopted significance standards for impacts related to cultural resources, but generally considers that implementation of the proposed project would have a significant impact on cultural resources if it were to:

- Cause a substantial adverse change in the significance of a historical resource as defined in CEQA Guidelines Section 15064.5, including those resources listed in Article 10 or Article 11 of the San Francisco Planning Code
- Cause a substantial adverse change in the significance of a unique archaeological resource pursuant to Section 15064.5 of the CEQA Guidelines
- Directly or indirectly destroy a unique paleontological resource or site or unique geological feature
- Disturb any human remains, including those interred outside of formal cemeteries

Areas of No Impact

The Thomas Shaft project site does not contain cultural resources within the project area. Therefore, implementation of the proposed project at the Thomas Shaft site would not demolish or alter individual historical resources or disturb a contributor to a historic district. No impact would occur in respect to this significance criterion.

Articles 10 and 11 of the San Francisco Planning Code pertain to officially designated city landmarks and buildings included within designated historic districts in San Francisco. As the proposed project does not propose improvements in San Francisco, there are no designated city landmarks or properties that contribute to designated historic districts in the project site vicinities and therefore, this ordinance would not apply to the proposed project.

The proposed project (Tesla Portal and Thomas Shaft) would not result in any operational impacts in regards to cultural resources because the operational functionality of the proposed facilities (e.g., water treatment) would have no effect on historical, archaeological or paleontological resources.

Approach to Analysis

The cultural resources analysis evaluates potential short-term and long-term impacts associated with the construction and operation of the proposed project at the Tesla Portal and Thomas Shaft sites in regards to paleontological resources, archaeological resources and historic architectural resources. In general, implementation of the proposed project would not result in significant direct and/or indirect long-term or short-term effects on known cultural resources, given compliance with existing regulations and established project procedures, Standard Construction Measure # 9, and the implementation of mitigation measures described in Section 5.0.

Area of Potential Effects

Cultural resources investigations conducted at the Tesla Portal and Thomas Shaft sites resulted in the identification of an area of potential effects (APE) (refer to Figures 4.7-1 and 4.7-2) for each site. The APE is divided into horizontal and vertical APEs for both archaeological and architectural resources. The horizontal APE consists of the footprint of project-related ground disturbance, including areas that would be excavated, graded, or modified in any way. The vertical APE includes the subsurface areas that could be impacted by project-related construction and other activities. Major ground disturbance has previously occurred at both project locations in conjunction with the original pipeline and building foundation construction. The APE for the built environment also considers above-ground, construction-related impacts and visual disturbances to potentially historic settings known and potential historical resources; therefore, the parameters of the architectural APE are equal to the developed site area of each project site. Following is a description of the APEs for the project sites.

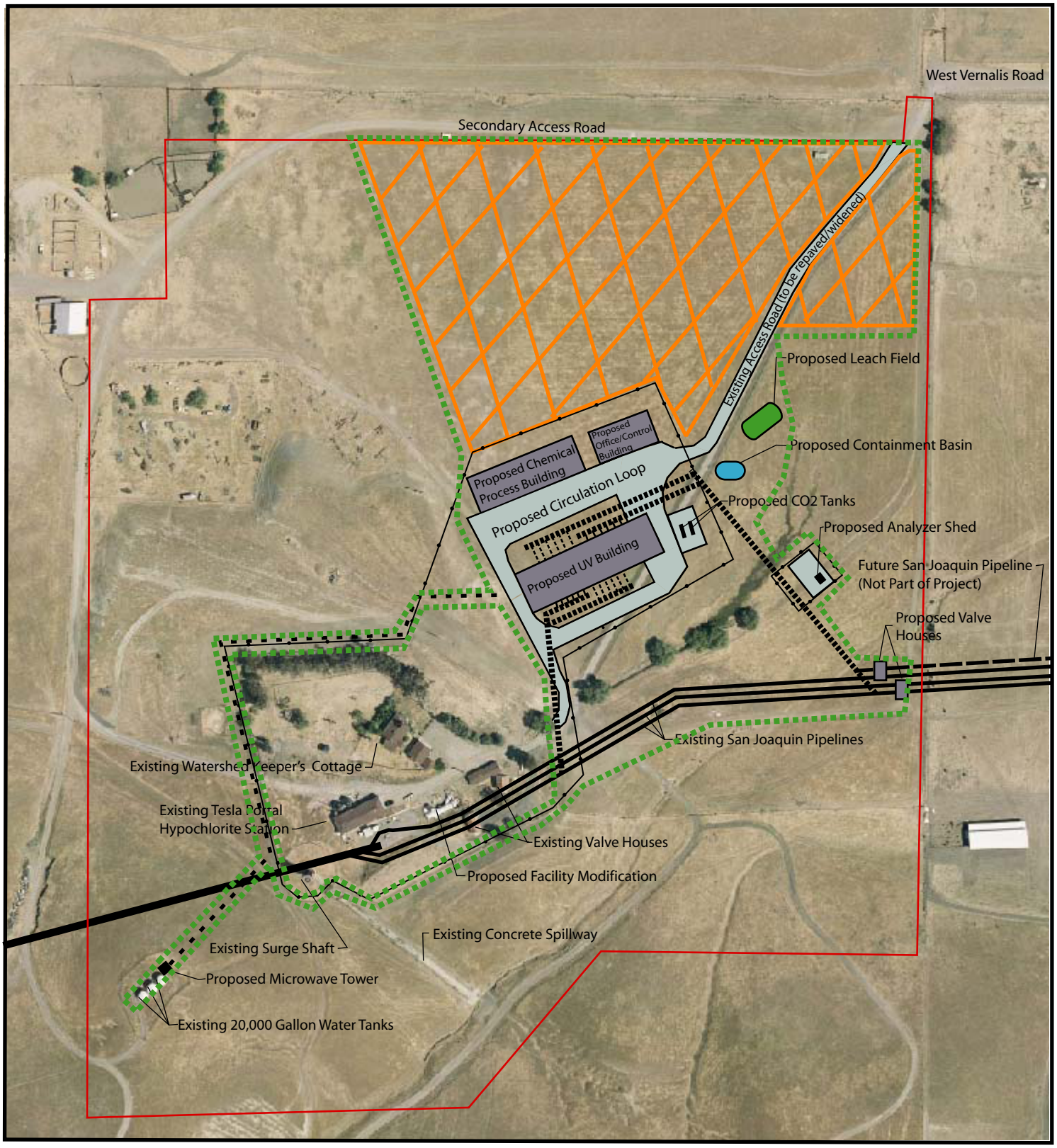
Tesla Portal Site

The horizontal architectural APE for the Tesla Portal site encompasses the entire project site (approximately 52 acres), including the surface area west of the Tesla Portal facility. However, the water facility resources located below ground west of the manifold, are not included as part of the architectural APE.[2] The horizontal archaeological APE encompasses the proposed construction (3 acres) and staging (9 acres) areas for a total of approximately 12 acres. The maximum vertical archaeological APE anticipated at the Tesla Portal site is 20 feet below ground surface which, based on old construction drawings, would exceed the historic depth of ground disturbance (14 feet) by 6 feet.

Thomas Shaft Site

The horizontal architectural and archaeological APEs for the Thomas Shaft site are located on the developed portion of the site, which totals approximately 1 acre. The maximum depth of disturbance proposed at the Thomas Shaft site is approximately 4 feet, for the installation of a 150 feet by 3 feet by 3 feet underground pipeline (refer to Chapter 3, Project Description). Based on old construction drawings, the previous depth of disturbance at the Thomas Shaft site was approximately 7 feet. The grade also varies plus or minus 3 feet, for a total estimated prior disturbance of 10 feet. Therefore, the proposed depth of disturbance would be close to but not exceed the historic depth of disturbance at the Thomas Shaft site.

[2] The Coast Range Tunnel is not in the APE for this project because the project would have no effect on the tunnel.



Legend

- Proposed Pipelines
- Project Boundary
- Proposed Underground Electrical Line
- Proposed Construction Staging Area
- Proposed Fenceline
- Proposed New Buildings
- Proposed New/Expanded Paved Area
- Archaeological C-APE
- Architectural C-APE

0 250 500 Feet

APPROXIMATE

SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT EIR

Tesla Portal Cultural Resources Area of Potential Effect

Figure 4-7.1

Source: Google Earth

Archaeological C-APE Architectural C-APE

SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT EIR

Thomas Shaft Cultural Resources Area of Potential Effect

Not To Scale

Figure 7-2

Construction Impacts

Paleontological Resources

Impact 4.7-1: Potential to disturb or destroy paleontological resources. (Tesla Portal: PSM; Thomas Shaft: PSM)

Site reconnaissance at the Tesla Portal and Thomas Shaft sites did not encounter any paleontological resources (GANDA, 2008b). However, as described previously, the following paleontologically sensitive geologic units were observed in or adjacent to both sites: late Pleistocene alluvium, Miocene San Pablo Group sandstones, and late Mesozoic Franciscan Complex sediments. Furthermore, numerous fossil resources have been discovered within 5 miles of each site, including important specimens.

Tesla Portal Site

The maximum depth of proposed ground disturbance at the Tesla Portal site would be 20 feet below ground surface, which would exceed historic ground disturbance of approximately 14 feet by 6 feet. In addition, the proposed improvements to the access road would require grading. Consequently, there is a high potential that underlying native sediments and bedrock within the Tesla Portal APE containing paleontologically sensitive geologic units would be disturbed during project construction. Even in areas where prior ground disturbance has occurred, project-related ground-disturbing activities could vertically or horizontally disturb sediments beyond the area of previous ground disturbance. The potential to disturb native sediments and bedrock containing paleontologically sensitive geologic units within the Tesla Portal APE could result in potentially significant impacts to paleontological resources.

Potentially significant impacts on paleontological resources would be reduced to a less-than-significant level by monitoring construction, relocating construction work away from the area if a paleontological resource is identified, and having the site inspected by a qualified paleontologist (Mitigation Measures 4.7-1a and 4.7-1b).

Thomas Shaft Site

Original Thomas Shaft construction drawings show a prior excavation depth of approximately 7 feet with a grade variation of plus or minus 3 feet, for a total estimated maximum prior disturbance of 10 feet and a minimum of 4 feet. The depth of the proposed ground disturbance at this site would be associated with the proposed 12-inch pipeline and would extend to approximately 4 feet below ground surface, which would come near but not exceed the depth of prior ground disturbance. Although the probability of potential impacts to paleontological resources is low, if such resources are encountered during project ground-disturbing activities, they could be inadvertently damaged or destroyed, which would be a significant impact. Implementation of Mitigation Measure 4.7-1b, which, among other features, requires suspension of construction work, relocating construction away from the area if a paleontological resource is identified, and having the site inspected by a qualified paleontologist, would reduce potential impacts to less than significant.

Archaeological Resources

Impact 4.7-2: Potential to disturb or destroy unknown prehistoric or historic-era archaeological resources or human remains. (Tesla Portal: PSM; Thomas Shaft: PSM)

Based on GANDA's archaeological investigation, which included a records search, field survey, historic map research, and personal communication with project engineers, no evidence was found that prehistoric archaeological resources are present within or adjacent to the APE for the Tesla Portal or Thomas Shaft sites. In addition, no evidence was found regarding archaeological deposits relating to the construction of the San Joaquin Pipelines, Thomas Shaft or Tesla Portal facilities. Furthermore, the potential for encountering intact buried archaeological deposits is low due to the level of previous disturbance and the soils present beneath the surface at each site.

The geomorphology of the Tesla Portal site, including the soils and landforms present, was assessed to determine the potential for buried prehistoric archaeological resources between 14 and 20 feet below the surface. As previously mentioned, the maximum depth of proposed ground disturbance at the Tesla Portal site would be 20 feet below ground surface (for excavation of the existing pipelines), which would exceed historic ground disturbance of approximately 14 feet by 6 feet. In addition, grading would be required for the proposed improvements to the access road. Grading for the access road would be shallow, but would be in an area that has not been previously disturbed to the extent the rest of the Tesla Portal site has been disturbed. Proposed buildings would be constructed on concrete pads with minimal grading. The proposed construction activities would have the potential to encounter native soils during excavation required for the pipelines and grading for the access road. However, geological information suggests that the landforms where grading would occur are Pleistocene alluvial deposits that are 10,000 years and older. Buried prehistoric archaeological deposits in the region are found within mid- to late Holocene-age alluvial deposits, which are less than 8,000-5,000 years old. Therefore, it is unlikely that the Tesla Portal APE is sensitive for the presence of deeply buried archaeological resources or prehistoric living surfaces (paleosols).

Similarly, the Thomas Shaft project site has a prior excavation depth of approximately 7 feet with a grade variation of plus or minus 3 feet, for a total estimated maximum prior disturbance of 10 feet and a minimum of 4 feet. The depth of the proposed ground disturbance at this site would be approximately 4 feet below ground surface, which would come near but not exceed the depth of prior ground disturbance. In addition, similar to Tesla Portal, the Thomas Shaft site is also underlain by Pleistocene alluvial deposits. As such, there is a very low sensitivity for the presence of buried archaeological deposits at the Thomas Shaft site.

There are no previously recorded prehistoric or historic-era archaeological resources within the APEs at the two project sites and no surface indications of these types of resources. Nevertheless, there remains the potential for encountering unanticipated subsurface archaeological deposits or human remains because their subsurface presence cannot be conclusively ruled out. Impacts to

unanticipated subsurface archaeological deposits or human remains would be a potentially significant impact without the implementation of mitigation measures.

If concentrations of prehistoric or historic-period materials are encountered during ground-disturbing work at the either the Tesla Portal or Thomas Shaft site, it is recommended that all work halt within 100 feet of the find until a qualified archaeologist can evaluate the find and make recommendations (Mitigation Measure 4.7-2a). If human remains are encountered, work in the immediate vicinity should stop and the County Coroner should be notified immediately. At the same time, a qualified archaeologist should be contacted to evaluate the finds. If the human remains are of Native American origin, the Coroner must notify the Native American Heritage Commission within 24 hours of this identification (Mitigation Measure 4.7-2b). Implementation of Mitigation Measures 4.7-2a and 4.7-2b would reduce potentially significant impacts to a less than significant level.

Historical Architectural Resources

Impact 4.7-3: Potential to cause a substantial adverse change in the significance of a historical resource. (Tesla Portal: PSM; Thomas Shaft: N/A)

Based on the cultural resources investigation for the project, the Southwest Valve House and the SJPLs No. 1 and No. 2 appear to be eligible for listing in the NRHP and/or the CRHR.

The Southwest Valve House appears to be eligible for listing in the NRHP under Criterion A and CRHR under Criterion 1 (URS-ATS Joint Venture, 2008). The SJPLs No. 1 and No. 2 appear to be eligible for listing on the NRHP under Criterion A and CRHR under Criterion 1 at the local level due to their association with the development of the San Francisco water system. Additionally, SJPL No. 1 appears to be eligible under NRHP Criterion C and CRHR Criterion 3 for the innovative engineering techniques used by the Youdall Company during its construction (URS-ATS Joint Venture, 2008).

SJPLs No. 1 and No. 2 would not be significantly altered as a result of the proposed project. SJPLs No. 1 and No. 2 would be connected to a new upstream manifold that would combine the flow and redirect water to the proposed UV reactors. Upon UV treatment, the water would be directed to an outlet manifold (downstream), which would tie back into the existing SJPLs. Construction of the manifolds would require cutting the SJPLs at the upstream and downstream connection points, and the new manifolds would be constructed at the SJPL tie-in point. The upstream manifold would include a line-sized isolation valve in each pipeline, which would include connection point for the future SJPL segment, similar to the existing manifold. The installation of the new manifolds would result in the abandonment of approximately 400 feet of SJPL No. 1 and No. 2. The pipeline segments would be capped, reburied and left in place upon completion of the proposed project.

Although the proposed work at Tesla Portal would result in minor modifications to the SJPLs No. 1 and No. 2, project-related activities would not have a significant adverse effect on this resource for the following reasons:

1) Project-related activities would not have an adverse effect on the SJPLs No. 1 and No. 2 because the proposed modifications to the resources would not change the characteristics of the pipelines that make them eligible for the NRHP/CRHR.

2) The proposed project's direct impact to SJPL No. 1 and No. 2 is limited to replacement of 300 feet of those structures, which are a total of 47.5 miles long each. Most of the SJPLs No. 1 and No. 2 would not be impacted by this project, including multiple points of the pipeline located above ground across the San Joaquin Valley. This change is thus a relatively minor alteration compared to the overall dimensions of the resources that does not diminish the overall historic integrity of the historical resources such that it cannot convey its significance.

3) There would be no indirect impact, including visual effects, on any portions of the SJPLs No. 1 and No. 2, as most of the work would occur on portions of the SJPLs that are located below ground surface.

4) The modifications to SJPLs No. 1 and No. 2 would not change the way the Hetch Hetch system operates and functions as a whole.

5) The overall modifications to SJPLs No. 1 and No. 2 are comprised of technology upgrades and facility infrastructure activities that are small in scale compared to the size of the Hetch Hetchy system.

In addition to SJPLs No. 1 and No.2, the NRHP/CRHR eligible Southwest Valve House would be in close proximity (25 feet) to above ground construction activities at the Tesla Portal site, but would not be directly modified by project activities. Construction near the Southwest Valve House would include the installation of a steel and concrete enclosure to be placed around the new Portal Manifold, as well as backfilling the enclosure. Project-related activities would not result in changes to the significant architectural features of the Southwest Valve House that make it a potentially eligible for the NRHP/CRHR, or change the relationship between the Southwest Valve House and the Portal Manifold. In addition, the installation of the steel and concrete enclosure would not result in physical modifications or significant visual impacts to the Southwest Valve House.

The installation of the proposed structures as part of the project at the Tesla Portal site would not have a significant direct effect on the Southwest Valve House, thus the project would not cause a substantial adverse change to the historical resource. In addition, construction related vibration would not be substantial enough to damage the Southwest Valve House (refer to Section 4.10, Noise and Vibration). However, given the proximity of construction activities to the Southwest Valve House (25 feet), accidental damage to the building during construction cannot be ruled out,

and therefore would be a potentially significant impact. Implementation of Mitigation Measure 4.7-3 (Architectural Resources Protection Plan) requires preparation and implementation of an architectural resources protection plan that specifies procedures for protecting historical resources during construction, and also requires a temporary protective barrier around the Southwest Valve House to prevent physical damage. With implementation of this mitigation measure, impacts would be reduced to a less-than-significant level.

The installation of the proposed project would not have a significant effect on the SJPLs No. 1 and No. 2, and therefore the project would not cause a substantial adverse change to the historical resources. However, construction-related activity associated with modifications to the SJPLs No. 1 and 2 would be expected to exceed the 0.2 in/sec threshold for sensitive structures (refer to Section 4.10, Noise and Vibration), and result in a potentially significant impact. Implementation of Mitigation Measure 4.10-2, which requires the construction contractor perform construction in such a manner as to maintain the structural integrity of the pipelines, would reduce potential impacts due to vibration to a less-than-significant level.

Operational Impacts

The proposed project would not result in operational impacts related to cultural resources as described above.

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4.8 Traffic, Transportation, and Circulation

4.8.1 Setting

Regional and Local Roadways

Characteristics of local intersections and roadways in the project vicinities are described below and shown on Figure 4.3-1a, and Figure 4.3-1b.

Tesla Portal Site

Interstate 580 (I-580) is an east/west freeway that extends from the San Francisco Bay Area, through the Altamont Pass, and connects to Interstate 5 (I-5), south of the City of Tracy. This interstate currently has four lanes in the segments closest to the project sites.

State Route 132 (SR 132) is a four-lane, east/west highway that traverses the southern part of San Joaquin County between I-580 and Stanislaus County; it eventually merges to two lanes. The portion of SR 132 closest to the Tesla Portal project site is a four-lane highway.

West Vernalis Road is an east/west roadway (local collector) that serves as a frontage road to I-580 and the main access route for the residential community of Chrisman, the Tesla Portal site, and three residences near the Tesla Portal site. West Vernalis Road has one lane in each direction. It begins at its intersection with South Chrisman Road to the east and public access ends at the Tesla Portal site's unpaved access road to the west. Although public access on West Vernalis Road ends at the Tesla Portal site, access to a private property located west of the site is provided via a right-of-way easement through SFPUC property.

South Chrisman Road is a north/south roadway (local collector) that serves the area south of I-580, including residential land uses, the Tracy Golf and Country Club and the Tesla Portal site. South Chrisman Road provides access to I-580, eastbound and westbound.

Thomas Shaft Site

Corral Hollow Road is an east/west arterial roadway in San Joaquin County, with one lane in each direction. Corral Hollow Road runs between the City of Livermore to the east and I-580 to the west. Corral Hollow Road becomes Tesla Road once it crosses from San Joaquin County into Alameda County.

Thomas Shaft Road is a gated, unpaved, gravel north/south roadway in San Joaquin County, with one 18-foot-wide lane leading to the Thomas Shaft site. The road is entirely within SFPUC property boundaries. Corral Hollow Road provides access to Thomas Shaft Road. There are future plans to improve Thomas Shaft Road that include replacing culverts and paving the roadway (see Section 4.15). The planned improvements will improve access to the Thomas Shaft Facility during the winter months.

Existing Traffic Volumes

Tesla Portal Site

Interstate I-580: Average daily trips on I-580, near the Tesla Portal site, are approximately 31,550 vehicles per day, or 328 vehicles per lane per hour (Caltrans, 2007). Of this traffic, approximately 16 percent of I-580's traffic volume consists of truck trips (Caltrans, 2007). According to the Caltrans Highway Design Manual, a four-lane highway (two-lanes in each direction) has a design capacity of 1,000 to 1,200 vehicles per lane per hour. Therefore, the portion of I-580 near the project sites is operating below its designed traffic volume capacity.

State Route 132: Traffic volumes on SR 132 are relatively light. The average daily traffic volume is approximately 19,500 vehicles per day, or 203 vehicles per lane per hour (Caltrans, 2007). Truck traffic represents more that 25 percent of the traffic volume (Caltrans, 2007). According to the Caltrans Highway Design Manual, a four-lane highway (two-lanes in each direction) has a design capacity of 1,000 to 1,200 vehicles per lane per hour. Therefore, the portion of SR 132 near the project sites is operating below its designed traffic volume capacity.

West Vernalis Road: Neither San Joaquin County or the San Joaquin County of Governments (SJCOG) have traffic counts for West Vernalis Road. Traffic counts were extrapolated based on the existing surrounding land uses (residential) and methodology provided in the Institute of Traffic Engineer's (ITE) Trip Generation Manual 7th Edition. Using this methodology, average daily traffic volume on West Vernalis Road, north of its intersection with South Chrisman Road is estimated at approximately 400 vehicles per day. According to the SJCOG, a local collector road has a traffic volume capacity of approximately 10,000 vehicles per day. Therefore, West Vernalis Road is operating below its designed traffic volume capacity.

South Chrisman Road: Neither San Joaquin County or the SJCOG have traffic counts for portions of South Chrisman Road nearest to the Tesla Portal site. Traffic counts were extrapolated based on the existing surrounding residential and recreational (golf course) land uses and methodology provided in the ITE Trip Generation Manual 7th Edition. Using this methodology, average daily traffic volume on South Chrisman Road is estimated at approximately 1,140 vehicles per day. According to SJCOG, a local collector road has a traffic volume capacity of approximately 10,000 vehicles per day. Therefore, South Chrisman Road is operating below its designed traffic volume capacity.

Thomas Shaft Site

Corral Hollow Road: In the vicinity of the Lawrence Livermore National Laboratory (LLNL) Site 300, the average daily traffic volume on Corral Hollow Road is 3,006 vehicles per day west of the LLNL Site 300, and 3,474 vehicles per day east of LLNL Site 300 (CCSF Planning Department, 2007). Corral Hollow Road has a capacity of approximately 10,000 vehicles per day and, therefore, is operating below its designed traffic volume capacity.

Thomas Shaft Road: Thomas Shaft Road is a private access road with limited capacity. Traffic volume along Thomas Shaft Road is minimal. This road serves the SFPUC Thomas Shaft

Facility, and a portion of this road also serves as the only access for one rural residence. Traffic counts were extrapolated based on the existing surrounding land uses (one residence), methodology provided in the ITE Trip Generation Manual 7th Edition (ITE, 2003), and on the average number of trips to the site by SFPUC personnel per day. Using this methodology, the average daily traffic volume on Thomas Shaft Road is estimated at approximately 11 vehicles per day. According to the SJCOG, a rural two-lane road has a traffic volume capacity of approximately 600 vehicles per lane per hour, and therefore Thomas Shaft Roadway is operating below its designed traffic volume capacity.

Existing Site Access and Onsite Circulation

Tesla Portal Site

Access to the existing Tesla Portal site is through an existing paved access road that connects to West Vernalis Road. The existing access road leads to the existing Tesla Portal facilities, which include a paved parking lot. There are a number of other unpaved access roads on the site that either cross or run along the perimeter of the property. However, the paved access road that connects to West Vernalis Road is the site's main access.

Thomas Shaft Site

Access to the Thomas Shaft site is through the unpaved, gravel 1.5-mile Thomas Shaft Road, off Corral Hollow Road. The Thomas Shaft site does not have a formal parking lot, but the paved area next to the existing building is large enough to provide temporary parking, and also along the roadway. These parking areas are utilized for maintenance and operation of the current facility.

The San Joaquin County Department of Public Works is planning a roadway safety improvement project to install guardrails on Corral Hollow Road approximately two miles west of I-580. Anticipated schedule of completion is end of 2008 or early 2009. In addition, SFPUC is planning to improve Thomas Shaft Road from its intersection with Corral Hollow Road to the Thomas Shaft Facility. Anticipated schedule of completion for the Thomas Shaft Roadway Improvement Project is January 2009.

Transit Service

The project sites are located near the City of Tracy, which provides two options for transit (bus) service, the Tracer (local system) and the San Joaquin Regional Transit District (intercity fixed-route, flexible fixed route and commuter express). Given the rural location of the project sites, there are no transit routes in the immediate vicinity that would serve the proposed project.

Bicycle and Pedestrian Network

San Joaquin County has identified bicycle routes as an energy efficient, non-polluting form of transportation and has included them in the region's multi-modal transportation system. According to the County's General Plan 2010, specific routes for bikeways (as well as

pedestrians) will be revised as future development occurs. Most planned bicycle routes in the County have not been constructed, and the County is giving the construction of "non-motorized travel" facilities the highest priority. Pedestrian facilities generally include sidewalks, crosswalks, and pedestrian signals. Given the rural location of the project sites, there are no bicycle or pedestrian facilities in the immediate vicinity that would serve the proposed project.

4.8.2 Regulatory Framework

Transportation analysis in California is guided by policies and standards set at the state level by the California Department of Transportation (Caltrans), as well as by local jurisdictions (San Joaquin County). There are no federal regulations that address transportation impacts associated with the proposed project. Both Caltrans and San Joaquin County generally assess the impact of long-term, not short-term, traffic conditions.

Plans and policies related to transportation aim to plan for and accommodate future growth and the vehicular, transit, pedestrian, and bicycle travel demand associated with that growth. Policies regarding traffic service levels apply to long-term, not short-term, traffic conditions. These policies generally specify maintaining a Level of Service[1] (LOS) of LOS C or LOS D on major streets during the peak periods of traffic. Mitigation measures would be required if project-related traffic impacts would result in an LOS exceeding the local jurisdiction's threshold.

San Joaquin County

San Joaquin County's General Plan 2010 does not have an established LOS threshold of significance.

The SJCOG Regional Transportation Plan (2007) establishes the LOS standards for roadways included in the Congestion Management Program (CMP) network. The CMP includes, among other roadways, I-580 and SR 132 as CMP roadways and the SJCOG establishes LOS E as the performance standard for these roadways. The LOS standards of roadway networks vary by roadway segment, although these standards do not generally apply to impacts resulting from construction, rehabilitation, or maintenance of facilities that impact the CMP network.

4.8.3 Impacts

Significance Criteria

The City and County of San Francisco (CCSF) has not formally adopted significance standards for impacts related to traffic, transportation and circulation, but generally considers that implementation of a proposed project would have a significant impact if it were to:

[1] LOS is a qualitative description of a facility's performance based on average delay per vehicle, vehicle density, or volume-to-capacity ratios. Levels of service range from LOS A, which indicate free-flow or excellent conditions with short delays, to LOS F, which indicate congested or overloaded conditions with extremely long delays.

- Cause an increase in traffic that is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume-to-capacity ratio on roads, or congestion at intersections)
- Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways (unless it is practical to achieve the standard through increased use of alternative transportation modes)
- Result in a change in air traffic patterns, including either an increase in traffic levels, an obstruction to flight, or a change in location, that results in substantial safety risks
- Substantially increase hazards due to a design feature (e.g., sharp curves at dangerous intersections) or incompatible uses, or interfere with existing transportation systems (including vehicular, pedestrian, and bicycle networks), causing substantial alterations to circulation patterns or major traffic hazards
- Result in inadequate emergency access
- Result in inadequate parking capacity that could not be accommodated by alternative solutions
- Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., conflict with policies promoting bus turnouts, bicycle racks, etc), or cause a substantial increase in transit demand that cannot be accommodated by existing or proposed transit capacity or alternative travel modes

Areas of No Project Impact

Several of these criteria are *not applicable* to the proposed project, as there is no potential for the impact to occur. Project implementation would not result in inadequate parking capacity. The Tesla Portal site has paved areas available, and the Thomas Shaft site has unpaved areas available that would sufficiently accommodate employee, visitor and delivery vehicles during project construction and operation. The project sites would not change air traffic patterns resulting in a substantial safety risk because neither site is located near an airport. Additionally, the project would not involve installation of structures that could interfere with airspace.

Access to the Tesla Portal site would be provided through the existing paved access road, which connects to West Vernalis Road. The existing access road would be widened (17 to 20 feet) and re-paved as part of the proposed project. The project site would include two access roads. The main access road would connect to a circulation loop that would provide access to the proposed Office/Control Building, as well as the Chemical Process Building and Ultraviolet (UV) Building. The circulation loop would connect back to the main access road. An existing secondary access route that runs parallel to the eastern property boundary, would provide access to existing property owners that have an easement along the SFPUC right of way. A total of 19 parking spaces (including two accessible spaces for disabled parking) would be provided at the Tesla Portal site for employee and visitor parking. Access to the Thomas Shaft site would be provided

via the existing 1.5 mile Thomas Shaft Road, off Corral Hollow Road. Parking for the Thomas Shaft Facility is available at the existing Thomas Shaft Facility and would continue to be used during the construction and operation of the proposed facilities. These improvements would not result in inadequate emergency access at either site.

The project would not change the existing or planned transportation network in San Joaquin County and, therefore, would not include any design features that would increase the potential for traffic safety hazards, nor would the project conflict with policies, plans, or programs related to transit, bicycle, or pedestrian travel. Project operation would not result in any increase in transit demand, nor is either site located in close proximity to any transit stops or routes. The project would not impair access to adjacent roadways and land uses for both general and emergency response traffic as well as for bicycles and pedestrians, nor would the project result in the displacement of on-street parking because project-related construction would be confined within existing SFPUC property. Therefore, the proposed project would have no impact with respect to these significance criteria.

Approach to Analysis

The analysis provided in this section assesses the potential transportation impacts associated with the implementation of the proposed project. This section evaluates the potential for short-term construction related impacts on roadways due to changes in roadway capacities or increases in construction related traffic, as well as long-term impacts due to the operation of new facilities at both project sites.

The impact assessment of construction related impacts assumes that that the contractor(s) for each project site would implement SFPUC Standard Construction Measure #5 (see Chapter 3, Project Description) for traffic, which specifies that each contractor prepare a traffic control plan to minimize traffic on any streets affected by construction of the proposed project. As appropriate, SFPUC or the contractor would consult with local traffic agencies. This transportation assessment assumes that if multiple contracts for work within a project are issued, each project would prepare a traffic control plan, as applicable to the situation.

Construction Impacts

Construction-related traffic impacts are not usually considered significant, because given their temporary nature, they are usually of limited duration. However, since construction of the proposed project at the Tesla Portal site could affect the local transportation network for a longer duration (approximately 24 months), its impacts could be determined to be potentially significant. Construction activities that affect roadway operations are typically regulated through permits and construction requirements to ensure acceptable levels of traffic flow during the period of traffic disruption. Construction best management practices, including the preparation of a traffic control plan, are required to be in place to ensure the safety of construction workers, motorists, bicyclists, and pedestrians throughout project construction.

Impact 4.8-1: Temporary reduction in roadway capacity and increased traffic delays (Tesla Portal: LS; Thomas Shaft: LS)

Project construction at the Tesla Portal site and the Thomas Shaft site would not result in temporary lane closures, road closures or detours, which could reduce the capacity of the main access routes that would serve the project sites and cause traffic delays. Construction at the project sites would be confined within SFPUC's existing right-of-way, and no construction (including construction staging) within public roadways would occur. Therefore, construction traffic would not result in the temporary reduction in traffic capacity on roadways within the vicinity of the project sites. In addition, implementation of SFPUC's Construction Measure #5 (traffic control plan) will address any potential traffic delays in the proximity of the project sites. This impact would be less than significant.

_____

Impact 4.8-2: Short-term traffic increases on roadways due to construction related vehicle trips (Tesla Portal: LS; Thomas Shaft: LS)

Tesla Portal Site

The access route for the Tesla Portal site includes I-580, Chrisman Road and West Vernalis Road. These access routes are operating at or below their designed traffic volume capacities. Construction activities associated with project activities at the Tesla Portal site would result in the temporary addition of approximately 25 to 30 daily construction-related round-trips (50 to 60 daily trips), for a duration of approximately 24 months. The temporary addition of 25 to 30 daily round-trips represents the anticipated amount of daily trips during the construction period and includes delivery trucks, as well as worker commuter trips.[2]

Additional truck trips would be required for at least four days for concrete pouring. Concrete required for mat foundations at the Tesla Portal site would result in 140 round-trips (280 trips in one day) for the UV Building, 120 trips (240 trips in one day) for the Chemical Process Building, 15 round-trips (30 trips in one day) for the Office/Control Building, and no more than 15 round-trips (30 trips in one day) for accessory components such as walls and vaults. Construction trips related to concrete delivery would occur on one day per each of these proposed facilities, and would be done on different days to reduce overall truck trips to the sites. The single day peak number of construction related trips at the Tesla Portal site would be 170 round-trips (340 trips). Refer to Table 4.8-1, Tesla Portal Site Construction-Related Trips.

[2] Worker commuter trips are generally regarded as peak hour trips. Peak hour trips are those trips that occur during peak traffic periods. Peak traffic periods are between 7:00 a.m. and 9:00 a.m. and 4:00 p.m. and 6:00 p.m.

TABLE 4.8-1
TESLA PORTAL SITE CONSTRUCTION-RELATED TRIPS

Type of Trips	Number of Daily Round-Trips	Duration
Daily Construction[1]	25 – 30	18 to 24 Months
Concrete Delivery Per Project Component[2]		
UV Building:	140	1 Day
Chemical Process Building:	120	1 Day
Office/Control Building:	15	1 Day
Accessory Components:	15	1 Day

[1] Daily construction trips are round-trips and include worker commuter trips.
[2] Concrete related trips would occur on a single day per project component.

Thomas Shaft Site

The access route for the Thomas Shaft site includes I-580, Corral Hollow Road and Thomas Shaft Road. Construction activities associated with the proposed project would result in the temporary addition of approximately five daily round-trips (10 truck trips per day) over a period of six months. Concrete required at the Thomas Shaft site would be very minimal (only to anchor the prefabricated enclosure for the valve head), which would result in only one daily round-trip (two trips for one truck load in one day). The single day peak number of construction related trips at the Thomas Shaft site is 6 round-trips (12 trips). Refer to Table 4.8-2, Thomas Shaft Site Construction-Related Trips.

TABLE 4.8-2
THOMAS SHAFT SITE CONSTRUCTION- RELATED TRIPS

Type of Trips	Number of Daily Round-Trips	Duration
Daily Construction[1]	5	6 Months
Concrete Delivery	1	1 Day
Prefabricated Enclosure for the Valve Head:	1	1 Day

[1] Daily construction trips are round-trips and include worker commuter trips.

The temporary addition of construction-related traffic would not represent a significant increase in traffic on the project sites' access routes. In addition, as part of the proposed project, SFPUC

would implement Construction Measure #5, which requires each construction contractor to prepare a traffic control plan that would minimize construction-related traffic on any streets affected by construction of the proposed project. As appropriate, the contractor would consult with local traffic and transit authorities. Based on the above, the proposed project impacts related to short-term traffic increases would be less than significant.

Potential cumulative traffic impacts, including the potential for overlapping Water System Improvement Program project activities and construction vehicles to affect regional traffic, are discussed in Section 4.15, Cumulative Effects.

Impact 4.8-3: Increased potential traffic safety hazards for vehicles, bicyclists, and pedestrians on public roadways during construction (Tesla Portal: LS; Thomas Shaft: LS)

Construction activities could potentially temporarily suspend the normal function of roadways and increase traffic safety hazards near the project sites, due to the frequency and duration of construction related traffic on local roads. Conflicts could occur between construction vehicles (with slower speeds and wider turning radii than autos) and vehicles, bicyclists, or pedestrians using the roadways. Such conflicts could occur within the community of Chrisman on West Vernalis Road where construction related trips for the Tesla Portal site would be concentrated. The risk of conflicts would increase on the four days when concrete delivery trips would be scheduled to occur because of the number of trips and the type of vehicles involved.

Project-related construction activities and construction related traffic could increase the potential for conflicts and safety hazards. However, construction activities at the Tesla Portal and Thomas Shaft project sites would be confined within SFPUC's property, and would not result in lane closures or affect other public rights-of-way (e.g., sidewalks or walkways), and therefore, would limit the potential for conflict between construction traffic and other vehicles, bicyclists and pedestrians on public roadways. In addition, as part of the project, SFPUC Construction Measure #5 (traffic control plan) would be implemented. Therefore, the project impacts at both sites would be less than significant.

Operational Impacts

Impact 4.8-4: Increase in vehicle trips to and from the facility sites for operation and maintenance (Tesla Portal: LS; Thomas Shaft: LS)

Tesla Portal Site

Implementation of the proposed project would result in approximately two new round-trips per day (four daily trips) to and from the Tesla Portal site, generated by the addition of two new full time equivalent (FTE) employees. Generally, FTE trips would be peak hour trips. In addition to

trips generated by new employees, the project would also result in new trips for maintenance, operation and deliveries at the Tesla Portal site. These trips would generate an average of five new round trips per day. At most, the proposed project would generate seven additional round-trips per day (two FTE and five maintenance, operation and delivery related round trips).

Current daily trips at the Tesla Portal site include approximately three daily round-trips (six trips) generated by the three FTEs employed at the site, and 3 daily round-trips for maintenance, operations and delivery related visits. Upon completion of the proposed project at the Tesla Portal site, the facility would generate an average of 13 round trips per day (refer to Table 4.8-3).

TABLE 4.8-3
TESLA PORTAL SITE EXISTING AND PROJECT RELATED TRIPS

Type of Trips	Number of Existing Round-Trips	Number of New Round-Trips	Total Round-Trips	Frequency
Employee Related Trips	3	2	5	Daily
Maintenance, Operation and Delivery Related Trips	3	5	8	Daily
Total:	6	7	13	--

Thomas Shaft Site

The Thomas Shaft site would remain unmanned. However, the facility would continue to receive deliveries of food grade acid once a month and would be visited daily by an operations representative as part of the site's ongoing maintenance (refer to Table 4.8-4).

TABLE 4.8-4
THOMAS SHAFT SITE EXISTING AND PROJECT RELATED TRIPS

Type of Trips	Number of Existing Round-Trips	Number of New Round-Trips	Total Round-Trips	Frequency
Delivery Related Trips	1	0	1	Monthly
Maintenance and Operation Related Trips	1-2	0	1-2	Daily

Given that the main access routes to the project sites (Tesla Portal and Thomas Shaft) operate below their designed traffic volume capacity, the addition of a minimal amount of new project related trips (operations, maintenance and deliveries) at the Tesla Portal project site would not result in a noticeable increase in traffic on adjacent streets even during peak traffic periods. Furthermore, the proposed project would not result in new trips at the Thomas Shaft site. The anticipated new project related trips at the Tesla Portal project site would not generate enough traffic volume to affect LOS standards within the sites' regional roadway systems. Impacts would be less than significant.

4.8.4 References

California Department of Transportation (Caltrans), http://www.dot.ca.gov/hq/traffops/saferesr/trafdata/2006all.htm, accessed September 26, 2007.

City and County of San Francisco (CCSF) Planning Department, *Thomas Shaft Road Initial Study/Mitigated Negative Declaration*, July, 24, 2007.

City of Tracy, General Plan, Chapter 5, Circulation Element, July 20, 2006.

Institute of Traffic Engineers (ITE), *Trip Generation* Manual (7th Edition), November 2003.

San Joaquin Council of Governments, *Regional Transportation Plan*, May 2007.

San Joaquin County General Plan, July 1992.

4.9 Air Quality

4.9.1 Air Pollutant Properties, Effects, and Sources

Air quality conditions in the vicinity of the Tesla Portal and Thomas Shaft sites are indicated by criteria air pollutants, and are discussed below.

General criteria pollutants include carbon monoxide (CO), particulate matter (PM), nitrogen dioxide (NO_2), ozone (O_3), and sulfur dioxide (SO_2). The measured local concentrations, health effects, and other characteristics of these criteria pollutants are summarized below; green house gas (GHG) emissions, reactive organic gasses (ROG), and volatile organic compounds (VOC) are also addressed, as they are pollutants of concern. Hydrogen sulfide, lead, sulfates, vinyl chloride, and visibility-reducing particles are of least concern in this study area because recorded levels are well below standards; further discussion of these pollutants is not presented. A more detailed description of the local air quality and monitoring stations (including justification for selection) of the study area is provided in Section 4.9.2.

Ozone (O_3)

Ozone (O_3) occurs in two layers of the atmosphere. The layer surrounding the earth's surface is the troposphere. Here, ground level or "harmful" ozone is an air pollutant that has a pungent odor, causes eye irritation, reduces visibility, and damages human health, vegetable crops, and many common materials. The troposphere extends to a level about 10 miles above the earth's surface, where it meets the second layer, called the stratosphere. The stratospheric or "helpful" ozone layer extends upward from about 10 to 30 miles and protects life on earth from the sun's harmful ultraviolet rays.

Unlike other pollutants, ground level ozone is not emitted directly into the air by specific sources. A primary constituent of smog, ozone is formed in the atmosphere in the presence of sunlight by a series of chemical reactions primarily (from a regulatory standpoint) involving oxides of nitrogen (NO_X) and reactive organic gasses (ROG). Because these reactions occur on a regional scale over a period of hours, ozone is considered a regional air pollutant. Industrial fuel combustion and motor vehicles are primary sources of NO_X. Primary sources of ROG are fugitive emissions from petroleum production and commercial use, and solvent evaporation and a wide variety of manufacturing processes.

As shown in Table 4.9-2, ozone concentrations have exceeded the National Ambient Air Quality Standards (NAAQS) and California Ambient Air Quality Standards (CAAQS) at the Stockton-Hazelton Street monitoring station for the past three years (refer to Section 4.9.2 for a discussion of applicable monitoring stations in the project area). These violations, together with other violations throughout the area, have resulted in the study area being designated as nonattainment with respect to the NAAQS and CAAQS for ozone.

Carbon Monoxide (CO)

CO is an odorless, colorless gas that can impair the transport of oxygen in the bloodstream; aggravate cardiovascular disease; and cause fatigue, headache, confusion, and dizziness. CO forms through incomplete combustion of fuels in vehicles, wood stoves, industrial operations, and fireplaces. In San Joaquin County, vehicular exhaust is a major source of CO. CO tends to dissipate rapidly into the atmosphere and consequently is generally a concern at the local level, particularly at major road intersections.

CO concentrations at the Stockton-Hazelton Street monitoring station have been well below the NAAQS and the CAAQS. In fact, all of San Joaquin County is in attainment of the CO standards.

Particulate Matter (PM_{10} and $PM_{2.5}$)

PM is generally composed of particles in the air such as dust, soot, aerosols, fumes, and mists. Of particular concern is PM_{10} (particulates that have aerodynamic diameters of 10 micrometers or less). A subgroup of PM_{10} is $PM_{2.5}$ (particles with aerodynamic diameters less than 2.5 micrometers), which have very different characteristics, sources, and potential health effects than particles with an aerodynamic diameter between 2.5 to 10 micrometers.

PM_{10} is generated by sources such as windblown dust, agricultural fields, and dust from vehicular traffic on unpaved roads. $PM_{2.5}$ is generally emitted from activities such as industrial combustion, vehicle exhaust, and residential wood-burning stoves and fireplaces. $PM_{2.5}$ is also formed in the atmosphere when gases such as SO_2, NO_X, and ROG are transformed by chemical reactions in the atmosphere. PM_{10} affects breathing and the respiratory system, and, in particular, can damage lung tissue, and contribute to cancer and premature death.

Separate standards for $PM_{2.5}$ were established in 1997 because these smaller particles can penetrate deep into the respiratory tract and cause adverse health effects even when the PM_{10} levels are below the 1997 PM_{10} standards (U.S. EPA, 1997). Health studies have shown a significant association between exposure to $PM_{2.5}$ and premature mortality. Other important effects include aggravation of respiratory and cardiovascular disease (as indicated by increased hospital admissions, emergency room visits, absences from school or work, and restricted activity days), lung disease, decreased lung function, asthma attacks, and certain cardiovascular problems such as heart attacks and cardiac arrhythmia. Individuals particularly sensitive to $PM_{2.5}$ exposure include older adults, people with heart and lung disease, and children.

Measured concentrations at the Stockton-Hazelton Street monitoring station (Table 4.9-2) have exceeded the CAAQS for the past three years and show one violation of the NAAQS in 2005. These violations, together with other violations throughout the area, have resulted in the study area being designated as nonattainment with respect to the NAAQS and CAAQS for PM_{10} and $PM_{2.5}$.

Nitrogen Dioxide (NO_2)

NO_2 is a brownish, highly reactive gas that can irritate the lungs, cause pneumonia, and lower resistance to respiratory infections. NO_X, which includes NO_2, is a key precursor to O_3 and acid

rain. NO_X forms when fuel is burned at high temperatures, principally from transportation sources and stationary fuel combustion sources such as electric utility and industrial boilers.

Table 4.9-2 shows that measured concentrations of NO_2 have consistently remained below the NAAQS and CAAQS standards for NO_2. In fact, all of San Joaquin County is in attainment of the NO_2 standards.

Reactive Organic Gases (ROG) and Volatile Organic Compounds (VOC) – Precursors to Ozone

Hydrocarbons are organic gases that are formed solely of hydrogen and carbon. There are several subsets of organic gases, including VOCs and ROGs. ROGs include all hydrocarbons except those exempted by California Air Resources Board (CARB). Therefore, ROGs are a set of organic gases based on state rules and regulations. VOCs are similar to ROGs in that they include all organic gases except those exempted by federal law. Both VOCs and ROGs are emitted from incomplete combustion of hydrocarbons or other carbon-based fuels. Combustion engine exhaust from automobiles and trucks and oil refineries are the primary sources of hydrocarbons. Another source of hydrocarbons is evaporation from petroleum fuels, solvents, dry cleaning solutions, and paint.

The primary health effects of hydrocarbons result from the formation of ozone and its related health effects (see ozone health effects discussion above). High levels of hydrocarbons in the atmosphere can interfere with oxygen intake by reducing the amount of available oxygen through displacement. There are no separate NAAQS or CAAQS for ROGs. Carcinogenic forms of ROGs are considered toxic air contaminants (TACs) and are discussed briefly below.

Sulfur Dioxide (SO_2)

SO_2 is a colorless acidic gas with a strong odor at high concentration levels. High concentrations of SO_2 affect breathing and may aggravate existing respiratory and cardiovascular disease. SO_2 is also a primary contributor to acid deposition, which causes acidification of lakes and streams and can damage trees, crops, building materials, and statues. In addition, sulfur compounds in the air can contribute to visibility impairment. The major source category for SO_2 is fuel-burning equipment combusting fossil fuels.

SO_2 has not been measured at the Stockton-Hazelton Street monitoring station for the past three years. This is not problematic, as the area has been designated as attainment for the NAAQS and CAAQS for SO_2. Other stations throughout the San Joaquin Valley Air Basin (SJVAB) have measured concentrations well within NAAQS and CAAQS for SO_2.

Greenhouse Gases

The earth's atmosphere naturally contains a number of gases, including (but not limited to) carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), which are collectively referred to as greenhouse gases (GHG). GHG emissions are generally numerically depicted (when applicable) as carbon dioxide equivalents (CO_2e). CO_2e represents CO_2 plus the additional warming potential from CH_4 and N_2O. In general, CH_4 and N_2O have 21 and 310 times the

warming potential of CO_2, respectively. Manmade emissions of GHG occur through the combustion of fuels, as well as a variety of other sources.

These gases trap some amount of solar radiation and the earth's own radiation, preventing it from passing through earth's atmosphere and into space. GHG are vital to life on earth; without them, earth would be an icy planet. For example, CO_2 is an element that is essential to the cycle of life. However, increasing GHG concentrations are believed to be warming the planet.

As the average temperature of the earth increases, weather may be affected, including changes in precipitation patterns, accumulation of snow pack, and intensity and duration of spring snowmelt. The sea level may rise, resulting in coastal erosion and inundation of coastal areas. Emissions of air pollutants and ambient levels of pollutants also may be affected in areas. Climate zones may change, affecting the ecology and biological resources of a region. There may be changes in fire hazards due to the changes in precipitation and climate zones.

While scientists have established a connection between increasing GHG concentrations and increasing average temperatures, important scientific questions remain about how much warming would occur, how fast it would occur, and how the warming would affect the rest of the climate system. At this point, scientific efforts are unable to quantify the degree to which human activity impacts climate change. The phenomenon is worldwide, yet it is expected that there would be substantial regional and local variability in climate changes. It is not possible with today's science to determine the effects of global climate change in a specific locale, or whether the effect of one aspect of climate change may be counteracted by another aspect of climate change, or exacerbated by it.

Human activities generate GHG. Since pre-industrial times, there has been a buildup of levels of GHG in the atmosphere. The human contribution to the increase in atmospheric GHG concentrations largely has resulted from the burning of fossil fuels. Fossil fuel combustion accounts for approximately 98 percent of GHG emissions from human activity.

GHG emissions in California are less than the national average, both in per capita emissions and in emissions per gross state product. Transportation is the largest source of CO_2e emissions in California, accounting for approximately 37 percent of total emissions. Electricity generation accounts for approximately 34 percent of CO_2e emissions in California, and the industrial sector accounts for approximately 6 percent (CARB, 2007b).

Toxic Air Contaminants (TAC)

In addition to the criteria pollutants discussed above, TACs are another group of pollutants of concern. There are many different types of TACs, with varying degrees of toxicity. Sources of TACs include industrial processes such as petroleum refining and chrome-plating operations, commercial operations such as gasoline stations and dry cleaners, and motor vehicle exhaust. Cars and trucks release at least 40 different toxic air contaminants. The most important, in terms of health risk, are diesel particulate, benzene, formaldehyde, 1,3-butadiene, and acetaldehyde. Public exposure to TACs can result from emissions from normal operations as well as accidental releases. Health effects of TACs include cancer, birth defects, neurological damage, and death.

4.9.2 Setting

As described in the project description (Chapter 3.0), the project is comprised of modifications at two separate sites: the Tesla Portal site and the Thomas Shaft site. Both project sites are within the SJVAB. The climate and topography of this air basin are discussed below. The SJVAB includes the counties of San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and a portion of Kern County.

San Joaquin Valley Air Basin

A horseshoe-shaped rim of mountains formed primarily by the Sierra Madre, Tehachapi, and Sierra Nevada mountain ranges surrounds the SJVAB. The Sierra Nevada Mountains to the northeast block most of the cold air that flows southward over the continent during the winter months. They also catch and store snow, providing irrigation water for use during the dry months. The Tehachapi Mountains, which form the southern boundary, obstruct winds from the northwest, causing heavier precipitation on the windward slopes, high wind velocity over the ridges, and occasional cloudiness in the south end of the valley that continues after skies have cleared elsewhere. The coastal ranges form the SJVAB western boundary, and the Pacific Ocean shore lies at a distance of 75 to 100 miles to the west.

The SJVAB has an "inland Mediterranean" climate, which is characterized by hot, dry summers and cool, rainy winters. The semi-permanent "Pacific High" over the eastern Pacific Ocean dominates the weather during the summer months, blocking low-pressure systems from passing through the area. Summers are cloudless, hot, and dry, with a normal daily maximum temperature of 98 degrees Fahrenheit (°F) in July. Severe freezes seldom occur and there are occasional years with no frost in certain warm areas. Winters are mild and semi-arid, yet fairly humid. December and January are characterized by frequent fog, mostly nocturnal, which prevails when marine air is trapped in the valley by high-pressure systems. The average daily minimum temperature in December is 56°F.

Precipitation in the SJVAB is confined primarily to the winter months, with some occurring in late fall and early spring. Nearly 90 percent of the annual precipitation in the SJVAB falls between the months of November and April. The amount of rainfall in the SJVAB varies by region, with the greatest amount occurring in the northern and eastern parts of the basin. The average annual rainfall in the SJVAB is about 10 inches.

Wind speed and direction data indicate that wind patterns tend to be seasonal. During the summer, light and variable winds usually result from an influx of air from the Pacific Ocean through the Bay Area delta region, entering the north end of the valley. The wind generally flows in a south-southeasterly direction through the valley, through the Tehachapi Pass, and into the Southeast Desert Air Basin portion of Kern County. In winter months, occasional south-southeasterly winds flow across the valley, and the valley experiences light, variable winds of less than 10 miles per hour.

A meteorological phenomenon known as inversion layer formation occurs in the SJVAB. Inversion layers are formed when the air temperature increases with elevation above the ground, as opposed to the normal decrease in temperature with height. This effect reduces the amount of

vertical mixing that occurs above the ground and can lead to pollution such as smog being trapped in higher concentrations close to the ground, with possible adverse effects on health. Inversion layer formation in the SJVAB is caused by nocturnal cooling of air near the ground surface, or by downward vertical motion in the atmosphere. Inversion layers are more stable during the winter months, when inversions occur from 50 to 1,000 feet above the SJVAB floor.

Ambient Air Quality

The federal government and the state government of California have established separate ambient air quality standards. The U.S. Environmental Protection Agency (U.S. EPA) has established primary and secondary National Ambient Air Quality Standards (NAAQS) that specify allowable ambient concentrations for criteria pollutants under the provisions of the Clean Air Act. Primary NAAQS are established at levels necessary, with an adequate margin of safety, to protect the public health, including the health of sensitive populations such as asthmatics, children, and the elderly. Similarly, secondary NAAQS specify the allowable levels of air quality determined appropriate to protect the public welfare from any known or anticipated adverse effects associated with air contaminants. NAAQS are set for carbon monoxide (CO), lead (Pb), respirable particular matter (PM_{10}), fine particulate matter ($PM_{2.5}$), nitrogen dioxide (NO_2), ozone, and sulfur dioxide (SO_2).

Table 4.9-1 summarizes the NAAQS for these pollutants. The 8-hour ozone and $PM_{2.5}$ standards listed in the table were promulgated in 1997 but were challenged in the courts. In 2002, the courts upheld these two standards. The U.S. EPA made final designations for the 8-hour ozone standards on April 15, 2004, and made final designations for the new federal $PM_{2.5}$ standards on December 2004. Recently, the U.S. EPA approved a more stringent 8-hour ozone standard (2008) and a more stringent $PM_{2.5}$ standard (2006). U.S. EPA and the states are currently working together to develop air quality plans to achieve compliance with these standards, where needed.

In California, the California Air Resources Board (CARB), which is part of the California Environmental Protection Agency, has promulgated California Ambient Air Quality Standards (CAAQS) for CO, Pb, PM_{10}, $PM_{2.5}$, NO_2, ozone, and SO_2 that are more stringent than U.S. EPA's NAAQS, as shown in Table 4.9-1. In 2002, CARB revised the state annual PM_{10} standard and established an annual $PM_{2.5}$ standard. These standards went into effect July 7, 2004. In April 2005, CARB approved a new 8-hour average standard for ozone that went into effect on May 17, 2006. CARB has also developed standards for hydrogen sulfide, sulfates, vinyl chloride, and visibility-reducing particles.

Areas (portions of or entire air districts, counties, or air basins) in California are classified separately as being either in attainment or nonattainment of the NAAQS and the CAAQS. An area's classification is determined by comparing actual monitored air pollutant concentrations to the NAAQS and the CAAQS. More than 200 air monitoring stations are located throughout California and are part of the State and Local Air Monitoring Network. These stations are operated by CARB, local Air Pollution Control Districts (APCDs) or Air Quality Management Districts (AQMDs), private contractors, and the National Park Service (NPS). Areas that do not have sufficient data for an attainment/nonattainment determination are given an unclassified designation and are not considered to be nonattainment.

TABLE 4.9-1

FEDERAL AND CALIFORNIA AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	NAAQS [1]	CAAQS
CO	1-Hour	35 ppm	20 ppm
	8-Hour	9 ppm	9.0 ppm
	8-Hour (Lake Tahoe)	None	6 ppm
NO_2	1-Hour	None	0.18 ppm
	Annual Average	0.053 ppm	0.030 ppm
Ozone	1-Hour	None [2]	0.09 ppm
	8-Hour	0.08 ppm (1997) 0.075 ppm (2008) [3]	0.070 ppm
Pb	30 days	None	1.5 $\mu g/m^3$
	Calendar Quarter	1.5 $\mu g/m^3$	None
PM_{10}	24-Hour	150 $\mu g/m^3$	50 $\mu g/m^3$
	Annual Average	Revoked [4]	20 $\mu g/m^3$
$PM_{2.5}$	24-Hour	65 $\mu g/m^3$ (1997) 35 $\mu g/m^3$ (2006) [5]	None
	Annual Average	15 $\mu g/m^3$	12 $\mu g/m^3$
SO_2	1-Hour	None	0.25 ppm
	3-Hour	0.5 ppm [6]	None
	24-Hour	0.14 ppm	0.04 ppm
	Annual Average	0.03 ppm	None
Hydrogen Sulfide	1-Hour		0.03 ppm
Sulfates	24-Hour	No Federal Standards	25 $\mu g/m^3$
Vinyl Chloride	24-Hour		0.01 ppm
Visibility Reducing Particles	8-Hour		Extinction coefficient of 0.23 per kilometer

Source: CARB, 2008a and U.S. EPA, 2008a

1 Primary NAAQS unless otherwise noted.

2 1-hour ozone standard revoked June 5, 2005, except for areas that do not yet have an effective date for their 8-hour designations.

3 "The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as EPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard." (U.S. EPA, 2008a)

4 Due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution, EPA revoked the annual PM_{10} standard in 2006 (effective December 17, 2006).

5 The 35 micrograms per cubic meter of air standard became effective December 17, 2006. The new standard will be applicable to measurements beginning with year 2007; 65 micrograms per cubic meter of air prior to 2007.

6 Secondary NAAQS.

The ambient pollutant monitoring stations closest to the project area are located in cities of Tracy, and Stockton. The City of Tracy has two monitoring stations:

- Tracy – 24371 Patterson Pass Road Station – This site only monitors only ozone (both 1-hour and 8-hour) and NO_2. There are no measurements for 2005 or 2006.

- Tracy – Airport Station – This site only monitors only ozone (both 1-hr and 8-hr) and NO_2. There are no measurements for 2004 or 2005.

The City of Stockton has two monitoring stations:

- Stockton – Wagner-Holt School – This site only monitors only PM_{10}.

- Stockton-Hazelton Street – This site monitors all criteria pollutants except for SO_2. Data are also available from 2004 – 2006.

Due to the availability of data, pollutant concentrations from the Stockton-Hazelton Street Station will be summarized to depict the local air quality, despite the fact that the Tracy monitoring stations are closer to the project area. Table 4.9-2 summarizes the measured criteria pollutant concentrations over the past three years (2004 – 2006) at the Stockton-Hazelton Street Station. SO_2 is not monitored at this station. However, this is not problematic, as the area is designated as unclassified/attainment of the SO_2 NAAQS and CAAQS.

At the Stockton-Hazelton Street monitoring station (Table 4.9-2), measured ozone concentrations have exceeded the NAAQS and the CAAQS; measured PM_{10} concentrations have exceeded the CAAQS; and measured $PM_{2.5}$ concentrations have exceeded the NAAQS and CAAQS. Formal attainment designations, however, are based on all monitored levels throughout the designated area (which varies and can mean portions of or entire air districts, counties, or air basins). As such, the study area is designated as:

- Serious nonattainment of the 8-hour ozone NAAQS and nonattainment of the 1-hour and 8-hour ozone CAAQS;

- Serious nonattainment of the 24-hour PM_{10} NAAQS (this is the current designation; re-designation of the NAAQS has been requested, as detailed in Section 4.9.2.1) and nonattainment of the 24-hour and annual PM_{10} CAAQS; and

- Nonattainment of the 24-hour and annual $PM_{2.5}$ NAAQS and nonattainment of the annual $PM_{2.5}$ CAAQS.

TABLE 4.9-2
MAXIMUM MEASURED POLLUTANT CONCENTRATIONS AT STOCKTON-HAZELTON STREET

			Standards		Maximum Measured Concentration					
					2004		2005		2006	
Pollutant	Averaging Time	Units	NAAQS	CAAQS	Federal Value	State Value	Federal Value	State Value	Federal Value	State Value
CO	1 hour	ppm	35	20	3.7	NA	4.3	NA	4.4	NA
	8 hours	ppm	9	9.0	2.5	2.51	2.9	2.86	2.3	2.25
NO_2	1 hour	ppm	None	0.25	0.079	0.079	0.087	0.087	0.072	0.072
	Annual Average	ppm	0.053	None	0.017	0.017	0.017	0.017	0.018	0.018
Ozone	1 hour	ppm	None	0.09	0.096 [b]	0.096 [b]	0.099 [b]	0.099 [b]	0.109 [b]	0.109 [b]
	8 hours	ppm	0.08	0.070	0.08	0.08 [b]	0.086 [a, b]	0.086 [a, b]	0.092 [a, b]	0.092 [a, b]
PM_{10}	24 hours	$\mu g/m^3$	150	50	60.0 [b]	61.0 [b]	79.0 [b]	84.0 [b]	82.0 [b]	85.0 [b]
	Annual Average	$\mu g/m^3$	None	20	28.6 [b]	29.4 [b]	28.9 [b]	29.8 [b]	32.6 [b]	33.4 [b]
$PM_{2.5}$	24 hours	$\mu g/m^3$	65	None	41.0	41.0	63.0	70.0 [a]	47.0	53.3
	Annual Average	$\mu g/m^3$	15	12	13.2 [b]	13.2 [b]	12.5 [b]	12.5 [b]	13.1 [b]	13.5 [b]
SO_2	1 hour	ppm	None	0.25	Not available at this site – Project Area is unclassified/attainment of the SO_2 NAAQS and CAAQS					
	3 hours	ppm	0.5	None						
	24 hours	ppm	0.14	0.04						
	Annual Average	ppm	0.030	None						

Source: Monitoring station located at 1593 E. Hazelton St., Stockton, CA 95205
Data taken from CARB, 2008b and U.S. EPA, 2008b

a Exceeds the NAAQS

b Exceeds the CAAQS

Notes:

Federal/state values. The federal and state values can differ due to differences in sampling methods and criteria. Federal and state values are provided separately. Federal values are generally taken from U.S. EPA data; State values are taken from CARB data.

$\mu g/m^3$ = micrograms per cubic meter; NA= not available; ppm = parts per million

Existing Emissions Sources

The concentrations of the criteria pollutants presented above are a result of emissions from man-made and natural sources. Manmade sources of emissions are generally divided into three types: stationary, area-wide, and mobile. The contributions of these source categories vary from region to region. CARB maintains an emissions inventory to determine the sources and quantities of air pollution generated within the state's counties and air basins. Table 4.9-3 presents a summary of the projected 2006 pollutant emission data for San Joaquin County.

TABLE 4.9-3
SUMMARY OF ESTIMATED 2006 POLLUTANT EMISSIONS IN SAN JOAQUIN COUNTY
(TONS PER DAY)

Source	CO	NO_X	PM_{10}	$PM_{2.5}$	ROG	SO_X
Stationary Sources						
Fuel Combustion	4.98	14.43	0.68	0.61	0.37	2.37
Waste Disposal	0.00	0.00	0.02	0.01	0.09	0.00
Cleaning and Surface Coating	0.00	--	0.05	0.05	2.18	--
Petroleum Production and Marketing	0.00	0.00	--	--	1.30	0.00
Industrial Processes	0.63	2.53	1.90	1.09	2.95	2.03
Total Stationary Sources	**5.61**	**16.97**	**2.64**	**1.75**	**6.90**	**4.40**
Area Sources						
Solvent Evaporation	--	--	--	--	7.72	--
Miscellaneous Processes	21.95	1.77	26.00	6.29	7.18	0.10
Total Area Sources	**21.95**	**1.77**	**26.00**	**6.29**	**14.90**	**0.10**
Mobile Sources						
On-Road Motor Vehicles	138.82	47.04	2.14	1.70	14.62	0.38
Other Mobile Sources	79.93	42.09	2.23	2.00	13.15	0.76
Total Mobile Sources	**218.75**	**89.13**	**4.36**	**3.70**	**27.77**	**1.14**
Total of All Sources	**246.30**	**107.87**	**33.00**	**11.75**	**49.56**	**5.64**

Source: CARB, 2008c

The Tesla Portal and Thomas shaft sites both contribute minimally to the existing air quality totals listed in 4.9-3. The Tesla Portal and Thomas Shaft sites both contribute to mobile source emissions due to the use of employee, maintenance, and equipment delivery vehicles. Both sites contribute to stationary source emissions due to the use of back-up generators.

Sensitive Receptors

According to the San Joaquin Guide to Assessing and Mitigating Air Quality Impacts (GAMAQI), "for CEQA purposes, a sensitive receptor is generically defined as a location where human populations, especially children, seniors, and sick persons are found, and there is reasonable expectation of continuous human exposure according to the averaging period for the AAQS (e.g., 24-hour, 8-hour, 1-hour)" (SJVAPCD, 2002). Sensitive receptors typically include residences, hospitals, schools, and parks.

There are no sensitive receptors in the immediate vicinity of the project sites. The residential structure closest to the Tesla Portal site is approximately 2,500 feet to the southeast of the project area, off West Vernalis Road. Roughly 0.5 mile to the east lies the community of Chrisman, which is an unincorporated rural residential area within the Tracy Planning Area and consists of

approximately 36 rural residential parcels. Aerial photographs show the nearest rural residence about 1.25 miles to the northeast of the Thomas Shaft site.

4.9.3 Regulatory Framework

This section provides information relating to adopted federal, state, and local regulations and policies that govern air quality in the project vicinity and are applicable to the projects emissions.

Air quality in the project vicinity is regulated by several agencies, including the U.S. EPA, the CARB, and the San Joaquin Valley Air Pollution Control District (SJVAPCD). Although U.S. EPA regulations may not be superseded, both state and local regulations may be more stringent than the federal requirements. The U.S. EPA is responsible for establishing the NAAQS, setting minimum New Source Review permitting and Operating Permit requirements for stationary sources; establishing New Source Performance Standards, National Emission Standards for Hazardous Pollutants and the Acid Deposition Control program; and administering regional air quality initiatives. The CARB's role includes development, implementation, and enforcement of California's motor vehicle pollution control program; administration of the state's air pollution research program; adoption and updating, as necessary, of CAAQS; review of local APCD activities, and coordination of the development of the State Implementation Plan (SIP) for achievement of the NAAQS. Local APCDs are responsible for implementing federal and state regulations at the local level, permitting stationary sources of air pollution, and developing the local elements of the SIP. Emissions from indirect sources, such as automobile traffic associated with development projects, are addressed through the APCD's air quality plans.

The project sites are located in San Joaquin County, which is located within the northernmost portion of the SJVAB and is under the jurisdiction of the SJVAPCD. The following three subsections describe in more detail the roles and requirements at the federal, state, and local levels of government. In addition to this, a fourth section including a review of recent federal and state regulations that cover GHGs is provided.

Federal

The federal government, through the U.S. EPA, has established primary and secondary NAAQS for criteria pollutants under the provisions of the Clean Air Act (see Table 4.9-1). The U.S. EPA has classified air basins (or portions thereof) as being in "attainment" or "nonattainment" or "unclassified" for each criteria air pollutant. An area is designated as being in attainment of a standard if the pollutant concentrations are consistently below the NAAQS, and it is classified as being in nonattainment if pollutant concentrations exceed the NAAQS. An area may be unclassified if insufficient air quality data are available on which to base a nonattainment or attainment designation.

The project sites are in the SJVAPCD, which is a nonattainment area for the federal 8-hour O_3, PM_{10}, and $PM_{2.5}$ NAAQS. For areas classified as being in nonattainment, the federal Clean Air Act requires states to develop and adopt a SIP, an air quality plan showing how air quality

standards will be attained/maintained. In California, the U.S. EPA has delegated SIP preparation to CARB, which, in turn, has delegated that authority to the individual APCDs.

To satisfy U.S. EPA state implementation requirements, CARB, with the help of the SJVAPCD, has compiled the following plans (most recent updates shown):

- San Joaquin Valley's 2007 Ozone Plan. The plan sets out the strategy to attain the federal 8-hour ozone standard by 2024. In September, the ARB strengthened the State's commitments to reduce emissions in the Valley in advance of the 2024 attainment date. (CARB, 2008d)

- San Joaquin Valley Unified Air Pollution Control District's (District) 2007 PM_{10} Maintenance Plan and Request for Redesignation (2007 Maintenance Plan) with modifications to the transportation conformity budgets. (CARB, 2008d)

- San Joaquin Unified Air Pollution Control District's (District) 2008 $PM_{2.5}$ Plan. (CARB, 2008d)

The federal Clean Air Act also regulates hazardous air pollutants (HAPs), airborne pollutants that are known to have adverse human health effects. Unlike criteria pollutants, HAPs do not have adopted ambient air quality standards. HAPs have been regulated at the federal level since the Clean Air Act of 1977 under Title 40 of the Code of Federal Regulations, Part 61 (40 CFR Part 61). The proposed project is not considered to be a major source of HAPs. A source that emits more than 10 tons per year of any single HAP or 25 tons per year of all combined HAPs would be considered a major source of HAPs.

State

In California, the lead air quality agency is the CARB. The CARB has promulgated CAAQS for O_3, PM_{10}, $PM_{2.5}$, CO, NO_2, SO_2, and Pb that are more stringent than the U.S. EPA's standards, as shown in Table 4.9-1. As with the federal ambient air standards, air basin areas (or portions thereof) are classified as being in attainment or nonattainment with respect to the CAAQS. The California Clean Air Act requires that each air basin area exceeding the CAAQS for O_3, CO, SO_2, PM_{10}, $PM_{2.5}$, or NO_2 must develop a plan aimed at achieving those standards in accordance with California Health and Safety Code 40911. The California Health and Safety Code Section 40914 requires each air district that is in nonattainment to design a plan that will achieve an annual reduction in district-wide emissions of 5 percent or more, averaged every consecutive three-year period. As previously discussed, the project sites are located in the SJVAPCD, which is a nonattainment area for the O_3, PM_{10}, and $PM_{2.5}$ CAAQS. As such, CARB has developed several implementation plans, as discussed in Section 4.9.2.1.

California also regulates TACs, which is a class of airborne pollutants similar to the federal HAPs. California's air toxics control program began in 1983 with the passage of the Toxic Air Contaminant Identification and Control Act, better known as Assembly Bill 1807 (AB 1807) or the Tanner Bill. The Tanner Bill established a regulatory process for the scientific and public

review of individual toxic compounds. When a compound becomes listed as a TAC under the Tanner process, CARB normally establishes minimum statewide emission control measures to be adopted by local APCD. By 1992, 18 of the 189 federal HAPs had been listed by CARB as state TACs. Later legislative amendments (AB 2728, Tanner 1992) required CARB to incorporate all 189 federal HAPs into the state list of TACs.

The second major component of California's air toxics program, which supplements the Tanner process, was provided by the passage of AB 2588, the Air Toxics "Hot Spots" Information and Assessment Act of 1987. AB 2588 currently regulates over 600 air compounds, including all of the Tanner-designated TACs. Under AB 2588, specified facilities must quantify emissions of regulated air toxics and report them to the local APCD or AQMD. If the APCD determines that a potentially significant public health risk is posed by a given facility, the facility is required to perform a health risk assessment and notify the public in the effected area if the calculated risks exceed specified criteria.

On August 27, 1998, CARB formally identified particulate matter emitted by diesel-fueled engines as a TAC. Diesel engines emit TACs in both gaseous and particulate forms. The particles emitted by diesel engines are coated with chemicals, many of which have been identified as HAPs by the U.S. EPA, and as TACs by CARB. Since by weight, the vast majority of diesel exhaust particles are very small (94 percent of their combined mass consists of particles less than 2.5 microns in diameter), both the particles and their coating of TACs are inhaled into the lungs. While the gaseous portion of diesel exhaust also contains other TACs, CARB's August 1998 action was specific to diesel particulate matter (DPM) emissions, which, according to supporting CARB studies, represent 50 to 90 percent of the mutagenicity (ability to cause mutations that lead to cancer) of diesel exhaust. Accordingly, diesel particulates are generally used as a surrogate to identify potential health risks from diesel emissions (CARB, 1998, 2006).

CARB's 1998 ruling prompted CARB to begin searching for means to reduce DPM emissions. In September 2000, CARB approved the Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles. The Diesel Risk Reduction Plan outlines a comprehensive and ambitious program that includes the development of numerous new control measures over the next several years aimed at substantially reducing emissions from new and existing on-road vehicles (e.g., heavy-duty trucks and buses), off-road equipment (e.g., graders, tractors, forklifts, sweepers, and boats), portable equipment (e.g., pumps), and stationary engines (e.g., stand-by power generators).

Local

At the local level, the SJVAPCD regulates air quality by establishing local air quality regulations, permitting stationary sources, and planning activities related to air quality. The District is also responsible for enforcing and implementing all NAAQS and CAAQS. In areas that are in nonattainment of a federal standard, the local district assists CARB in the development of the SIP. Current plans are discussed in Section 4.9.2.1.

The SJVAPCD has developed significance thresholds for operational air pollutant emissions. Projects with the potential to generate operational emissions exceeding those thresholds would be considered to have a significant impact on air quality and would require appropriate mitigation measures.

The SJVAPCD published the GAMAQI in 2002, which "is an advisory document that provides Lead Agencies, consultants, and project applicants with uniform procedures for addressing air quality in environmental documents" (SJVAPCD, 2002). In practice, the GAMAQI provides details regarding significance thresholds, mitigation measures, and guidance for evaluating air quality impacts under the CEQA process.

The SJVAPCD operational emission thresholds are summarized in Table 4.9-4. Feasible mitigation measures must be applied to reduce operational emissions below the significance thresholds during operation of any project within the SJVAPCD. If emissions cannot be reduced below the thresholds, then emissions are considered to have a significant impact on air quality.

TABLE 4.9-4
SUMMARY OF OPERATIONAL SIGNIFICANCE THRESHOLDS FOR SJVAPCD

Air Pollutant	SJVAPCD (tons/year)
ROG	10
NO_X	10

Notes:
NO_X = nitrogen dioxide
ROG = reactive organic gases
SJVAPCD = San Joaquin Valley Air Pollution Control District

In accordance with the GAMAQI, construction emissions are considered less than significant if the project adheres to the control measures required in the GAMAQI. No formal numerical thresholds are developed for construction emissions (SJVAPCD, 2002).

Greenhouse Gas Emissions

In 1988, the United Nations established the Intergovernmental Panel on Climate Change to evaluate the impacts of global warming and to develop strategies that nations could implement to curtail global climate change. In 1992, the United Nations Framework Convention on Climate Change established an agreement with the goal of controlling GHG emissions, including CH_4.

As a result, the Climate Change Action Plan was developed to address the reduction of GHG in the United States. The plan consists of more than 50 voluntary programs.

Currently, the U.S. EPA does not regulate GHG emissions. In *Massachusetts v. U.S. EPA*, decided April 2, 2007, the U.S. Supreme Court held that U.S. EPA has the authority to regulate GHG emissions from cars and trucks under the Clean Air Act. However, the court did not decide whether U.S. EPA is required to regulate GHG emissions, or may exercise discretion to not

regulate at this time. Currently, U.S. EPA has not adopted any regulations to date directly regulating emissions of GHG.

The federal government recently passed the Energy Independence and Security Act of 2007, which mandates a host of actions that would aid in the reduction of GHGs. However, the federal government has stopped short of directly regulating GHG emissions. These new actions include (but are not limited to): fuel economy standard of 35 miles per gallon by 2020; improve energy efficiency in lighting and appliances; and investments in efficiency and renewable energy use (White House, 2008).

In 2005, Governor Schwarzenegger established Executive Order S-3-05, which sets forth a series of target dates by which statewide emissions of GHG would be progressively reduced, as follows:

- By 2010, reduce GHG emissions to 2000 levels;
- By 2020, reduce GHG emissions to 1990 levels; and
- By 2050, reduce GHG emissions to 80 percent below 1990 levels.

In 2006, California passed the California Global Warming Solutions Act of 2006 (Assembly Bill No. 32; California Health and Safety Code Division 25.5, Sections 38500, et seq., or AB 32), which requires the CARB to design and implement emission limits, regulations, and other measures, such that feasible and cost-effective statewide GHG emissions are reduced to 1990 levels by 2020 (representing a 25 percent reduction in emissions).

The Act defines GHG emissions as all of the following gases: CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. This agreement represents the first enforceable statewide program in the United States to cap all GHG emissions from major industries that includes penalties for noncompliance. While acknowledging that national and international actions will be necessary to fully address the issue of global warming, AB 32 lays out a program to inventory and reduce GHG emissions in California and from power generation facilities located outside the state that serve California residents and businesses.

AB 32 established a timetable for the CARB to adopt emission limits, rules, and regulations designed to achieve the intent of the Act, as follows (AB 32):

- Publish a list of discrete early action GHG emission reduction measures by June 30, 2007.
- Establish a statewide GHG emissions cap for 2020, equivalent to the 1990 emissions level by January 1, 2008.
- Adopt mandatory reporting rules for significant sources of GHGs by January 1, 2008.

- Adopt a scoping plan by January 1, 2009, indicating how GHG emission reductions will be achieved from significant GHG sources via regulations, market-based compliance mechanisms and other actions, including the recommendation of a de minimis threshold for GHG emissions, below which emission reduction requirements would not apply.

- Adopt regulations by January 1, 2011 to achieve the maximum technologically feasible and cost-effective reductions in GHGs, including provisions for using both market-based and alternative compliance mechanisms.

- Establish January 1, 2012 as the date by which all regulations adopted prior to January 1, 2010 are to become operative (enforceable).

As directed by AB 32, CARB has developed a series of "Early Action Measures" to reduce GHG emissions. The intent of these measures is to make a substantial contribution to the overall 2020 statewide GHG emission reduction goal. The early action measures are divided into three groups as follows:

- **Group 1:** Three new GHG-only regulations are proposed to meet the narrow legal definition of "discrete early action GHG reduction measures": a low-carbon fuel standard, reduction of refrigerant losses from motor vehicle air conditioning system maintenance, and increased methane capture from landfills. These regulations are expected to take effect by January 1, 2010.

- **Group 2:** The CARB is initiating work on 23 other GHG emission-reducing measures in the 2007-to-2009 time period with rulemaking to occur as soon as possible, where applicable. These GHG measures relate to the following sectors: agriculture, commercial, education, energy efficiency, fire suppression, forestry, oil and gas, and transportation.

- **Group 3:** The CARB is initiating work on 10 conventional air pollution controls aimed at criteria and toxic air pollutants, but with concurrent climate co-benefits through reductions in carbon dioxide or non-Kyoto pollutants (i.e., diesel particulate matter, other light-absorbing compounds, and/or ozone precursors) that contribute to global warming.

As directed by AB 32, CARB has also approved a statewide greenhouse gas emissions limit. On December 6, 2007, CARB staff resolved an amount of 427 million metric tons of CO_2e as the total statewide greenhouse gas 1990 emissions level and 2020 emissions limit. The limit is a cumulative statewide limit, not a sector or facility specific limit (CARB, 2007a).

On December 6, 2007, the Air Resources Board (ARB) approved a regulation for the mandatory reporting of greenhouse gas emissions from major sources, pursuant to the California Global Warming Solutions Act of 2006. The Board directed ARB staff to make specified changes and appropriate conforming modifications to the proposed regulation that was released on October 19, 2007. The revised regulation was made available for a "15-day" public review and comment

between May 15 and June 5, 2008. Staff is currently reviewing these comments and considering whether further revisions are needed. (CARB, 2008e)

CARB is then to conduct rulemaking, culminating in rule adoption by January 1, 2011, for reducing GHG emissions to achieve the emissions cap by 2020. The rules must take effect no later than 2012. In designing emission reduction measures, CARB must aim to minimize costs, maximize benefits, improve and modernize California's energy infrastructure, maintain electric system reliability, maximize additional environmental and economic co-benefits for California, and complement the state's efforts to improve air quality.

In concurrence with the state's plans for GHG reductions, CEQA documents must address the effect of GHG emissions from new projects. However, the analytical tools required to do so are still being developed. There is currently no established guidance or method to determine the effect on worldwide global warming from a particular increase in GHG emissions, or the resulting effects on climate change in a particular locale. Accordingly, no CEQA significance threshold has yet been developed to evaluate the impacts of the proposed project, or any project, on global climate change or on the environment in California.

The approach used in this report for addressing the significance of GHG is detailed under Impact 4.9-7.

Climate Action Plan for San Francisco

In February 2002, the San Francisco Board of Supervisors passed the Greenhouse Gas Emissions Reduction Resolution (Number 158-02) committing the CCSF to a GHG emissions reduction goal of 20 percent below 1990 levels by the year 2012. The resolution also directs the San Francisco Department of the Environment (SFDE), the SFPUC, and other appropriate City agencies to complete and coordinate an analysis and planning of a local action plan targeting GHG emission-reduction activities. In September 2004, the SFDE and the SFPUC published the *Climate Action Plan for San Francisco: Local Actions to Reduce Greenhouse Emissions* (SFDE and SFPUC, 2004). Although the San Francisco Board of Supervisors has not formally committed the City to perform the actions addressed in the plan, and many of the actions require further development and commitment of resources, it serves as a blueprint for GHG emission reductions, and several actions are now in progress.

The plan presents estimates of San Francisco's baseline GHG inventory and reduction targets. It states that burning fossil fuels in vehicles and for energy use in buildings and facilities are the major contributors to San Francisco's GHG emissions; in 1990, these activities produced approximately 9.1 million tons of CO_2. The plan also recommends emissions reduction actions in the key target sectors (transportation, energy efficiency, renewable energy, and solid waste management) to meet stated goals by 2012.

Greenhouse Gas Reduction Ordinance

In May 2008, San Francisco adopted an ordinance amending its Environment Code to establish greenhouse gas emission targets and action plans, to authorize the Department of the

Environment to coordinate efforts to meet these targets, and to make environmental findings. The ordinance establishes the following greenhouse gas emission reduction limits for San Francisco and the target dates to achieve them:

- Determine 1990 City greenhouse gas emissions by 2008, the baseline level with reference to which target reductions are set;
- Reduce greenhouse gas emissions by 25 percent below 1990 levels by 2017;
- Reduce greenhouse gas emissions by 40 percent below 1990 levels by 2025; and
- Reduce greenhouse gas emissions by 80 percent below 1990 levels by 2050.

The ordinance also specifies requirements for City departments to prepare Climate Action Plans that assess and report GHG emissions and prepare recommendations to reduce emissions. As part of this, the San Francisco Planning Department is required to: (1) update and amend the City's applicable General Plan elements to include the emissions reduction limits set forth in this ordinance and policies to achieve those targets; (2) consider a project's impact on the City's GHG reduction limits specified in this ordinance as part of its review under CEQA; and (3) work with other City departments to enhance the "transit first" policy to encourage a shift to sustainable modes of transportation thereby reducing emissions and helping to achieve the targets set forth by this ordinance.

Existing CCSF GHG Reduction Actions

The CCSF is already implementing a range of actions related to the reduction of GHG emissions. Some of these actions relate to transportation, solar power, and energy efficiency. With regard to transportation, in 1999 the Board adopted the Healthy Air and Smog Prevention Act, which was incorporated into San Francisco's Environment Code. This ordinance requires the CCSF to purchase or lease passenger vehicles and light-duty trucks that are rated as ultra-low-emission vehicles or zero-emission vehicles (ZEV) (at least 10 percent were to be ZEV by July 1, 2000). Requirements were also set forth for medium and heavy-duty vehicles and motorized equipment, and for phasing out all highly polluting vehicles and equipment (SFDE and SFPUC, 2004). The CCSF has also contributed grant funds toward the development of three alternate fueling facilities. It continues to seek funds to expand alternate fueling infrastructure and has been successful in developing a number of electric-vehicle charging stations in San Francisco and throughout the Bay Area. In addition, the CCSF encourages car sharing within San Francisco and limits the amount of parking allowed in new downtown residential developments (Planning Code Section 151.1). The CCSF funds municipal solar and energy-efficiency programs through SFPUC Power Enterprise (formerly part of Hetch Hetchy Water and Power Enterprise) revenues, state grants and loans, and the City's General Fund at approximately $5.5 million annually.

Existing SFPUC GHG Reduction Actions

The SFPUC owns and operates a gravity-driven regional water system. In addition to the GHG reduction measures that will be implemented as part of all WSIP facility improvement projects,

including the proposed project (see Greenhouse Gas Reduction Actions in Section 3.0, Project Description), the SFPUC is also developing renewable generation and energy-efficiency projects. To date, the SFPUC has constructed several renewable generation projects, and many more are in the planning, design, or construction phases. The SFPUC also manages and implements energy efficiency projects in municipal buildings and facilities, and provides energy efficiency services such as energy audits, design, and construction management. Energy retrofit technologies include installing energy-efficient equipment such as lighting, heating, ventilating, and air conditioning, motors, controls, and energy management systems. The SFPUC is also looking at several sites in the Bay Area for wind power development, and the feasibility of wind power development on CCSF property in the Sierra Nevada foothills is also being considered.

SFPUC GHG Reduction Actions as Part of the Proposed Project. In addition to the actions set forth above, the SFPUC is committed to the following GHG reduction actions as part of the WSIP program.

1. As part of the proposed project, the SFPUC will include the following measures in contractor specifications, which, in addition to having other environmental benefits, would also help reduce GHG emissions.

   A. The SFPUC will require that contractors maintain tire inflation to the manufacturers' inflation specifications.

   B. The SFPUC will implement a construction worker education program.

   C. Contractors who construct new buildings will consult with the SFPUC Power Enterprise's Energy Efficiency Group to incorporate all applicable energy-efficiency measures into the project design. To maximize energy efficiency, the design will attempt to exceed Title 24 minimum requirements by at least 20 percent. Project building components will attempt to meet or exceed Leadership in Energy and Environmental Design Silver certification as required by the CCSF's Green Building Ordinance.

2. This EIR also includes mitigation measures that would be implemented as part of the proposed project, and some of these measures would also help reduce project-related GHG emissions. They include SJVAPCD exhaust control measures (speed limit restrictions, idling restrictions, activity management, and proper equipment maintenance) and incorporation of energy efficiency measures. In addition, CARB regulations (Title 13 of the California Code of Regulations, Sections 2480 and 2485), which limit idling of diesel-fueled commercial motor vehicles, would help to limit GHGs associated with project-related construction vehicles.

4.9.4 Impacts

Significance Criteria

The CCSF has not formally adopted significance thresholds or guidance for making impact determinations related to air quality, but generally considers that implementation of the proposed project would have a significant air quality impact if it were to:

- Conflict with or obstruct implementation of the applicable air quality plan;
- Violate any air quality standard or contribute substantially to an existing or projected air quality violation;
- Conflict with the state goal of reducing GHG emissions in California to 1990 levels by 2020, as set forth by the timetable established in AB 32, California Global Warming Solutions Act of 2006, such that the project's GHG emissions would result in a substantial contribution to global climate change;
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is in nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions that exceed quantitative thresholds for O_3 precursors);
- Expose sensitive receptors to substantial pollutant concentrations; or
- Create objectionable odors affecting a substantial number of people.

Areas of No Project Impact

At the Thomas Shaft site, the proposed project would not result in any increase in air emissions over existing conditions during operation. Project operation at the Thomas Shaft site would not require an emergency generator, diesel tanks, nor result in any increase in the number of employees required onsite. Therefore, these operational emissions categories would not apply to the Thomas Shaft site, and at this site, the significance criteria associated with operational emissions would not be applicable. Additionally, the treatment system at the Thomas Shaft site is enclosed, and no new potential odor sources would be generated by the project at this site. Therefore, the significance criterion associated with odors would not be applicable at the Thomas Shaft site and is not discussed further.

Approach to Analysis

The proposed project is located in San Joaquin County, which is under the jurisdiction of the SJVAPCD. CEQA Guidelines allow counties and air districts to develop significance thresholds for both short-term (construction) and long-term (operational) air pollutant emissions. Therefore, significance determinations are based on guidance provided by the SJVAPCD's GAMAQI, CEQA Guidelines, and CARB guidelines.

The proposed project would result in construction emissions, but it is not expected to have any substantive increase in operational (long term, continual) emissions.

As stated in the GAMAQI, "The entire SJVAB is a serious nonattainment area for PM_{10} and any addition to the current PM_{10} problem could be considered significant. However, the SJVAPCD has established regulations governing various activities that contribute to the overall PM_{10} problem. The SJVAPCD has adopted a set of PM_{10} Fugitive Dust Rules collectively called Regulation VIII. Several components of Regulation VIII specifically address fugitive dust generated by construction related activities. Therefore, the SJVAPCD has determined that any determination of significance with respect to construction emissions should be based on a consideration of the control measures to be implemented. From the perspective of the SJVAPCD, compliance with Regulation VIII for all sites and implementation of all other control measures indicated in Tables 6-2 and 6-3 of Regulation VIII (as appropriate, depending on the size and location of the project site) will constitute sufficient mitigation to reduce PM_{10} impacts to a level considered less than-significant" (SJVAPCD, 2002). In accordance with the GAMAQI, this approach is used for the analysis of construction impacts.

The SJVAPCD guidelines provide significance thresholds for criteria pollutant emissions associated with project operations (Table 4.9-4). However, the proposed project would only result in minimal increases in operational emissions over existing conditions resulting from: programmatic testing and emergency operation of emergency generators, minor increases from diesel tank emissions, minor increases in employee and maintenance vehicle emissions, and minor increases in vehicle hauling emissions. Therefore, operational emissions associated with the proposed project are discussed qualitatively.

The presentations of impacts below are shown individually for each project site for ease of presentation. However, it is important to note that the combined effects (the contributions from Thomas Shaft and Tesla Portal together) for each impact were also evaluated. The combined impacts resulting from contributions of the Tesla Portal and Thomas Shaft sites for each impact are the same as the project site specific impact findings.

Construction Impacts

Construction of the proposed project would result in short-term impacts to the existing air quality in the project area. These impacts would include temporary increases of CO, CO_2e, NO_X, PM_{10}, $PM_{2.5}$, SO_X, and ROG emissions at both the Tesla Portal and the Thomas Shaft sites. Emissions resulting from the construction of this project are broadly categorized as follows:

- Equipment exhaust (CO, CO_2e, NO_X, PM_{10}, $PM_{2.5}$, SO_X, and ROG);
- Fugitive dust from earth moving (PM_{10}, $PM_{2.5}$);
- Employee vehicle emissions (CO, CO_2e, NO_X, PM_{10}, $PM_{2.5}$, SO_X, and ROG);
- Construction truck emissions (CO, CO_2e, NO_X, PM_{10}, $PM_{2.5}$, SO_X, and ROG); and

- Paving emissions (ROG).

Equipment exhaust emissions are generated from the combustion of fuels used for the operation of construction equipment. Fugitive dust emissions are generated by the suspension of particulate during earth-moving activities. Employee vehicle emissions and construction truck emissions are generated from the combustion of fuels and from the entrainment of road dust during travel along roadways on site and off site of the construction area. Asphalt paving emissions are generated from the evaporation of regulated volatiles, or diluents, used to liquefy asphalt cement. Reasonable worst-case uncontrolled construction emissions are summarized in Table 4.9-5.

TABLE 4.9-5
REASONABLE WORST-CASE ANNUAL UNCONTROLLED EMISSIONS AT THE TESLA PORTAL SITE DURING CONSTRUCTION (TONS PER YEAR)

Project Component	ROG	NO_x	CO	SO_2	PM_{10} (Dust)	PM_{10} (Exhaust)	PM_{10} Total	$PM_{2.5}$ (Dust)	$PM_{2.5}$ (Exhaust)	$PM_{2.5}$ Total	CO_2
Chemical Building	0.30	1.14	0.72	0	0.02	0.07	0.09	0	0.06	0.07	113.04
Office Building	0.18	1.06	0.57	0	0	0.07	0.07	0	0.06	0.06	94.04
UV Building	0.37	1.19	0.81	0	0.02	0.07	0.09	0	0.07	0.07	123.90
Total	**0.85**	**3.38**	**2.10**	**0**	**0.04**	**0.21**	**0.25**	**0.01**	**0.19**	**0.20**	**330.97**

Source: URS, 2008.

Please refer to Chapter 3, Project Description, for more detailed project information regarding construction schedules, duration, size, etc.

Impact 4.9-1: Construction emissions of criteria pollutants (Tesla Portal: PSM; Thomas Shaft: PSM)

As stated above, the SJVAB is a serious nonattainment area for $PM_{10.}$ Therefore, any addition to the current levels of PM_{10} emissions could be considered potentially significant. The SJVAPCD considers PM_{10} to be the pollutant of greatest concern when evaluating construction emissions. As stated in the GAMAQI, significance of construction emissions should be based on a consideration of the control measures that would be implemented. The SJVAPCD considers implementation of the control measures in Regulation VIII and in Tables 6-2 and 6-3 (when applicable) of the GAMAQI sufficient mitigation to reduce PM_{10} impacts to a level considered less than significant.

The SJVAPCD focuses significance determinations on PM_{10} emissions. However, equipment exhaust emissions are also a concern during construction. The SJVAPCD suggests that CEQA Lead Agencies seeking to reduce emissions from construction equipment exhaust should consider implementing the mitigation measures outlined in Table 6-4 of the GAMAQI. As stated in the

GAMAQI, "The SJVAPCD recognizes that these measures are difficult to implement due to poor availability of alternative fueled equipment and the challenge of monitoring these activities" (SJVAPCD, 2002). Additionally, mitigation required by Regulation IX (Mobile and Indirect Sources, Rule 9510) is applied to the proposed project.

Tesla Portal

Details regarding the size, scope, and length of construction for the Tesla Portal site are outlined in the project description (Chapter 3). Chapter 3 also details expected construction equipment that will be operational throughout build out. In general, construction at this location is anticipated to start in January 2009 and last approximately 24 months.

Construction at the Tesla Portal site would create an increase in short-term emissions of criteria pollutants and precursors, specifically PM_{10}. SJVAB is a nonattainment area for $PM_{10.}$ Therefore, any addition to the current levels of PM_{10} emissions would be considered a potentially significant impact under the guidance of GAMAQI. However, as described above, the SJVAPCD considers

PM_{10} to be the pollutant of concern when evaluating impacts from construction; the SJVAPCD also considers implementation of the control measures in Regulation VIII and in Tables 6-2, 6-3, and 6-4 of the GAMAQI sufficient mitigation to reduce PM_{10} impacts to a level considered less than significant.

In accordance with SFPUC Standard Construction Measure #3, a dust control plan would be prepared and several dust control measures would be implemented.

- In accordance with the guidance outlined in the GAMAQI, the SFPUC would implement Mitigation Measures 4.9-1a and 4.9-1b, which require a host of actions that the SJVAPCD has determined will reduce fugitive dust (PM) emissions and equipment exhaust emissions. These measures include, but are not limited to: stabilization of dust emissions, hauling restrictions, track out restrictions, speed restrictions, idling restrictions, and activity management. See Section 5.2.5 for a specific listing of these actions. Implementation of fugitive dust control measures alone would result in a reduction in PM_{10} dust-related emissions by 40 percent and $PM_{2.5}$ emissions by 38 percent. Total PM_{10} and $PM_{2.5}$ emissions would be reduced (by 7 and 2 percent, respectively) related to construction emissions at the Tesla Portal site (URS, 2008). Implementation of all of the measures included in Mitigation Measures 4.9-1a and 4.9-1b would reduce the potentially significant air quality impact associated with project construction emissions of criteria pollutants at the Tesla Portal site to less than significant.

Thomas Shaft

- Details regarding the size, scope, and length of construction for the Thomas Shaft site are outlined in the project description (Chapter 3). Chapter 3 also details expected construction equipment that will be operational throughout build out. In general, construction at this location is anticipated to start July 2009 and last for approximately 6 months. The development footprint at the Thomas Shaft site is below the SJVAPCD's Rule 9510 threshold triggering the need for quantification and therefore emissions have not been calculated but are discussed qualitatively.

Construction at the Thomas Shaft site would be minimal (trenching for a shallow pipeline, and installation of a prefabricated building and percolation tank) and would create an increase in short-term emissions of criteria pollutants and precursors, specifically PM_{10}. SJVAB is a nonattainment area for $PM_{10.}$ Therefore, any addition to the current levels of PM_{10} emissions could be considered potentially significant under the guidance of GAMAQI. SJVAPCD considers PM_{10} to be the pollutant of concern when evaluating impacts from construction; the SJVAPCD also considers implementation of the control measures in Regulation VIII and in Tables 6-2, 6-3, and 6-4 of the GAMAQI sufficient mitigation to reduce PM_{10} impacts to a level considered less than significant.

In accordance with SFPUC Standard Construction Measure #3, a dust control plan would be prepared and several dust control measures would be implemented.

In accordance with the guidance outlined in the GAMAQI, the SFPUC would implement Mitigation Measures 4.9-1a and 4.9-1b, which require a host of actions that the SJVAPCD has determined will reduce fugitive dust (PM) emissions and equipment exhaust emissions. These measures include, but are not limited to: stabilization of dust emissions, hauling restrictions, track out restrictions, speed restrictions, idling restrictions, and activity management. See Section 5.2.5 for a specific listing of these actions. Implementation of these mitigation measures would reduce

the potentially significant air quality impacts of construction at the Thomas Shaft site to less than significant.

Impact 4.9-2: Exposure to DPM during construction (Tesla Portal: LS; Thomas Shaft: LS)

Diesel exhaust is generated from the operation of diesel-fueled construction equipment and vehicles (i.e., diesel construction equipment, delivery/haul trucks, and worker commute vehicles). Of the TACs found in diesel exhaust, the primary TAC of concern is DPM. The SJVAPCD provides the following two thresholds for evaluating significance for TACs in the GAMAQI. It should be noted that these are generally only applied towards a project's operational emissions, as the risks associated with TACs are evaluated for a project's long- term operational emissions; because "for cancer health effects, risk is expressed as an estimate of the increased chances of getting cancer due to facility emissions over a 70-year lifetime. This increase in risk is expressed as chances in a million (e.g., 10 chances in a million)" (CARB, 2005). The effects of TACs would be significant if:

- The probability of contracting cancer for the Maximally Exposed Individual (MEI) exceeds 10 in one million.
- The ground-level concentrations of non-carcinogenic TACs would result in a Hazard Index greater than 1 for the MEI.

Tesla Portal Site

The only DPM emitting construction activities at the Tesla Portal site would be the use of diesel-fueled construction equipment, hauling vehicles, and diesel-fueled employee (construction) vehicles. There is an on-site caretaker residence (see Figure 3-1 in Section 3.0) within the project boundary. The closest off-site residential structure to the Tesla Portal site is located approximately 2,500 feet to the southeast of the project area, off West Vernalis Road. Additionally, the community of Chrisman is approximately 0.75 miles east of the Tesla Portal site (off-site) and is adjacent to the project hauling route.

Based on minimum separation distances recommended by CARB for other DPM emitting sources and sensitive land uses (*Air Quality and Land Use Handbook: A Community Health Perspective* [CARB, 2005]), the location of the off-site receptors would not be considered at risk for chronic exposure to the Tesla Portal on-site construction-related DPM emissions.

Construction at the Tesla Portal site would take approximately 24 months. Throughout this time, diesel particulate emissions would be generated from hauling along specified routes (see Section 4.8 Traffic, Transportation, and Circulation) and from diesel fueled construction equipment. Construction employee vehicle emissions would be minor. Diesel emissions would be inconsistent and would vary depending on the nature of the day's particular activities. Over the 24 month construction period, construction activities would increase DPM emissions temporarily over existing conditions. However, the time frame and frequency of exposure to DPM emissions is short in duration when the temporary and incremental increases are averaged over the 70 years over which cancer risk is evaluated. As such, the off-site and on-site receptors would not be considered at risk for chronic exposure to the Tesla Portal construction-related DPM emissions (including those located along haul routes).

Due to the short-term and variable nature of the construction DPM-emitting activities (compared to a 70-year exposure scenario) and the proximity of sensitive receptors to the Tesla Portal site, it is not expected that any sensitive receptors would be exposed to significant annual (chronic long-term) concentrations of DPM. The cancer risk associated with DPM would be below the threshold listed above. Therefore, the impact of DPM from construction at the Tesla Portal site is considered to be less than significant.

Furthermore, in accordance with Mitigation Measure 4.9-1b (exhaust control measures) required to mitigate Impact 4.9-1, all construction equipment with engines equal to or greater than 50 horsepower would:

- Be equipped with verified Level 3 (at least 85 percent reduction of PM from the baseline emission level) Diesel Emission Control Strategies as defined in Title 13, CCR, §2700 through 2710;

- Be equipped with Tier 2 diesel engines as defined in Title 13, CCR, §2423; and

- Minimize idling (vehicles) to 5 minutes, in accordance with Title 13, CCR, §2485.

Thomas Shaft

The only DPM emitting construction activities at the Thomas Shaft site would be the use of diesel-fueled construction equipment, hauling vehicles, and diesel-fueled employee (construction) vehicles. There are no sensitive receptors in the immediate vicinity of the Thomas Shaft site. The closest residential structure to the Thomas Shaft site (according to aerial photographs), is a rural residence about 1.25 mile to the northeast of the site. The location of this receptor would not be considered at risk for chronic exposure to the Thomas Shaft on-site construction-related DPM emissions (CARB, 2005).

It is likely that receptors would be located adjacent to haul roads at some point along the specified routes (see Section 4.8 Traffic, Transportation, and Circulation). As detailed above, the time frame and frequency of exposure to hauling emissions would be short in duration when the temporary and incremental increases are averaged over the 70 years over which cancer risk is evaluated. As such, any receptors adjacent to haul routes would not be considered at risk for chronic exposure to the Thomas Shaft construction-related DPM emissions from hauling.

Construction at the Thomas Shaft site would take approximately 6 months. Due to the short-term nature of the construction DPM-emitting activities (compared to a 70-year exposure scenario) and the proximity of the closest sensitive receptor to the Thomas Shaft site, it is not expected that any sensitive receptors would be exposed to significant annual (chronic long-term) concentrations of DPM. The cancer risk associated with DPM would be below the threshold listed above. Therefore, the impact of DPM from construction at the Thomas Shaft site is considered to be less than significant. Mitigation Measure 4.9-1b, required to mitigate Impact 4.9-1, would also be implemented at this site.

Operational Impacts

Operation of the proposed project would result in long-term impacts to the existing air quality in the project area. These impacts would include minor increases of CO, CO_2e, NO_X, PM_{10}, $PM_{2.5}$, SO_X, and ROG emissions. Emissions resulting from the operation of this project are broadly categorized as follows:

- Emergency generator exhaust (CO, CO_2e, NO_X, PM_{10}, $PM_{2.5}$, SO_X, and ROG);
- Diesel tank emissions (ROG); and
- Vehicle emissions (CO, CO_2e, NO_X, PM_{10}, $PM_{2.5}$, SO_X, and ROG).

- All operational exhaust emissions are generated from the combustion of fuels. Diesel tank emissions are generated from the displacement of volatile vapors during refilling and the evaporation of volatiles. Reasonable worst-case uncontrolled operations emissions are summarized in Table 4.9-6.

TABLE 4.9-6
REASONABLE WORST-CASE ANNUAL UNCONTROLLED EMISSIONS ESTIMATES AT THE TESLA PORTAL SITE DURING OPERATIONS (TONS PER YEAR)

Source	ROG	NO_X	CO	SO_2	PM_{10}	CO_2
Emergency Generator	0.0553	1.0515	0.5996	0.0009	0.0346	82.5757
Transportation	0.0014	0.0274	0.0210	0.0001	0.00069	9.6761
Diesel Tanks	0.0343	--	--	--	--	--
Total	**0.0911**	**1.0789**	**0.6206**	**0.0009**	**0.0353**	**92.2518**

Source: URS, 2008

Impact 4.9-3: Air pollutant emissions during project operation (Tesla Portal: LS, Thomas Shaft: N/A)

Operational emissions from the proposed project are considered to be minor. They are broadly grouped into the following 5 categories: emissions from new emergency generators, emissions from diesel tanks, employee vehicles, maintenance vehicle trips, and chemical delivery vehicles. Each category, as it applies to each site, is discussed below. Indirect emissions resulting from the proposed project's increased power demands are discussed separately in Impact 4.9-6.

Tesla Portal

Operation of the Tesla Treatment Facility would include the use of two new 1,500 kW emergency generators. Typically, emergency generators comprise a fuel storage tank and an internal combustion engine. Emergency generators are stationary sources and are only operated for programmatic testing and in emergency situations—specifically, power outages. Operation of the Tesla Treatment Facility would result in a minor increase in criteria pollutant and precursor emissions associated with the programmatic testing and emergency operation of the generators. Stationary source generator emissions would be infrequent, short-term events. As such, emissions from the emergency generators would be minor in any given year of operation.

Two 15,000-gallon diesel fuel tanks would be installed at the Tesla Portal site to support the emergency generators. Minor ROG emissions would result from the refilling of the diesel tanks at the Tesla Portal site, as vapors inside the tank are displaced to the atmosphere by liquid. Additionally, evaporative emissions (losses) would occur as the tanks vent throughout the year in response to heating and cooling temperatures. Evaporative emissions from diesel fuels are generally minor due to the fuel's low volatility. Furthermore, the tanks would only need to be

refilled periodically following emergency operation, programmatic testing, or top off. As such, the increase in emissions associated with the diesel tanks would be minor.

A minor increase in mobile source emissions would result from the addition of two new full-time employees at the Tesla Portal site. Employees at the Tesla Portal site would only be onsite intermittently, as needed. As such, additional emissions would result from two intermittently used employee vehicles. The criteria pollutant and precursor emissions from these vehicles would be minor. The increase in employee vehicle trips is estimated at 2 vehicle round trips per day, as shown in Section 4.8, Traffic, Transportation, and Circulation.

The Tesla Treatment Facility would also require additional diesel vehicle trips for maintenance and delivery activities. These vehicle trips would be required for routine maintenance and to deliver virgin chemicals and fuel to the site. The increase in maintenance and delivery vehicle trips is summarized in Section 4.8, Traffic, Transportation, and Circulation and is estimated at 5

vehicle round trips per day. These increased vehicle trips do not represent a significant increase in criteria pollutant and precursor emissions over existing conditions.

The emissions resulting from the operation of the proposed facilities at the Tesla Portal site would be below SJVAPCD thresholds (10 tons/year NO_X and ROG) and the impact is considered less than significant.

Impact 4.9-4: Exposure to diesel particulate matter during operation (Tesla Portal: LS; Thomas Shaft: N/A)

Tesla Portal Site

The only operational DPM emitting activities at the Tesla Portal site would be the use of diesel-fueled chemical delivery trucks and the sporadic operation of the emergency diesel generators.

Diesel delivery trucks are estimated to make 5 vehicle round trips per day. This represents a minor increase in DPM emissions over existing conditions. The use of emergency diesel generators would also be very limited; emissions in any given year are expected to be insignificant. Due to the minor increase in operational DPM-emitting activities and the proximity of the off-site receptors to the Tesla Portal site, it is not expected that any receptors (including the care takers residence and those adjacent to haul routes) would be exposed to significant annual (chronic long-term) concentrations of DPM from this activity. The cancer risk associated with DPM would be below the threshold listed for impact 4.9-2. Therefore, the impact of operational DPM is considered less than significant.

Impact 4.9-5: Odors generated during project operation (Tesla Portal: LS; Thomas Shaft: N/A)

Tesla Portal Site

The proposed treatment system at the Tesla Portal site would be enclosed, with the exception of the 90,000-gallon containment basin. Potential odor sources at the Tesla Portal site are as follows: three 16,000-gallon sodium hypochlorite tanks, two 15,000-gallon diesel fuel tanks, and a septic tank and leach field system.

Sodium hypochlorite has a characteristic odor, similar to bleach or chlorine. The largest release of sodium hypochlorite vapors would occur during the routine filling of the tanks, as vapors are displaced by liquid. However, this release would be minor as filling of the tanks would be infrequent, occurring on the magnitude of 0 to 4 times per month. Sodium hypochlorite would be used in the treatment system at the Tesla Portal site. Under normal operation, there would not be any odors associated with the addition of sodium hypochlorite to the water supply, as it is an

enclosed system. As such, the storage and use of sodium hypochlorite would not be a significant source of odors.

Diesel fuel has a characteristic petroleum distillate odor. The largest release of diesel vapors/odors would result from the refilling of the diesel tanks at the Tesla Portal site, as vapors inside the tank are displaced to the atmosphere by liquid. Additionally, the tanks would vent vapors/odors throughout the year as volatiles evaporate in response to heating and cooling temperatures. Evaporative losses from diesel fuel are generally minor due to the fuel's low volatility. Furthermore, the tanks would only need to be refilled periodically following emergency operation, programmatic testing, or top off. As such, the storage and use of diesel fuel would not be a significant source of odors.

Septic tanks generally vent hydrogen sulfide and other unpleasant odorous compounds that are generated from the anaerobic decomposition of waste in the tank. These odors are emitted through an elevated vent that aids in the rapid dispersion of the odors so that they are not detected on the ground by humans. When odors are detected from a septic tank and leach field system, it is generally a clear indication that the system is operating improperly. The septic tank at the Tesla Portal site would be installed and maintained properly and would not be a significant source of odors.

The above odor sources would all be installed, vented, and maintained in accordance with applicable regulations and therefore would not be significant sources of odors. Therefore, odors wouldn't affect the nearest sensitive receptors and the impact of odors from the Tesla Portal site is considered less than significant.

Impact 4.9-6: Indirect emissions at power plants from project operation (Tesla Portal: LS; Thomas Shaft: LS)

Tesla Portal Site

The Tesla Portal site would have an increased power demand over that of existing operational demands. This increased power demand would be a direct result of new electrical equipment that would be installed at the Tesla Portal site. A description of this new electrical equipment is detailed in Chapter 3.0 (Project Description).

The capacity to provide power to the Tesla Portal site would be present in the existing electrical grid feeding the Tesla Portal site. That existing electrical grid power is primarily provided by SFPUC Power Enterprise, but is distributed to the site by PG&E. SFPUC Power Enterprise primarily generates their power from hydroelectric sources, although they also purchase power that is derived from a variety of sources, including hydroelectric, alternative energy, and fossil fuels. All of these existing local power-generating facilities have been licensed to operate

depending on the varying supply and demand in the regional electrical grid at any one point in time.

As such, the increased power demand from the Tesla Portal site would not exceed allowable emission rates of local power generating facilities. The local power generating facilities serving the existing grid at the Tesla Portal site have previously gone through California's stringent regulatory processes to ensure minimum environmental impacts, specifically including air quality.

Additionally, as stated in Section 4.14, Energy Resources, the SFPUC has consulted with the Power Enterprise Energy Efficiency Group and would incorporate their "Recommended Energy Use Guidelines" into the design of the Tesla Portal site. The SFPUC may also consider the use of solar power at the Tesla Portal site in the future; however, solar panels are not currently proposed as part of the project and if solar panels were installed at Tesla Portal, they would be added after completion of all construction activities at the site.

The Tesla Portal site would operate within the existing electrical grids confines. Therefore, the incremental increase in power demand during operation of the Tesla Portal site would result in an indirect air quality impact that is less than significant on criteria air pollutant levels.

Thomas Shaft Site

The Thomas Shaft site would have an increased power demand over that of existing operational demands. This increased power demand would be a direct result of new electrical equipment that would be installed at the Thomas Shaft site. The capacity to provide power to the Thomas Shaft site would be present in the existing electrical grid feeding the Thomas Shaft site. Therefore, the incremental increase in power demand during operation of the proposed project at the Thomas Shaft site would result in an indirect air quality impact that is less than significant on criteria air pollutant levels.

Impact 4.9-7: Conflict with implementation of applicable regional air quality plans addressing criteria air pollutants and state goals for reducing GHG emissions (Tesla Portal: LS; Thomas Shaft: LS)

Regional Plans

This impact relates to the regional effect of the project. Therefore, the contributions of each site (Tesla Portal and Thomas Shaft) are not discussed separately. Instead, the regional impact of the project as a whole is assessed qualitatively.

Plans adopted by the SJVAPCD anticipate that new stationary sources would locate within the SJVAPCD in future years (and that existing sources would expand operations) and seek authority to emit air pollutants under the SJVAPCD Rule 2201 (New and Modified Stationary Source

Review Rule). To allow for such future economic growth, the plans anticipate that stationary sources would seek approvals from the SJVAPCD and would be required to provide emission reduction credits to offset (or mitigate) emission increases. The result of the offset program is that the net increase of emissions within the SJVAPCD from stationary sources would be zero.

If applicable, SFPUC would be required to seek approval for its proposed project under SJVAPCD Rule 2201 and provide emission reduction credits for the stationary emergency generators if required to do so by the rule. Stationary source emissions would therefore be consistent with the SJVAPCD adopted air quality plans and impacts to regional air quality are considered less than significant.

State GHG Goals

This impact relates to the state-wide effect of GHGs from the proposed project. Therefore, the contributions of each site (Tesla Portal and Thomas Shaft) are not discussed separately. Instead, the state-wide impact (as it relates to GHG emissions) of the project as a whole is assessed.

The California Air Pollution Control Officers Association (CAPCOA) recently released a resource guide addressing GHG emissions from projects subject to CEQA. However, the "paper is intended as a resource, not a guidance document. It is not intended, and should not be interpreted, to dictate the manner in which an air district or lead agency chooses to address greenhouse gas emissions in the context of its review of projects under CEQA." (CAPCOA, 2008)

The resource guide specifies that there are "basic options air districts and lead agencies can pursue when contemplating the issues of CEQA thresholds for greenhouse gas emissions" (CAPCOA, 2008). The resources guide "explores each path and discusses the benefits and disbenefits of each." The three basic paths suggested in this resource guide are:

- No significance threshold for GHG emissions;
- GHG emissions threshold set at zero; or
- GHG emissions threshold set at a non-zero level.

Although progress is being made and several approaches for evaluating GHG impacts are being discussed, no clear methodology has been established (CAPCOA, 2008). The decision of which approach to take must be scientifically based; and a clear scientific threshold (zero or non-zero) or basis for a threshold has yet to be determined. As such, no air district or lead agency in California, including the SJVAPCD, has identified a significance threshold for GHG emissions or a methodology for analyzing air quality impacts related to GHG emissions. However, this does not relieve any lead agency from the responsibility of addressing and assessing GHG impacts from proposed projects.

The Governor's Office of Planning and Research (OPR) is responsible for adopting regulations implementing CEQA; that agency has not yet promulgated any regulations directly concerning

analysis of global climate change, but has published a technical advisory document that provides guidance specific to addressing GHG emission in CEQA documents. This document does not establish thresholds, but provides guidance on what factors to consider when analyzing the impacts of a proposed project on global climate change (OPR 2008). CARB is the state-wide agency responsible for administering air quality programs within the state, and has been tasked with developing many of the regulatory programs required by AB 32, but CARB likewise has not developed any regulations regarding evaluation of global climate change within CEQA documents. The SJVAPCD is the regional agency responsible for regulating air emissions within the project area, but has yet to develop guidance regarding evaluation of global climate change within CEQA documents.

In the absence of adopted regulations and thresholds, this report patterns its global climate change analysis on available guidance and a qualitative analysis demonstrating that the projects impacts would not conflict with the state goal of reducing GHG emissions in California to 1990 levels by 2020, as set forth by the timetable established in AB 32 (California Global Warming Solutions Act of 2006).

With this approach, it is possible to conclude that if all feasible and applicable emissions reduction strategies are implemented, the GHG impact of the proposed project is considered less than significant.

Construction

The current statewide annual net GHG inventory is estimated at 479.74 million metric tons of CO_2e (CARB, 2007b). CARB staff resolved an amount of 427 million metric tons of CO_2e as the total statewide greenhouse gas 1990 emissions level and 2020 emissions limit. The limit is a cumulative statewide limit, not a sector or facility specific limit (CARB, 2007a). Therefore, the state's goals are to reduce GHG emissions by 52.74 million metric tons of CO_2e by the year 2020.

The proposed project's reasonable worst-case annual construction emissions of GHG are estimated at 5,289 metric tons of CO_2e per year. This number includes emissions from construction equipment, material hauling vehicles, and construction employee vehicles. The current statewide annual net GHG inventory is estimated at 479.74 million metric tons of CO_2e per year (CARB, 2007b). Therefore, the reasonable worst-case annual uncontrolled emission of GHG from construction activities would represent only 0.0011 percent of the statewide total. Based on this result, it is evident that GHG emissions from construction of the proposed project would be minor in comparison to the state total.

Additionally, construction emissions are transient and temporary. Therefore, once construction of the proposed project is over, GHG emissions generated by the project's construction activities would cease. Mitigation Measure 4.9-1b, required to mitigate Impact 4.9-1, would reduce the emissions generated from all construction equipment exhaust and is consistent with federal and

state emission reduction strategies. Furthermore, existing CARB regulations (Title 13 of the California Code of Regulations, Sections 2480 and 2485) and Early Action Measures (pursuant to the California Global Warming Solutions Act of 2006) would require emission reduction measures for diesel trucks and diesel off-road equipment. CARB would review and adopt Early Action Measures by January 1, 2010, and equipment used for the construction of the proposed project could be subject to these requirements. SFPUC would implement these measures as required.

Given the minor amount (comparatively) of GHG that would be emitted during construction of the proposed project, implementation of Mitigation Measure 4.9-1b (which outlines measures for exhaust control), continuing compliance with federal and state GHG regulations, and continuing implementation of GHG reduction actions by the CCSF and SFPUC and additional GHG reductions actions that SFPUC would implement as part of the proposed project (described under the Setting), construction of the proposed project would not conflict with the state goal of reducing GHG emissions in California to 1990 levels by 2020, as set forth by the timetable established in AB 32 (California Global Warming Solutions Act of 2006). Therefore, the impact during project construction is considered less than significant.

Operations

Operational GHG emissions from the proposed project would be minor. GHG emissions would be generated from three sources: (1) programmatic testing and operation of emergency generators; (2) operation of vehicles that would be used for employees, deliveries, and to carry out routine maintenance activities; and (3) indirect emissions from power plants due to increased power demand from project operation. The Tesla Portal site would have two CO_2 tanks on site that would be used to lower pH. The CO_2 would be injected into the water and would be consumed by the water. Therefore, there are no CO_2 emissions generated by this process.

Though not quantified, emissions from the infrequent use of the emergency generators and emissions from operational vehicles would be minor. Future compliance with federal and state regulations regarding stationary and mobile sources would help to ensure that these sources are in compliance and do not conflict with the state's goals of reducing GHG emissions to 1990 levels by 2020.

Similarly, for the reasons described above in Impact 4.9-6, the GHGs that would be indirectly emitted from power generating facilities supporting the proposed project is also considered to be less than significant.

Given the very minor amount of GHG that would be emitted during operation of the proposed project, compliance with federal and state stationary source regulations (if applicable), continuing compliance with federal and state GHG regulations, and continuing implementation of GHG reduction actions by the CCSF, operation of the proposed project would not conflict with the state goal of reducing GHG emissions in California to 1990 levels by 2020, as set forth by the timetable established in AB 32 (California Global Warming Solutions Act of 2006). Therefore, the impact during project operation is considered less than significant.

4.9.5 References

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4.10 Noise and Vibration

4.10.1 Setting

Noise and Vibration Terminology

Noise is commonly defined as unwanted sound that annoys or disturbs people and potentially causes an adverse psychological or physiological effect on human health. Because noise is an environmental pollutant that can interfere with human activities, evaluation of noise is necessary when considering the environmental impacts of a proposed project.

The effects of noise on people can be grouped into three categories: (1) subjective effects of annoyance, nuisance and dissatisfaction; (2) interference with such activities as speech and sleeping; and (3) physiological effect, such as hearing loss.

Sound is measured in decibels (dB). Although decibels describe the purely physical amplitude of sound, they cannot accurately describe sound as perceived by the human ear, because the human ear is only capable of hearing sound within certain frequency ranges. The frequency of sound must be taken into account when evaluating the potential human responses. For this reason, a frequency-dependent weighting system is used and the results reported in A-weighted decibels (dBA). Decibels and other technical terms are defined in Table 4.10-1. Typical A-weighted noise levels are shown for different noise sources in Table 4.10-2.

An important method for determining a person's subjective reaction to a new noise is by comparing it to ambient (existing) conditions. The following describes the general effects of noise on people (Harris, 1998):

- A change of 1 dBA cannot typically be perceived, except in carefully controlled laboratory experiments
- A 3-dBA change is generally considered a just-perceivable difference
- A minimum of 5-dBA change is required before any noticeable change in community response is expected
- A 10-dBA change is subjectively perceived as approximately a doubling or halving in loudness

In unconfined space, such as outdoors, noise attenuates with distance according to the inverse square law. Noise levels at a known distance from point sources are reduced by 6 dBA for every doubling of that distance for hard surfaces, such as cement or asphalt surfaces, and 7.5 dBA for every doubling of distance for soft surfaces, such as undeveloped or vegetative surfaces (Caltrans, 1998). Noise levels at a known distance from line sources, such as roadways, theoretically decrease at a rate of 3 dBA for every doubling of the distance for hard surfaces and 4.5 dBA for every doubling of distance for soft surfaces (Caltrans, 1998). A greater decrease in noise levels can result from the presence of intervening structures or buffers.

TABLE 4.10-1
DEFINITIONS OF ACOUSTICAL TERMS

Term	Definition
Decibel (dB)	A unit describing the amplitude of sound, equal to 20 times the logarithim to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter). Sound described in decibels is usually referred to as Sound and Noise "Level".
Frequency: Hertz (Hz)	The number of complete pressure fluctuations per second above and below atmospheric pressure.
A-Weighted Sound Level (dBA)	The sound pressure level in decibels as measured on a sound level meter using an A-weighted filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
L01, L10, L50, L90	The average A-weighted noise levels that are exceeded 1, 10, 50 and 90 percent of the time during the measurement period.
Equivalent Noise Level (L_{eq})	The energy average A-weighted noise level during the measurement period.
Community Noise Equivalent Level (CNEL)	The energy average A-weighted noise level during a 24-hour day, obtained after addition of 5 dB in the evening (7:00 to 10:00 p.m.) and after addition of 10 dB to sound levels during the night (10:00 p.m. to 7:00 a.m.).
Day/Night Noise Level (L_{dn})	The energy average A-weighted noise level during a 24-hour day, obtained after addition of 10 dB to levels measured in the night (10:00 p.m. and 7:00 a.m.).
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measured period.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	Noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends on its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.
Pure Tone	A pure tone is a single frequency tone with no harmonic content.

TABLE 4.10-2
TYPICAL SOUND LEVELS MEASURED IN THE ENVIRONMENT

Examples of Common, Easily Recognized Sounds	Decibels (dBA)	Subjective Evaluations
Near Jet Engine	140	Deafening
Threshold of Pain	130	
Threshold of Feeling – Hard Rock Band	120	
Accelerating Motor Cycle (at a few feet away)	110	Very Loud
Loud Horn (at 10 feet away)	100	
Noisy Urban Street	90	
Noisy Factory	85[a]	
School Cafeteria with Untreated Surfaces	80	Loud
Stenographic Room	70[b]	
Near Freeway Auto Traffic	60[b]	Moderate
Average Office	50[b]	
Soft Radio in Apartment	40	Faint
Average Residence Without Stereo Playing	30	
Average Whisper	20	Very Faint
Rustle of Leaves in Wind	10	
Human Breathing	5	
Threshold of Audibility	0	

[a] Continuous exposure above 85 dBA is likely to degrade the hearing of most people.
[b] Range of speech is 50 to 70 dBA

Source: U.S. Department of Housing and Urban Development, Office of Community Planning and Development, 1985.

Since decibels are logarithmic units, sound pressure levels cannot be added or subtracted by ordinary arithmetic means. For example, if one automobile produces a noise level of 70 dBA when it passes an observer, two cars passing simultaneously would not produce 140 dB. In fact, they would combine to produce 73 dBA (Caltrans, 1998). When combining sound levels, Table 4.10-3 may be used to approximate the combined result.

TABLE 4.10-3
DECIBEL ADDITION

When The Decibel Values Differ By:	Add This Amount to the Higher Value
0 or 1 dB	3 dB
2 or 3 dB	2 dB
4 to 9 dB	1 dB
10 dB or more	0 dB

Source: Caltrans, 1998

Vibration

Vibrations caused by construction activities can be interpreted as energy transmitted in waves through the soil mass. These energy waves generally dissipate with distance from the vibration source. Since vibration energy, like sound energy, is reduced by geometric spreading as it propagates away from its source, vibration that is distant from a source is usually less perceptible than vibration closer to the source. However, actual human and structure response to different vibration levels is influenced by a combination of factors, including soil type, distance between source and receptor, duration, and the number of perceived events.

Perceptible ground-borne vibration is generally limited to areas within a few hundred feet of construction activities. The construction activities that typically generate the most severe vibrations are blasting and impact pile-driving, neither of which is proposed by the project. If great enough, the energy transmitted through the ground as vibration can result in structural damage. To assess the potential for structural damage associated with vibration, the vibratory ground motion in the vicinity of the affected structure is measured in terms of peak particle velocity (PPV) in the vertical and horizontal directions (vector sum), typically in units of inches per second (in/sec). A freight train passing at 100 feet can cause vibrations of 0.1 in/sec PPV, while a strong earthquake can produce vibrations in the range of 10 in/sec PPV. In general, cosmetic or threshold damage to residential buildings can occur at over 0.5 in/sec PPV. The term "threshold damage vibration" is defined as the highest vibration amplitude at which no cosmetic, minor, or major damage occurs, which includes "threshold cracks" or "hairsized" cracks in room walls that occur at the lowest vibration amplitudes.

Agencies such as the Federal Transit Administration (FTA) and the National Park Service (NPS) use PPV as a descriptor because it is related to the stresses experienced by buildings. Although PPV is appropriate for evaluating the potential of building damage, it is not suitable for evaluating human response. Because it takes some time for the human body to respond to vibration signals, a 1-second average velocity is typically used to assess vibration impacts on humans. This average is expressed using decibels, or VdB. The background vibration velocity level in residential areas is usually 50 VdB or lower, well below the threshold of perception for humans, which is approximately 65 VdB. Human response to vibration is usually not significant until it exceeds 70 VdB.

Vibration thresholds vary depending on the nature of the vibration and frequency range. Controlled detonations do not generate structural damage if they produce vibrations of less than 0.5 in/sec PPV (measured at the residential building setback line at the ground surface). This level is consistent with the U.S. Bureau of Mines' threshold cracking criteria of 0.5 in/sec PPV for low frequencies and 2.0 in/sec PPV for high frequencies. Continuous vibration caused by vibratory pile drivers, impact pile drivers, and large vibratory rollers/compactors can cause annoyance but do not cause structural damage if the continuous vibration is less than 0.2 in/sec PPV. This criterion is less than the controlled detonation vibration limit, reflecting the longer exposure time and the potential effect of structural resonances. Vibratory mechanical equipment may be operated over many minutes several times per day, and the associated response of structures can

build up over several seconds due to resonance of the structure, especially during startup and shutdown of vibratory compactors. Impact pile driving, which is not proposed as part of project construction, involves repeated impacts of several hundred per day, much more than occurs for controlled detonations. Thus, the vibration limit for impact pile driving is the same as the threshold for continuous vibration (0.2 in/sec PPV) (Wilson Ihrig & Associates, 2005). Lastly, the FTA's recommended vibration threshold criterion for fragile buildings is 0.2 in/sec PPV (U.S. Department of Transportation, Federal Transit Administration, 1995).

Existing Noise Environment and Sensitive Receptors Locations

Neither site is located within two miles of a public airport or public use airport or is in an area covered by an airport land use plan, and neither site is in the vicinity of a private airstrip.

Sensitive Receptors

Sensitive receptors are identified on land uses where noise-sensitive receptors may be present or where noise-sensitive activities may occur. These areas may require special consideration to achieve protection from excessive noise. Noise-sensitive land uses include residences, schools, hospitals, and retirement homes. Noise-sensitive activities occur in locations such as churches, libraries and recreational areas. No hospitals, medical centers, daycare facilities, colleges, or schools are located near the project sites.

Tesla Portal Site

The noise-sensitive receptors in the vicinity of the Tesla Portal site consist of the residential community of Chrisman approximately 0.75 miles to the east, a residence approximately 2,500 feet to the southeast, and the onsite caretaker's residence.

Thomas Shaft Site

The only noise-sensitive receptor in the vicinity of the Thomas Shaft site consists of a residence approximately 1.25 miles to the northeast. The Lawrence Livermore National Laboratory (LLNL) Site 300, at the intersection of Thomas Shaft Road and Corral Hollow Road, is about 1.5 miles to the north. LLNL Site 300 contains a variety of office buildings and other structures; however, this is not considered a noise-sensitive receptor.

Ambient Noise Levels

An ambient noise survey was not conducted at either the Tesla Portal or Thomas Shaft sites or at any noise-sensitive receptors. However, expected noise levels at those locations can be estimated based on the types of noise sources and distances to those sources using the FTA Transit Noise and Vibration Impact Assessment Manual (U.S. Department of Transportation, Federal Transit Administration 2006). Existing noise levels are estimated by first examining the site's proximity to major roads and railroad lines. If these noise sources are far enough away that ambient noise is dominated by local streets and community activities, the estimate is made based on population density. The decision of which to use is made by comparing the noise levels from each of the three categories, roadways, railroads and population density, and selecting the highest level. The table used to estimate existing noise levels from the FTA Manual is provided below (Table 4.10-4).

Table 4-10.4
Estimate of Typical Roadway Noise Levels

Distance from Major Noise Source[1] (ft)		Population Density (people per sq mile)	Noise Exposure Estimates			
Interstate Highways[2]	Other Roadways[3]		L_{eq} Day	L_{eq} Evening	L_{eq} Night	L_{dn}
10-50			75	70	65	75
50-100			70	65	60	70
100-200			65	60	55	65
200-400			60	55	50	60
400-800			55	50	45	55
800 and up			50	45	40	50
	10-50		70	65	60	70
	50-100		65	60	55	65
	100-200		60	55	50	60
	200-400		55	50	45	55
	400 and up		50	45	40	50
			--	--	--	75
			--	--	--	70
			--	--	--	65
			--	--	--	60
			--	--	--	55
			--	--	--	50
			--	--	--	45
		1-100	35	30	25	35
		100-300	40	35	30	40
		300-1,000	45	40	35	45
		1,000-3,000	50	45	40	50
		3,000-10,000	55	50	45	55
		10,000-30,000	60	55	50	60
		30,000 and up	65	60	55	65

[1] Distances to not include shielding from intervening rows of buildings. General rule for estimating shielding attenuation in populated areas: Assume 1 row of buildings every 100 ft; -4.5 dB for first row, -1.5 dB for every subsequent row up to a maximum of -10 dB attenuation.
[2] Roadways with 4 or more lanes that permit trucks, with traffic at 60 mph.
[3] Parkways with traffic at 55 mph, but without trucks, and city streets with the equivalent of 75 or more heavy trucks per hour and 300 or more medium trucks per hour at 30 mph.
Source: U.S. Department of Transportation, Federal Transit Administration, 2006

Tesla Portal Site

At the Tesla Portal site, existing noise sources consist of the existing water system facilities, including two diesel standby generators and an engine pump; vehicle noise from truck deliveries and workers' vehicles; ranching or farming-related equipment; and vehicle traffic along roadways such as Interstate 580 (I-580), which is approximately 2,600 feet from the property's northern property boundary. Based on the distance from the major highway (I-580), existing noise levels for the Tesla Portal site and all noise-sensitive receptors except for Chrisman were determined assuming a population density of 300 to 1,000 people per square mile. Using this population density, existing noise levels are expected to be approximately 45 dBA L_{dn} (45 dBA L_{eq} daytime, 40 dBA L_{eq} evening, and 35 dBA L_{eq} night) (See Table 4.10-1 for definition of terms). Existing noise levels in the community of Chrisman are expected to be slightly higher because they are located closer to I-580: 50 dBA L_{dn} (50 dBA L_{eq} daytime, 45 dBA L_{eq} evening, and 40 dBA L_{eq} night.

Thomas Shaft Site

At the Thomas Shaft site, existing noise sources consist of the existing water system facilities, including an intermittently operating generator; some vehicle noise from truck deliveries and workers' vehicles; and ranching or farming-related equipment. Because the site is situated in an even more remote rural area than the Tesla Portal site, expected noise levels were estimated using a population density of 100 to 300 people per square mile. Existing noise levels are expected to be 40 dBA L_{dn} (40 dBA L_{eq} daytime, 35 dBA L_{eq} evening, and 30 dBA L_{eq} night).

4.10.2 Regulatory Framework

Noise

Noise standards typically are promulgated at the local level. However, federal and state agencies provide standards and guidelines to local jurisdictions. Local noise issues are addressed through implementation of general plan policies, including noise and land use compatibility guidelines, and through enforcement of noise ordinance standards. General plan policies provide guidelines for determining whether a noise environment is appropriate for a proposed or planned land use. Noise ordinances regulate noise sources, such as mechanical equipment and amplified sounds, as well as prescribe hours of heavy equipment operation. In most cases, noise ordinances are part of local building and zoning ordinances of other jurisdictions; these building and zoning ordinances do not apply to SFPUC projects outside of City and County of San Francisco (CCSF) boundaries (refer to Section 4.2, Plans and Policies). However, time and noise limits prescribed in local noise ordinances are used in this EIR as criteria to determine the significance of project impacts under CEQA.

San Joaquin County Noise Limits

The project sites are located in unincorporated San Joaquin County. The San Joaquin County Development Title implements the land use policies of the San Joaquin County General Plan and functions as the County's zoning ordinance, containing regulations governing the use of land and improvement of real property within zoning districts. The County Development Title limits construction activities to specific hours of the day, and specifies noise limits for the operation of stationary equipment.

Construction Noise

The County Development Title does not specify noise exposure limits for construction activities, but construction activities are limited to between 6:00 a.m. and 9:00 p.m., on both weekdays and weekends (San Joaquin Development Title, Section 9-1025.9(c)(3)).

No sound level limits for construction noise are set in the San Joaquin County Development Title. Where no noise limits are specified for construction noise, a significant noise impact can be defined as interference with human activities during the day and night. One indicator that construction noise could interfere with daytime activities would be speech interference, and an indicator that construction noise could interfere with nighttime activities would be sleep interference. Nighttime is defined as activities taking place between 10:00 p.m. and 7:00 a.m.

Speech interference is an indicator of impact on typical daytime and evening activities. A speech interference criterion, in the context of impact duration and time of day, is used to identify a significant noise impact from temporary construction activities. Noise peaks generated by construction equipment could result in speech interference in adjacent buildings if the noise level in the interior of the building exceeds 45 to 60 dBA.[1] A typical building can reduce noise levels by 25 dBA with the windows closed (U.S. EPA, 1974). This noise reduction could be maintained only on a temporary basis in some cases, since it assumes windows must remain closed at all times. Assuming a 25-dBA reduction with the windows closed, an exterior noise level of 70 dBA L_{eq} at receptors would maintain an acceptable daytime interior noise environment of 45 dBA. It should be noted that such noise levels would be sporadic rather than continuous, because different types of construction equipment would be used throughout the construction process.

Noise peaks generated by construction at night could result in sleep interference in adjacent buildings if the noise level in the interior exceeds an interior level of 35 dBA (U.S. EPA, 1974). Assuming a 25-dBA reduction with the windows closed used for the speech interference criterion, an exterior noise level of 60 dBA L_{eq} at receptors would maintain an acceptable interior nighttime noise environment.

Transportation Noise

The County Development Title specifies L_{dn} limits for transportation noise sources. These limits would apply to the traffic associated with construction activities at both sites. The standard applicable to residential land uses is an L_{dn} of 65 dBA (San Joaquin Development Title, Table 9-1025.9, Part I).

Operational Noise

The County Development Title specifies L_{eq} limits for stationary noise sources. These limits would apply to the water treatment equipment that would be installed at the Tesla Portal and Thomas Shaft sites under the proposed project. Table 4.10-5 identifies the County's maximum allowable noise exposure from a stationary source.

[1] For indoor noise environments, the highest noise level that permits relaxed conversation with 100 percent intelligibility throughout the room is 45 dBA. Speech interference is considered to become intolerable when normal conversation is precluded at 3 feet, which occurs when background noise levels exceed 60 dBA. For outdoor environments, the highest noise level that permits normal conversation at 3 feet with 95 percent sentence intelligibility is 66 dBA (U.S. EPA, 1974).

TABLE 4.10-5
SAN JOAQUIN COUNTY MAXIMUM ALLOWABLE NOISE EXPOSURE – STATIONARY NOISE SOURCES

	Outdoor Activity Areas Daytime (7:00 A.M. to 10:00 P.M.)[1,2]	Outdoor Activity Areas Nighttime (10 P.M. to 7:00 A.M.)[1,2]
Hourly Equivalent Sound Level (L_{eq}), dBA	50	45
Maximum Sound Level (L_{max}), dBA	70	65

Notes:
1. Where the location of outdoor activity areas is unknown or is not applicable, the noise standard shall be applied at the property line of the receiving land use. When determining the effectiveness of noise mitigation measures, the standards shall be applied on the receiving side of noise barriers or other property line noise mitigation measures.
2. Each of the noise level standards specified shall be reduced by 5 dBA for impulsive noise, single tone noise, or noise consisting primarily of speech or music.

Source: San Joaquin County Development Title, Table 9-1025.9, Part II.

Occupational Noise Standards

Federal Occupational Safety and Health Administration

Under the Occupational Safety and Health Act of 1970 (29 USC Section 1919 et seq.), the Federal Occupational Safety and Health Administration (OSHA) has adopted regulations designed to protect workers against the effects of occupational noise exposure. These regulations list permissible noise level exposure as a function of the amount of time during which the worker is exposed. The noise exposure level of workers is regulated at 90 dBA over an 8-hour work shift (29 Code of Federal Regulations 1910.95); higher levels are permissible for shorter periods of time. If employees are exposed to levels exceeding 85 dBA for 8 hours, employers must develop a hearing conservation program. Such programs include monitoring the noise to which workers are exposed, making workers aware of overexposure to noise, and periodically testing the workers' hearing to detect hearing loss.

California Occupational Safety and Health Administration

Occupational noise exposure is regulated by California Occupational Safety and Health Administration (Cal-OSHA), which has promulgated Occupational Noise Exposure Regulations (California Code of Regulations, Title 8, Sections 5095-5099). These regulations set employee noise exposure limits and are equivalent to the Federal OSHA standards described above.

Vibration

The FTA has identified criteria for assessing the impacts of ground-borne vibration associated with rail and transit construction projects, which have been applied by other jurisdictions to other types of projects. The FTA measure of the threshold for architectural damage for sensitive structures is 0.2 in/sec PPV. The threshold of perception is 0.01 in/sec PPV (U.S. Department of Transportation, Federal Transit Administration, 2006).

The NPS has published guidelines for assessing the impact of vibration on historic structures (NPS, 1984). The NPS measure is 0.2 in/sec PPV for historic or architectural structures and 0.5 in/sec PPV for all other historic sites.

4.10.3 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to noise, but generally considers that implementation of the proposed project would have a significant noise impact if it were to:

- Expose people to or generate noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies
- Expose people to or generate excessive groundborne vibration or groundborne noise levels
- Create a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project
- Create a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project
- For a project located within an area covered by an airport land use plan (or, where such a plan has not been adopted, within two miles of a public airport or public use airport), expose people residing or working in the project area to excessive noise levels
- For a project within the vicinity of a private airstrip, expose people residing or working in the project area to excessive noise levels
- Be substantially affected by existing noise levels

For this project, potential significant impacts were evaluated using the following standards from the San Joaquin Development Title, Section 9:

- Proposed project construction activities would create unacceptable (70 dBA L_{eq} daytime, 60 dBA L_{eq} nighttime) short-term sound levels at noise-sensitive receptors.
- Proposed project generated traffic would result in sound levels exceeding 65 dBA L_{dn} at residential land uses as recommended in the San Joaquin County Development Title
- Stationary sources would result in noise levels at sensitive receptors exceeding hourly levels of 50 dBA L_{eq} (daytime) or 45 dBA L_{eq} (nighttime)
- Proposed project-generated vibration would exceed 0.2 in/sec PPV at sensitive structures

Areas of No Project Impact

Several of the criteria listed above are *not applicable* to the proposed project, as there either is no potential for the impact to occur, or the applicable environmental resource does not occur within the study area or the area of potential effect. As discussed above, neither site is located within two miles of a public airport or public use airport or is in an area covered by an airport land use plan, and neither site is located in the vicinity of a private airstrip. In addition, the noise sources in the vicinity of project sites would have no impact upon project construction or operation. The project sites are primarily used as water treatment facilities, which are not considered sensitive receptors. Implementation of the proposed project would not alter land uses adjacent to the project site. Project construction at the Thomas Shaft site would not require soil hauling, as no grading would be needed and vehicle trips are estimated to be low during both the six-month construction period; therefore, no impacts to sensitive receptors from noise along construction truck routes would occur. Also at the Thomas Shaft site, given the types of equipment that would be used and the distance to the nearest sensitive receptors, vibration impacts to offsite receptors would be less than 0.2 in/sec PPV from activities and, thus, the project would not cause disturbances due to construction-related vibrations. Therefore, the proposed project would have no impact with respect to these significance criteria.

Approach to Analysis

This analysis assesses potential noise and vibration impacts from construction activities, construction traffic, and operations of the proposed project. For construction noise and vibration, the potential for impact is defined by the proximity of sensitive receptors, typical noise and vibration levels associated with construction equipment, the potential for construction noise levels to interfere with daytime and nighttime activities, whether construction noise audible to nearby receptors will occur outside of construction time limits specified in local ordinances, or whether vibration levels are expected to exceed 0.2 in/sec PPV at sensitive structures. For operational noise, the potential for impact is defined by the proximity of sensitive receptors to the proposed facilities, and the potential for operational noise to remain within noise ordinance limits at the nearest receptors.

Construction Impacts

Impact 4.10-1: Disturbance from temporary construction-related noise increases (Tesla Portal: PSM; Thomas Shaft: LS)

Construction activities associated with the project would result in a short-term, temporary increase in the ambient noise level. Noise would result from operation of the construction equipment. The increase in noise level would be primarily experienced close to the noise source. The magnitude of the impact would depend on the type of construction activity, noise level generated by various pieces of construction equipment, duration of the construction phase, and distance between the noise source and receiver. Table 4.10-6 shows maximum noise levels generated by typical construction equipment. Sound levels of typical construction equipment range from approximately 65 dBA to 95 dBA at 50 feet from the source, with an average level of 89 dBA at 50 feet during the noisiest activities (U.S. Environmental Protection Agency [U.S. EPA], 1971). This analysis will use 89 dBA at 50 feet as the reference noise level for construction noise for both daytime and nighttime noise.

Acoustical calculations were performed to estimate noise from construction activities at the closest residences. Noise from the activity was assumed to have point source acoustical characteristics. Generally, a point source sound diminishes at a rate of 6 dB per doubling of distance from the source. This is a logarithmic relationship that does not take into account the type of ground surface the sound travels over. The calculations are based on the formula below (Harris, 1998):

$$SPL_2 = SPL_1 - 20\log\left(\frac{d_2}{d_1}\right), \text{ where:}$$

SPL_1 = known sound level,

SPL_2 = desired sound level,

d_1 = known distance, and

d_2 = desired distance.

TABLE 4.10-6
TYPICAL NOISE LEVELS AND ABATEMENT POTENTIAL OF CONSTRUCTION EQUIPMENT NOISE AT 50 FEET (IN dBA)

	Noise Level at 50 Feet		Expected Equipment at Each Site[b]	
Equipment	**Without Controls[a]**	**With Controls[a]**	**Tesla Portal**	**Thomas Shaft**
Earthmoving				
Front Loaders	79	75	X	X
Backhoes	80	75	X	X
Dozers	80	75	X	X
Graders	85	75	X	X
Trucks	91	75	X	X
Materials Handling				
Concrete Mixers	85	75	X	
Concrete Pumps	82	75	X	
Crane, Mobile	83	75	X	X
Crane, Derrick	88	75	X	
Stationary				
Pumps	76	75	X	X
Generators	78	75	X	X
Compressors	81	75	X	
Impact				
Jack Hammers	88	75	X	X
Pneumatic Tools	86	80	X	X
Other				
Vibrators	76	75	X	X

[a] Estimated levels can be obtained by selecting quieter procedures or machines and implementing noise-control features that do not require major redesign or extreme cost (e.g., improved mufflers, equipment redesign, use of silencers, shields, shrouds, ducts and engine enclosures).
[b] All equipment could be used during either day or nighttime work.

Source: U.S. Environmental Protection Agency, 1971; U.S. Department of Transportation, Federal Transit Administration, 2006

SFPUC Standard Construction Measure #6 for noise requires compliance with local noise ordinances regulating construction to the extent feasible.

Most construction activities from the project would not occur between 9:00 p.m. and 6:00 a.m. which is in accordance with the San Joaquin County noise ordinance construction time limits. However, some activities could occur at night, particularly during the tie-ins, as described in Section 3.3.1.

Tesla Portal Site

Apart from the movement of construction materials, construction activities for the proposed project would take place within the boundaries of the Tesla Portal site.

Typical noise levels for these equipment types can be found in Table 4.10-6.

Offsite Sensitive Receptors: The offsite noise-sensitive receptors in the vicinity of the Tesla Portal site consist of the residential community of Chrisman approximately 0.75 mile to the east, a residence approximately 2,500 feet to the southeast, and several uninhabited ranch structures approximately 750 feet to the west. Based on the distance from the proposed construction activities, resulting hourly sound levels at the community of Chrisman and the residence to the southeast would average approximately 55 dBA and levels at the ranch structures to the west would be approximately 65 dBA. Because of the intermittent nature of construction work, the energy average sound level for an 8-hour workday would be expected to be substantially less than predicted.

The estimated noise levels at the residences would be below the daytime speech interference criterion of 70 dBA and the nighttime sleep interference criterion of 60 dBA; therefore, there would be a less-than-significant impact for offsite sensitive receptors. Estimated noise levels at the ranch structures would exceed the sleep interference criterion; however, impacts would be less-than-significant because they are uninhabited. Moreover, actual noise levels at the receptors would be less than predicted with the implementation of SFPUC Standard Construction Measure #6 that requires contractors to undertake efforts to minimize any noise disruption to nearby neighbors and sensitive receptors during construction.

Onsite Sensitive Receptors: Even with the incorporation of noise reduction techniques on equipment, noise levels would often be above the speech and sleep interference criteria at the caretaker's residence at Tesla Portal. Given the proximity of the caretaker's residence to the proposed construction areas at Tesla Portal, construction-related noise would likely be beyond what is acceptable and, therefore, would be a potentially significant impact. Mitigation Measure 4.10-1, which requires this residence be vacated during construction activities that would exceed the speech and sleep interference criteria, would reduce potentially significant noise impacts to a less-than-significant level.

Noise levels generated by individual pieces of equipment, including those with noise controls, could exceed OSHA and Cal-OSHA standards for workers in the immediate vicinities of such equipment. Compliance with regulatory standards would ensure that workers would be adequately protected from potential noise hazards. For example, areas with decibel levels above 85 dBA would be posted as high-noise level areas, and hearing protection would be required.

Thomas Shaft Site

Apart from the movement of construction materials, construction activities at the Thomas Shaft site would be within site boundaries. Fewer types of construction equipment would be required for construction at the Thomas Shaft site than the equipment listed above for construction at the Tesla Portal site, and the construction period would be limited to six months, compared to the two-year construction period at the Tesla Portal site.

Typical noise levels for this equipment are found in Table 4.10-6. The only sensitive receptor in the immediate vicinity of the Thomas Shaft site is a rural residence located about 1.25 miles to the northeast of the Thomas Shaft site. Based on the distance from the proposed construction activities, sound levels at the residence to the northeast would be 47 dBA. This estimated level would be below the daytime speech interference criterion and the nighttime sleep interference criterion. Furthermore, because the Thomas Shaft site is separated by hills from the sensitive receptor, noise generated by construction activities would likely not be audible. Therefore, construction noise is considered to be less than significant.

No employees are stationed at the Thomas Shaft site. Regarding construction workers, similar considerations would apply to occupational noise as discussed above for the Tesla Portal site, therefore, the impact is considered to be less than significant.

Impact 4.10-2: Temporary noise disturbance along construction haul routes (Tesla Portal: LS; Thomas Shaft: LS)

Construction-related vehicle trips that would occur as a result of the proposed project would include construction workers traveling to and from the project sites, and materials and equipment deliveries. Truck noise is the major potential contributor to noise impacts along haul routes. A traffic analysis was conducted to determine the potential traffic impacts on the local circulatory system due to the project (see Section 4.8, Traffic, Transportation and Circulation). The Federal Highway Administration (FHWA) Traffic Noise Model Version 2.5 Look-Up is a Windows-based program that calculates highway traffic noise for an infinitely long, straight roadway over flat ground, with a receiver set at a height of 5 feet above the ground. This program was used to calculate existing and existing with project noise levels at 50 feet from the centerline of the roadways for the purpose of estimating the change in sound level resulting from the project at offsite receptors.

Calculations were performed for a distance of 50 feet from I-580, SR 32, West Vernalis Road, South Chrisman Road, Corral Hollow Road, and Thomas Shaft Road. The actual sound level at receptor locations is dependent on such factors as the source-receptor distance and the presence of intervening structures, barriers, and topography. The modeling effort considered estimated average vehicle speed and the average daily traffic (ADT). The following assumptions were included in the model for existing conditions: (1) peak hour traffic volume is 10 percent of the ADT; (2) truck mix of 16 percent for I-580, 25 percent for SR 32, and 5 percent for all other roads; and (3) average speeds of 65 miles per hour (mph) on I-580, 55 mph on SR 32, and 35 mph on all other roads. The following assumptions were included in the model for project-generated traffic: (1) approximately 65 percent of the ADT was heavy trucks; (2) trucks would operate between 6:00 a.m. and 9:00 p.m.; (3) trucks would be evenly distributed over the 15-hour period; and (4) average speeds were the same as for existing conditions.

The model also assumed "hard" site propagation conditions, i.e., a paved surface such as roadways, parking lots, or hard-packed graded lots. Generally, a hard site propagation rule diminishes traffic sound from a source to a receiver at a rate of 3 dB per doubling of distance from the source. This is a logarithmic relationship that applies to the propagation of sound waves with no ground interaction or the interaction with a hard surface.

Tesla Portal Site

The access route for the Tesla Portal site includes I-580, Chrisman Road, and West Vernalis Road. As discussed in Section 4.8, Traffic, Transportation and Circulation, construction activities would result in a temporary addition of 25-30 roundtrips (50 to 60 daily construction trips) for approximately 24 months. The single-day peak number of construction trips, including estimated daily construction and single-day concrete delivery, would be 340 trips (170 round trips) on concrete pouring days. Calculations were performed for both average and peak construction trip scenarios. Table 4.10-7 summarizes the results of the calculations. A review of the table shows that sound levels would increase by less than 1 dBA on I-580 and SR 132 by 7 dBA on West Vernalis Road, and by 4 dBA on South Chrisman Road with peak trips and by less than 3 dBA for all roadways with average construction trips.

Table 4.10-7 shows that calculated sound levels with and without the project along all roadways except I-580 and SR 132 would remain below the 65 dBA community noise equivalent level (CNEL) threshold at residential uses. The table also shows that sound levels would increase by less than 1 dBA along I-580 or SR 132, which would be imperceptible. Additionally, SFPUC Standard Construction Measure #6 for noise would be applied. Therefore, impacts to residences along these roadways are considered less than significant.

TABLE 4.10-7
CALCULATED TRAFFIC SOUND LEVELS AT 50 FEET FROM ROADWAYS (DBA CNEL)

Roadway	Existing		With Project (Peak Trips)[1]			With Project (Average Trips)[2]		
	ADT[3]	Calculated Level (dBA CNEL)[4]	ADT	Calculated Level (dBA CNEL)	Delta	ADT	Calculated Level (dBA CNEL)	Delta
Tesla Portal Site								
Interstate 580	31550	80.7	31890	80.8	0.10	31610	80.7	0.0
State Route 32	19500	77.8	19840	77.9	0.10	19560	77.8	0.0
West Vernalis Road	400	52.6	740	59.3	6.70	460	54.8	2.2
South Chrisman Rd	1140	57.1	1480	60.7	3.60	1200	58.0	0.9
Thomas Shaft Site								
Corral Hollow Road	3474	62.0	3486	62.0	0.00	3476	62.0	0.0
Thomas Shaft Road	11	36.8	23	44.3	7.50	13	39.5	2.7

[1] Peak trips based on 170 roundtrips (340 trips) per day for Tesla Portal site and 5 roundtrips (10 trips) per day for Thomas Shaft site
[2] Average trips based on 30 roundtrips (60 trips) per day for Tesla Portal site and 2 trips per day for Thomas Shaft site
[3] ADT = Average daily traffic
[4] dBA CNEL = A-weighted decibel, community noise equivalent level
[5] Delta is difference between with project ADT (average and peak trips) and existing ADT

Thomas Shaft Site

The access route for the Thomas Shaft site includes Corral Hollow Road and Thomas Shaft Road. As discussed in Section 4.8, construction activities would result in a temporary addition of two daily construction trips for approximately 6 months. The single-day peak number of construction trips would be 10 trips on concrete pouring days. Calculations were performed for both average and peak construction trip scenarios. Table 4.10-7 summarizes the results of the calculations. A review of the table shows that sound levels along all roadways would not increase on Corral Hollow Road for peak or average trips, and would increase by 3 dBA or 8 dBA for average or peak trips, respectively, on Thomas Shaft Road. However, because there are no residences on Thomas Shaft Road, impacts are considered less than significant.

Table 4.10-7 shows that calculated sound levels with and without the project along all roadways would remain below the 65 dBA CNEL threshold at residential uses on Corral Hollow Road. In addition, SFPUC Standard Construction Measure #6 would be implemented. Therefore, impacts to residences along this roadway are considered less than significant.

Impact 4.10-3: Disturbance due to construction-related vibration (Tesla Portal: PSM; Thomas Shaft: N/A)

Some construction equipment can cause vibration that could disturb local residents and cause cosmetic damage to buildings and structures. Therefore, vibration from equipment proposed for this project was analyzed to determine the potential impact to neighbors and structures.

Table 4.10-8 presents the vibration levels generated by different types of construction equipment. The highest level of vibration for proposed construction is generated by large bulldozers, which generate approximately 87 VdB or 0.089 in/sec PPV. This level was used to estimate vibration levels at sensitive receptors. Vibration propagates according to the following expression, based on point sources with normal propagation conditions (U.S. Department of Transportation, Federal Transit Administration, 2006):

$$PPV_{equip} = PPV_{ref}\left(\frac{D_{ref}}{D}\right)^{1.5}$$

where: PPV_{equip} = the peak particle velocity in in/sec of the equipment adjusted for distance
PPV_{ref} = the reference vibration level in in/sec at 25 feet
D_{ref} = the reference distance
D = the distance from the equipment to the receiver

TABLE 4.10-8
VIBRATION LEVELS FOR CONSTRUCTION EQUIPMENT AT 25 FEET

Equipment[a]	PPV at 25 Feet (in/sec)	VdB at 25 feet
Large Bulldozer	0.089	87
Loaded Trucks	0.076	86
Jackhammer	0.035	79
Small Bulldozer	0.003	58

Notes: Vibration levels for construction equipment at 25 feet are based on measured data near various types of equipment and assume normal propagation conditions.

It should be noted that vibration propagation characteristics would depend on a number of factors, including the type and condition of geologic materials, depth of construction, and type of construction equipment and activity.

Source: U.S. Department of Transportation Federal Transit Administration, 2006.

Tesla Portal Site

Based on an upper limit vibration level of 0.089 in/sec at 25 feet from a large bulldozer and the general FTA vibration propagation formula given above, at the closest offsite sensitive receptors (uninhabited ranch structures) at 750 feet, the equipment would generate a velocity level of less than 50 VdB or a PPV of 0.00054 in/sec. At the onsite caretaker's residence (40 feet from equipment), the vibration levels would be 0.044 in/sec PPV and 55 VdB. The vibration level is acceptable for both humans and structures; therefore impacts are considered to be less than significant.

As discussed in Section 4.7, Cultural Resources, the Southwest Valve House and the portions of the San Joaquin Pipelines 1 and 2 located at the Tesla Portal site would be eligible for listing on

the National Register of Historic Places and the California Register of Historic Resources. Construction activities at the Tesla Portal site would take place approximately 25 feet from the Southwest Valve House. Based on an upper vibration level of 0.089 in/sec at 25 feet from a large bulldozer, which is below the 0.2 in/sec PPV threshold for sensitive structures, impacts would be less than significant.

As described in Section 3.3.1, the tie-in of the proposed UV Building to San Joaquin Pipelines 1 and 2 would require cutting into pipelines and connecting a new manifold. Due to the proximity of the construction activity, vibration levels are expected to exceed the 0.2 in/sec threshold for sensitive structures and, therefore, would be a potentially significant impact. Mitigation Measure 4.10-2, which requires the construction contractor to conduct work in a manner that maintains the structural integrity of the pipelines, would reduce potentially significant vibration impacts to a less-than-significant level.

Operational Impacts

Impact 4.10-4: Disturbance due to long-term noise increases associated with operation of project facilities (Tesla Portal: LS; Thomas Shaft: LS)

Tesla Portal Site

Operational noise at Tesla Portal would consist of noise generated by the addition of up to two diesel standby power generators. The proposed generators would be used infrequently, and only during power outages and for periodic testing, which would be conducted during daytime hours. Although the new UV equipment would operate 24 hours/day, the equipment would be located within the proposed UV building and would not be audible outside of the building. Due to the distance to the offsite sensitive receptors, noise from these sources would be below the San Joaquin County noise limit of 50 dBA L_{eq}, and would not represent a substantial increase in the ambient noise level at the site. Therefore, impacts would be less than significant.

Thomas Shaft Site

Thomas Shaft is not located near any noise-sensitive land uses, and potential operational noise from the proposed UV reactors would be negligible given that they would be enclosed within the existing Chlorination Facility building. The two new pumps would be installed 300 feet below ground and would not be audible at the ground surface. Therefore, operational noise associated with the proposed facilities would be less than significant.

4.10.5 References

California Department of Transportation (Caltrans), Technical Noise Supplement, a Technical Supplement to the Traffic Noise Analysis Protocol, October 1998.

Harris, Cyril M., ed., Handbook of Acoustical Measurements and Noise Control. Third edition. McGraw-Hill, Inc. New York, NY. 1998.

National Park Service (NPS), Assessing the Effect of Vibration on Historic Buildings, Bulletin for the Association for Preservation Technology Volume XVI No. 3 and 4, 1984.

San Joaquin County Development Title, Table 9-1025.9, Part II, 1999.

U.S. Department of Housing and Urban Development, Office of Community Planning and Development, The Noise Guidebook, 1985.

U.S. Department of Transportation, Federal Transit Administration (FTA), Transit Noise and Vibration Impact Assessment, FTA-VA-90-1003-06, May 2006.

U.S. Environmental Protection Agency (U.S. EPA), Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances, December 1971.

U.S. EPA, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety (Condensed Version), Washington D.C. (EPA/ONAC 550/9-74-004), 1974.

4.11 Public Services and Utilities

4.11.1 Setting

Water Service

The San Francisco Public Utilities Commission (SFPUC) provides water delivery services to retail and wholesale customers, primarily in San Francisco, San Mateo, Santa Clara, and Alameda counties, as well as isolated regional retail customers along the water system. The SFPUC currently provides potable water to the Tesla Portal site. No potable water is currently supplied to the Thomas Shaft site, but there is a 5,000-gallon water tank and pump for fire protection.

SFPUC has a contractual agreement with Lawrence Livermore National Laboratory (LLNL), one of the SFPUC's retail customers, to deliver drinking water to LLNL Site 200 from Mocho Shaft and to LLNL Site 300 from Thomas Shaft, under which the maximum rate of flow contracted will not exceed 0.8 million gallons per day (mgd). To assist in water delivery to Site 300, LLNL installed a ten-inch water line and pumps in 1995 across Thomas Shaft Road from the existing Chlorination Facility. However, currently, the SFPUC supplies LLNL only from Mocho Shaft because water from Thomas Shaft does not meet the Surface Water Treatment Rule (SWTR) for *Giardia* inactivation. The current water supply for Site 300 comes from onsite wells[1] serving a population of about 250 workers and visitors.

Law Enforcement Services

The San Joaquin County Sheriff's Department provides law enforcement services within San Joaquin County, including the Tesla Portal and Thomas Shaft sites. The Sheriff's Department is headquartered in French Camp, approximately five miles south of Stockton. The Sheriff's Department serves approximately 138,400 people in unincorporated San Joaquin County and has approximately 815 permanent positions. The County is generally a low-crime area with the most common crimes being thefts and burglaries (San Joaquin County Sheriff's Department, 2007b).

Fire Protection Services

The City of Tracy Fire Department provides both fire protection and emergency medical services to the project sites. The Fire Department employs 60 professional firefighters and approximately 30 reserve firefighters and maintains eight fire stations, two of which are located near the project sites at 7700 Linne Road (Station 95) and 1551 Durham Ferry Road (Station 93).

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1 The wells are owned by the Department of Energy/National Nuclear Security Administration, and operated by Lawrence Livermore National Security, LLC (LLNS), the contractor in charge of LLNL. LLNS is a limited liability corporation made up of Bechtel National, Inc., the University of California, BWX Technologies, Inc., and the Washington Group International, Inc. The team also includes Battelle Memorial Institute, four small business subcontractors, and Texas A&M University.

Station 95, which is approximately four miles from the Tesla Portal site and eight miles from the Thomas Shaft site, currently serve the project site and would continue to do so in the future. Station 95 has a 1984 Van Pelt 1,500 gallons per minute (gpm) Type 1 Pumper and 2000 Ford F-550 Type 4 Pumper in reserve status. Type I fire engines are designed to protect structures, with the ability to pump 1,250 gpm. Type IV fire engines are designed to fight wildfires, and carry 400 gallons of water and 20 gallons of wildland firefighting foam (City of Tracy Fire Department, 2007).

Station 93, located at 1551 Durham Ferry Road in New Jerusalem, is approximately 5 ½ miles from the Tesla Portal site and 10 miles from the Thomas Shaft site. Station 93 houses a 1997 American La France/High Tech (Engine 93) (City of Tracy Fire Department, 2007).

Solid Waste Management

Solid waste in San Joaquin County is taken by collection agencies and individuals either directly to landfills or to transfer stations, which accumulate waste for later transport to landfills. There are three active landfills within San Joaquin County: Foothill Sanitary Landfill, Forward Landfill, Inc., and North County Landfill. The closest landfill to the project sites is the Forward Landfill, located on Waverly Road. The Forward Landfill opened in 1973 and has a total capacity of 51,040,000 cubic yards of waste. With 78.4 percent capacity remaining, it is not scheduled to close until the year 2020 (CIWMB, 2007a). Table 4.11-1 identifies active landfills in San Joaquin County and the types of waste they accept.

Wastewater

Wastewater is collected, treated, and disposed of in San Joaquin County in two ways: community collection and treatment systems and individual onsite treatment systems (San Joaquin County General Plan, 2007). Septic tank systems are the major means of onsite wastewater treatment and disposal in rural areas of San Joaquin County. Septic tanks are onsite systems that receive wastewater, allow heavier solids to settle in a tank, and release the remainder of the effluent to leach fields. The leach fields consist of perforated lines through which the wastewater percolates into the soil. The remaining solids must be periodically pumped from the tank and disposed. There is an existing septic tank and leachfield serving onsite structures at the Tesla Portal site; there are no wastewater disposal facilities at the Thomas Shaft site (there are no restroom facilities onsite).

TABLE 4.11-1
ACTIVE LANDFILLS WITHIN SAN JOAQUIN VALLEY

Active Landfills	Total Estimated Permitted Capacity[a] (cubic yards)	Remaining Estimated Capacity (cubic yards)	Remaining Capacity Date[b]	% Remaining Capacity	Closure Date	Waste Types Accepted/Permitted
Foothill Sanitary Landfill	102,000,000	94,969,466	As of 6/1/2005	93.1%	1/1/2054	Agricultural, construction/ demolition, industrial, mixed municipal, tires, wood waste
Forward Landfill, Inc.	51,040,000	40,031,058	As of 1/1/2002	78.4%	1/1/2020	Agricultural, asbestos, asbestos friable, ash, construction/demolition, contaminated soil, green materials, industrial, mixed municipal, sludge (biosolids), tires, shreds
North County Landfill	17,300,000	13,239,032	As of 9/1/2004	76.5%	1/1/2035	Agricultural, construction/ demolition, industrial, metals, mixed municipal, other designated, tires, wood waste

a Capacity information from 2000 (California Integrated Waste Management Board [CIWMB], 2007b)
b Calculated using CIWMB, 2007 data.

Stormwater

Stormwater at the Tesla Portal site drains off of the paved surfaces to the adjacent open fields. In addition, the site contains an artificial wetland area as well as a small-unnamed ephemeral drainage feature. The wetland area is approximately 0.308 acre in size and was created in upland habitat from the release of untreated sample water from the existing Tesla Portal facilities. The ephemeral drainage is located in the southern border of the site and is approximately 1.5 feet wide. The ephemeral drainage is a product of rainfall in the nearby hills and it is also used as a drainage outlet for emergency releases from an SFPUC overflow shaft. The overflow shaft releases overflow water from the Coast Range Tunnel at elevation 501 feet into a concrete spillway that drains to the ephemeral drainage.

At the Thomas Shaft site, surface runoff currently drains to the open areas on the site adjacent to paved surfaces.

Electricity

The SFPUC Power Enterprise provides electric power services for SFPUC facilities, primarily from power generation by the SFPUC's hydroelectric facilities in the Hetch Hetchy system. Some SFPUC sites, including both Tesla Portal and Thomas Shaft sites, are served and metered by Pacific Gas and Electric through their local distribution line using power from the Hetch Hetchy system. The Hetch Hetchy system comprises 400 megawatts of hydroelectric power generation plants on the Tuolumne River and 150 miles of high-voltage transmission lines linking Hetch Hetchy power to California's electricity grid at Newark. Energy production is discussed in greater detail in Section 4.14, Energy Resources.

Telecommunications

Telephone service is provided by AT&T in San Joaquin County via overhead and underground lines. Telephone service at the Tesla Portal site is provided by AT&T and telephone service at the Thomas Shaft site is provided by LLNL.

4.11.2 Regulatory Framework

California Public Utilities Commission

The California Constitution vests in the California Public Utilities Commission (CPUC) exclusive power and sole authority with respect to the regulation of privately-owned and investor-owned public utilities. This exclusive power extends to all aspects of the location, design, construction, maintenance, and operation of regulated utility facilities. The CPUC has provisions for regulated utilities to work closely with local governments and give due consideration to their concerns.

California Integrated Waste Management Act of 1989

- The California Integrated Waste Management (CIWM) Act of 1989 (Public Resources Code [PRC], Division 30), enacted through Assembly Bill (AB) 939 and modified by subsequent legislation, requires all California cities and counties to implement programs to reduce, recycle, and compost at least 50 percent of wastes by the year 2000 (PRC Section 41780). The state determines compliance with this mandate (which includes both disposed and diverted waste) through a complex formula. This formula requires cities and counties to conduct empirical studies to establish a "base year" waste generation rate against which future diversion is measured. The actual determination of the diversion rate in subsequent years is arrived at through deduction, not direct measurement. Instead of counting the amount of material recycled and composted, the city or county tracks the amount of material disposed at landfills, then subtracts the disposed amount from the base year amount. The difference is assumed to be diverted (PRC Section 41780.2).

In the original determination of their base year generation rate, cities and counties may not count certain diverted materials, including agricultural wastes, scrap metals, discarded major appliances, or inert solids such as rock, concrete, brick, sand, soil, fines, asphalt, and unsorted

construction and demolition waste, unless the city or county can demonstrate that these materials had previously been disposed in a landfill and were now being diverted through a specific action of the city or county (PRC Section 41781.2). In subsequent years, these materials only have an impact on a city's or county's attainment of the diversion mandate if the materials are disposed in landfills. If they continue to be diverted, they are never accounted for.

4.11.3 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to public services and utilities, but generally considers that implementation of a proposed project would have a significant impact if it were to:

- Result in substantial adverse physical impacts associated with the provision of, or the need for, new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any public services such as fire protection, police protection, schools, parks, or other services

- Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board (RWQCB)

- Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects

- Require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects (discussed in Section 4.5)

- Not have sufficient water supply available to serve the project from existing entitlements and resources, or require new or expanded water supply resources or entitlements

- Result in a determination by the wastewater treatment provider that would serve the project that it has inadequate capacity to serve the project's projected demand in addition to the provider's existing commitments

- Be served by a landfill with insufficient permitted capacity to accommodate the project's solid waste disposal needs

- Be out of compliance with federal, state, and local statutes and regulations related to solid waste

- Disrupt operation of or require relocation of regional or local utilities

Areas of No Project Impact

Under some of the significance criteria listed above, there is no potential for the impact to occur with implementation of the proposed project, or the criterion is not applicable to the proposed project, as the applicable environmental resource does not occur within the project area. The project would not increase local population, or otherwise affect the need for fire protection, police protection, schools, parks or other public services.

At the Thomas Shaft site, solid waste generation would be minimal and would occur during the six-month construction period. No demolition is proposed that would generate construction waste, and soil excavation associated with the 150 feet by 3 feet by 3 feet trench between the existing Chlorination Facility building and the Thomas Shaft would be roughly balanced onsite. During project operation, similar to existing conditions, there would be no permanent onsite employees at Thomas Shaft site. Therefore, solid waste generation during construction and operation would not adversely affect landfill capacity in San Joaquin County, nor would it violate any federal, state or local statutes and regulations related to solid waste. There would be no impact with respect to the significance criteria related to solid waste at the Thomas Shaft site.

During project operation, the increase in the number of onsite employees would be minimal (two new employees at the Tesla Portal site and no new employees at the Thomas Shaft site), and the associated increase in the demand for potable water and the generation of wastewater or solid waste would also be minimal. At the Tesla Portal site, wastewater is treated by onsite wastewater treatment/disposal facilities (septic tank and leachfield), and the site is not served by an offsite municipal treatment facility. The project would construct a new septic tank and leachfield at the Tesla Portal site to serve the proposed building, in compliance with applicable individual sewage disposal system permitting requirements described in the San Joaquin County Environmental Health Department's Onsite Wastewater Disposal Standards (San Joaquin County, 2003), and would not discharge wastewater offsite from the Tesla Portal site. No wastewater facilities are proposed at the Thomas Shaft site. At the Tesla Portal site, project operation would not substantially increase water demand because the proposed improvements would result in only three new employees, and the minimal increase in demand would be accommodated by existing onsite systems. No potable water is currently supplied to the Thomas Shaft site, and is not proposed as part of the project. Therefore, project operation would not result in an insufficient water supply at either site.

Project operation would result in a minimal increase in the number of employees as the Tesla Portal site, and no increase at the Thomas Shaft site. The associated incremental increase in solid waste generation would be accommodated by existing services, and would comply with federal, state and local statutes and regulations and would be served by nearby landfills with adequate capacity.

Project operation would not contribute stormwater to any offsite storm drainage facilities, nor would it require the construction of new storm drainage facilities or the expansion of such facilities at either of the project sites. Additionally, the project would not result in service

disruption or relocation of subsurface or above ground utility lines or cables. Therefore, project operation would not result in impacts associated with these significance criteria, and project operational impacts are not discussed further.

Approach to Analysis

One area of focus of this analysis is on temporary construction-related impacts on utility services. Implementation of the project would not have direct, long-term impacts on the demand for public utilities, with the exception of electricity (discussed in Section 4.14, Energy Resources). Long-term electricity use would increase for the proposed project.

The second focus of this analysis is the potential temporary impact on landfill capacity due to the disposal of construction waste from the Tesla Portal site. The largest potential source of solid waste would be removed pipeline segments and asphalt from part of the access road that would be removed at the Tesla Portal site. This analysis assumes that excavated soil would be reused onsite and would not be disposed in landfills.

Construction Impacts

Impact 4.11-1: Potential temporary damage to or disruption of existing regional and local public utilities (Tesla Portal: LS; Thomas Shaft: LS)

The existing facilities at the Tesla Portal and Thomas Shaft sites would be upgraded and expanded to increase system reliability and improve the supply of water to SFPUC customers. These new facilities would be built within the SFPUC's existing property and would not affect offsite utility services. In addition, construction of new facilities at the Tesla Portal site would not interrupt service to existing water supply customers. The system would be shutdown during a regularly scheduled maintenance shutdown from approximately January 5, 2010, to February 16, 2010, which would allow for the tie-in to the new facilities at the Tesla Portal site. However, no interruption to SFPUC water customers would result, as they would continue to be served by other system sources. At the Thomas Shaft site, no on or offsite utilities would be affected. Therefore, potential impacts to existing regional and local public utilities would be less than significant.

Impact 4.11-2: Temporary adverse effects on solid waste landfill capacity (Tesla Portal: LS; Thomas Shaft: N/A)

Construction of the proposed project at the Tesla Portal site would generate solid waste during construction. Potential solid waste materials include construction debris, pipeline segments that would be removed and replaced, and asphalt from the existing access road. This would result in approximately 500 cubic yards of solid waste. Due to the relatively flat nature of the site, it is

expected that cut and fill volumes would be roughly balanced onsite, and the project would not require offsite soil hauling.

The three landfills within the project vicinity, Foothill Sanitary Landfill, Forward Landfill, Inc., and North County Landfill, are permitted to accept construction and demolition waste. As shown in Table 4.11-1, there is landfill capacity to accept the solid waste anticipated to be generated by the project.

In addition, the SFPUC has standard practices and waste management requirements that would be implemented during project construction. These requirements include, but are not limited to, the recovery, reuse and recycling of demolition and salvage materials (SFPUC, 2008). Given the minimal amount of solid waste that would be generated at the Tesla Portal site during construction, available capacity of nearby landfills, and SFPUC construction practices, impacts from the project on solid waste landfill capacity would be less than significant.

Impact 4.11-3: Impacts related to compliance with federal, state and local statutes and regulations related to solid waste (Tesla Portal: LS; Thomas Shaft: N/A)

The proposed project would comply with all federal, state and local statutes and regulations related to solid waste. The CIWMB found that unincorporated San Joaquin County achieved a diversion rate of 59 percent for the year 2005 and, thus, is in compliance with the CIWM Act of 1989 (CIWMB, 2007b). Solid waste generated by the proposed project during construction would be minimal and is not expected to impact this diversion rate. Therefore, the impacts would be less than significant.

Operational Impacts

The proposed project would not result in operational impacts related to public services and utilities as described above.

4.11.4 References

California Integrated Waste Management Board (CIWMB), www.ciwmb.ca.gov, accessed August 2007a.

CIWMB, http://www.ciwmb.ca.gov/Profiles/County, accessed August 2007b.

City of Tracy Fire Department, http://www.ci.tracy.ca.us/departments/fire, accessed July 2007.

San Francisco Public Utilities Commission (SFPUC), Standard Specifications Division I, Document 00815, 2008d.

San Joaquin County Sheriff Department, http://www.co.san-joaquin.ca.us/sheriff, accessed August 2007a.

San Joaquin County Sheriff's Department, Media Release: Crime Statistics http://www.sjgov.org/sheriff/media/stat.htm, accessed July 2007b.

San Joaquin County Environmental Health Department, *Online Wastewater Disposal Standards*, October 2003.

San Joaquin County, San Joaquin County General Plan 2010. July 1992.

4.12 Agricultural Resources

4.12.1 Setting

California leads the nation in agricultural production, responsible for approximately one-eighth of the country's agricultural output. San Joaquin County is among the top 15 most agriculturally productive counties in the state (California Legislative Analyst's Office, 2002; Umbach, 1997). San Joaquin County ranks among the top 10 counties in the state in terms of gross agricultural production value.

More than 45 percent of San Joaquin County's total land area (912,601 acres) consists of land designated as Prime Farmland. There is also substantial acreage designated as Farmland of Statewide Importance (10.1 percent), Unique Farmland (6.8 percent), Farmland of Local Importance (6.2 percent), and Grazing Land (16.3 percent). Almost 85 percent of the county is mapped as some type of important farmland (California Department of Conservation, 2005).

Both the Tesla Portal and Thomas Shaft sites are classified as Grazing Land by the maps prepared pursuant to the Farmland Mapping and Monitoring Program (San Joaquin County, 2007).

The project sites are located on extraterritorial land owned by the City and County of San Francisco (CCSF). California Government Code Section 53090 et seq. provides that CCSF receives intergovernmental immunity from the planning and building laws of any other city or county in which its extraterritorial lands are located. Therefore, the San Joaquin County zoning designation for the project sites is not binding, and is identified here for informational purposes. The San Joaquin County zoning designation for the project sites is AG-160 (General Agriculture). This zoning designation requires a minimum parcel size of 160 acres. The purpose of the AG zone is to preserve agricultural lands for the continuation of commercial agriculture enterprises. The following are permitted uses in the AG-160 zone:

- Single-family residential
- Group care facilities
- Small residential shelters
- Animal raising, including general animal raising, family food production, and educational animal projects
- Animal specialty services (farm)
- Family day care homes
- Crop production
- Farm produce stands

- Off-premises signs
- Minor utility services

In addition, this zoning designation allows a variety of other uses subject to site approval, or approval of an Improvement Plan, Quarry Excavation Permit, Second Dwelling Permit, or Use Permit. Specifically, germane to the proposed project, the AG-160 zone allows "essential" public services subject to site approval. While the Development Title of San Joaquin County specifies that lots zoned AG-160 must be at least 160 acres, it also allows AG-160 zoned parcels with an existing use or a use granted by a permit to be smaller than the required minimum size.

Additionally, both sites are within an agricultural preserve (R-69-C1). The R-69-C1 is a resolution that was passed by the San Joaquin County Board of Supervisors that allows properties with an agricultural land use designation to enter into a Williamson Act contract (Griffin, 2007).

The Tesla Portal and Thomas Shaft sites are located in rural settings with existing agricultural uses on adjacent lands consisting of ranching operations and cattle grazing. Neither the Tesla Portal site nor the Thomas Shaft site is under a Williamson Act contract. However, there is an existing grazing lease at the Tesla Portal site that allows cattle grazing.

4.12.2 Regulatory Framework

Land Conservation Act

The California Land Conservation Act (LCA), also known as the Williamson Act, was adopted initially by the state of California in 1965 with the basic intent of encouraging the preservation of the state's agricultural lands in view of the increasing trend toward their conversion to urban use. The LCA established a land contract procedure whereby a county board of supervisors could stabilize (i.e., not increase) taxes on certain qualifying lands in return for an owner's guarantee to keep the lands in agricultural preserve status for a ten-year period. A Williamson Act contract is automatically renewed each year, unless a notice of non-renewal is initiated by the land owner or the county. Once a notice of non-renewal is given, the contract remains in place on the land for the remaining nine-year term. Once the nine-year term expires, the land is no longer restricted to agricultural or open space uses. As of January 1, 2003, 16.6 million of the state's 30 million acres of farm and ranch land were protected by Williamson Act contracts.

Public Resources Code Section 21060.1

Public Resources Code Section 21060.1 defines agricultural land for the purposes of assessing environmental impacts using the Farmland Mapping and Monitoring Program (FMMP). The FMMP was established in 1982 to assess the location, quality, and quantity of agricultural lands and the conversion of these lands. The FMMP provides analysis of agricultural land use and land use changes throughout California.

The California Department of Conservation Farmland Mapping and Monitoring Program maps important farmlands throughout California. Important farmlands are divided into the following five categories based on their suitability for agriculture: Prime Farmland, Unique Farmland, Farmland of Statewide Importance, Farmland of Local Importance, and Grazing Land. Prime Farmland is land with soils that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. The land can be cropland, pastureland, rangeland, forestland, or other land, but not urban built-up land or water. Unique Farmland is used for specific high-value food and fiber crops. Farmland of Statewide Importance includes soils that are nearly prime, producing high yields of crops when treated and managed according to acceptable farming methods. Grazing Land is comprised of vegetation that is suited for the grazing of livestock.

4.12.3 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to agricultural resources, but generally considers that implementation of a proposed project would have significant impacts to these resources if it would:

- Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Department of Conservation, to a nonagricultural use
- Conflict with existing zoning for agricultural use, or a Williamson Act contract
- Involve other changes in the existing environment, which due to their location or nature, could result in conversion of Farmland of Statewide Importance to nonagricultural use

Approach to Analysis

For the purpose of this analysis, the project elements at both sites are considered in relation to farmland in the immediate vicinity of each site to identify any potential disruption that might be caused temporarily (during project construction) or permanently (due to project operations). In addition, the project was examined for its potential to affect land under Williamson Act contract.

Areas of No Project Impact

Under some of the significance criteria listed above, there is no potential for the impact to occur with implementation of the proposed project, or the criterion is not applicable to the proposed project, as the applicable environmental resource does not occur within the project area. Both the Tesla Portal and Thomas Shaft sites are designated as Grazing Land and, therefore, the project would not result in the conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to nonagricultural use. Moreover, the proposed improvements would not preclude agricultural activities on the portion of either site that is not developed with project

implementation. Neither project site is under a Williamson Act contract. Project construction or operation would not disrupt access or otherwise affect existing grazing operations on adjacent parcels. Therefore, the proposed project would have no impact with respect to these significance criteria.

Impact 4.12-1: Conflicts with existing zoning for agricultural use (Tesla Portal: LS; Thomas Shaft: LS)

The existing San Joaquin County zoning designation for both project sites is AG-160 (General Agriculture), the purpose of which is to preserve agricultural lands for the continuation of commercial agriculture enterprises. Both project sites contain facilities that are components of a regional water system (an essential public service) that is owned and operated by the CCSF. These essential public facilities are permitted in the AG-160 zone. The proposed project would replace and upgrade existing water treatment facilities at the Tesla Portal site, construct new water treatment facilities at the Tesla Portal site, and install an ultraviolet disinfection system at the Thomas Shaft site, as well as implement various ancillary improvements. These improvements would further the continued use of each site as an essential public facility, which is allowed under the agricultural zoning designation. Consequently, the proposed project would not conflict with the existing zoning for agricultural use.

Additionally, each site has contained regional water system facilities for more than 50 years. Therefore, even though both sites are smaller in size than the minimum required in the AG-160 zone, they are not in conflict with this requirement, as the Development Title of San Joaquin County allows AG-160 zoned parcels with an existing use to be smaller than the minimum acreage. Furthermore, there is an existing grazing lease at the Tesla Portal site, which is allowed under the AG-160 zoning designation. There is no grazing lease at the Thomas Shaft site.

Therefore, based on the discussion above, the proposed project would not conflict with existing zoning for agricultural uses and the impact would be less than significant.

4.12.4 References

California Department of Conservation, The California Land Conservation (Williamson) Act: 2004 Status Report, 2004.

California Department of Conservation, San Joaquin County: 2002–2004 Land Use Conversion, 2005.

California Department of Finance, California Statistical Abstract, 2003.

California Department of Finance, California Statistical Abstract, 2004.

California Legislative Analyst's Office, 2002 Cal Facts: Economy, December 2002.

Griffin, Rick, Senior Planner, San Joaquin County, Community Development Department, Personal Communication, April 6, 2007.

San Joaquin County, San Joaquin County General Plan 2010, July 1992.

San Joaquin County, Title 9 Development Title of San Joaquin County, 1995.

San Joaquin County website, Online Static Map Documents, Important Farmland Map, http://www.sjmap.org/mapdocs/FrontCounter_Important_Farmland.pdf, accessed May 15, 2007.

Umbach, Kenneth W., Ph.D., A Statistical Tour of California's Great Central Valley, California Research Bureau Report CRB-97-009, August 1997.

4.13 Hazards

4.13.1 Setting

The Tesla Portal and Thomas Shaft sites are located in rural areas. Each facility stores hazardous materials on site, described later in this section. Neither project site is within 1/4 mile of an existing or proposed school (Merritt, 2007), nor is either site listed in the following databases that make up the lists compiled pursuant to Government Code Section 65962.5. Collectively, these lists are known as the Hazardous Waste and Substances Sites List, which is also known as the Cortese List (Cal EPA, 2007):

- List of Hazardous Waste and Substances sites from the Department of Toxic Substances Control EnviroStor database
- List of Leaking Underground Storage Tank Sites by County and Fiscal Year from the State Water Resources Control Board GeoTracker database
- List of solid waste disposal sites identified by the State Water Resources Control Board with waste constituents above hazardous waste levels outside the waste management unit
- List of "active" Cease and Desist Orders and Cleanup and Abatement Orders from the State Water Resources Control Board
- List of hazardous waste facilities subject to corrective action pursuant to Section 25187.5 of the Health and Safety Code, identified by Department of Toxic Substances Control

The closest Cortese List site to either the Tesla Portal or Thomas Shaft site is Lawrence Livermore National Laboratory (LLNL) Site 300, which is a National Priority List site. The boundary of the 11-square mile LLNL Site 300 is about 1.5 miles from the Thomas Shaft site, and approximately 4 miles from the Tesla Portal site. There is no evidence that groundwater or other contamination emanating from Site 300 has reached the Thomas Shaft site (LLNL, 2006), or the more distant Tesla Portal site.

Neither the Tesla Portal nor the Thomas Shaft sites are located within two miles of a public airport or in an area covered by an airport land use plan, and neither site is located in the vicinity of a private airstrip.

The Certified Unified Program Agency (CUPA) in San Joaquin County is the County Environmental Health Department.

Wildland Fire

The Tesla Portal and Thomas Shaft sites are in a “Moderate” Fire Hazard Severity Zone (San Joaquin County, 2007). Both project sites are in areas designated by the California Department of

Forestry and Fire Protection (CDF) as a "Wildland Area That May Contain Substantial Forest Fire Risks and Hazards" (CDF, 2000). The Tesla Portal site has adequate water supplies for fire-fighting and the Thomas Shaft site has an existing 5,000-gallon water tank with a pump for fire protection. See Section 4.11-1 for information on fire protection services at the sites.

Hazardous Materials

Tesla Portal Site

The Tesla Portal site has two 13,000-gallon and four 4,000-gallon aboveground storage tanks (ASTs) containing sodium hypochlorite, a liquid form of chlorine.[1] No chlorine gas is used, and no airborne releases of chlorine occur. Other hazardous materials at the Tesla Portal site include a 1,000-gallon propane AST, sodium thiosulfate, and small quantities of chemicals used for maintenance activities (paint thinner, oils, lubricants, isopropyl alcohol, transmission fluid, and antifreeze). The Tesla Portal site generates less than 55 gallons of hazardous waste per year, consisting of waste oil from machinery maintenance (CCSF 1999). A transformer at the Tesla Portal site was installed within the last few years and does not contain polychlorinated biphenyls (PCBs) (refer to "Hazardous Building Materials," later in this section).

A Phase I Environmental Site Assessment (ESA), including a site inspection and a review of environmental databases, was conducted for the Tesla Portal site by AGS, Inc. (AGS, 2007). The types of sites identified in the environmental databases include permitted hazardous materials uses,[2] environmental cases,[3] and spill sites.[4] AGS did not find any current or historical recognized environmental conditions at Tesla Portal site. As defined by ASTM E1527-05, *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*, recognized environmental conditions are the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property. The Phase I ESA found no reported incidents of spills or other contaminant releases at that site. No listed hazardous waste sites were located within various radii (e.g., National Priority List [Superfund] sites within one-half mile; Resource Conservation and Recovery Act [RCRA] hazardous waste treatment, storage, or disposal faculties within one-half mile, and RCRA Corrective Action sites within one mile). No evidence of past or current contamination at the site was visible in aerial photographs, or described in interviews with site

1 The tanks are a nominal 14,000-gallon capacity but actually have 13,000 gallons usable capacity, as they have unusable space due to overflow fittings.

2 Permitted hazardous materials uses are facilities that use hazardous materials or handle hazardous wastes but comply with current hazardous materials and hazardous waste regulations.

3 Environmental cases are sites suspected of releasing hazardous substances or that have had cause for hazardous materials investigations and are identified on regulatory agency lists. These are sites where soil and/or groundwater contamination is known or suspected to have occurred.

4 Spill sites are locations where a spill has been reported to the state or federal regulatory agencies. Such spills do not always involve a release of hazardous materials.

personnel. During a May 31, 2007 reconnaissance at the Tesla Portal site, AGS found that hazardous materials were properly managed.

AGS found three de minimis environmental conditions at the Tesla Portal site. Under ASTM E1527-05, de minimis conditions generally do not present a threat to human health or the environment and generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies. Conditions determined to be de minimis are not recognized environmental conditions, and would not create a significant impact under the CEQA significance criteria set out in Section 4.14.3. The three conditions were:

- The sewage at the site goes into a septic system with an underground storage tank (UST) and a leach field, which is located west of the facility caretaker's house. During the site reconnaissance, the ground surface in the area of the septic system was wet, possibly indicating a leak.

- During the site reconnaissance, there were two ASTs in the northwest area of the site, at a fenced area not under SFPUC control where there were vehicles and farm equipment. One AST was on the ground and was empty. This AST was marked "Elissagara Sheep-Cattle." The other AST was on wheels and it could not be determined whether or not there was anything inside of it. This AST was marked "3E Ranch." Neither AST belongs to the SFPUC.

- There is a dump site in a ravine, outside of SFPUC property, located along the west side of the dirt road that goes up to the three potable water storage ASTs, which is just beyond western boundary of the property and not under SFPUC control. Miscellaneous debris has been dumped into this ravine and burned. During the site reconnaissance, the refuse items in this ravine included large household appliances, tires and car parts, animal bones, 55-gallon drums, and other buckets and containers. The drums and containers checked were empty at the time of the site reconnaissance, but some items may have been concealed underneath other debris. The terminus of this ravine is near the west to northwest boundary of the property.

Thomas Shaft Site

The Thomas Shaft site has three 8,000-gallon (of which 6,000 gallons is usable) hypochlorite tanks and one 2,025-gallon waste storage AST. No hazardous wastes are generated at the site (CCSF 1998). Due to the small scale of current and historic operations at the Thomas Shaft site, its remote location, and the limited scope of improvements and excavation that would be involved under the proposed project, a Phase I ESA was not performed at this site.

4.13.2 Regulatory Framework

Hazardous materials, defined in Section 25501(h) of the California Health and Safety Code, are materials that, because of their quantity, concentration, or physical or chemical characteristics, pose a substantial present or potential hazard to human health and safety or to the environment if

released to the workplace or environment. Hazardous materials have been and are commonly used in commercial, agricultural, and industrial applications as well as in residential areas to a limited extent. A waste is any material that is relinquished, recycled, or inherently waste-like. In accordance with Title 22 of the California Code of Regulations, Division 4.5, Chapter 11, a waste is considered a hazardous waste if it is toxic (causes adverse human health effects), ignitable (has the ability to burn), corrosive (causes severe burns or damage to materials), or reactive (causes explosions or generates toxic gases) in accordance with the criteria established in Article 3. Article 4 lists specific hazardous wastes and Article 5 identifies specific waste categories, including RCRA hazardous wastes, non-RCRA hazardous wastes, extremely hazardous wastes, and special wastes.

Hazardous materials and hazardous wastes are subject to numerous federal, state, and local laws and regulations intended to protect health and safety and the environment. The major federal, state, and regional agencies enforcing these regulations include the U.S. Environmental Protection Agency (U.S. EPA, federal); the Department of Toxic Substances Control (DTSC) and the Regional Water Quality Control Boards (RWQCBs) of the California Environmental Protection Agency (Cal-EPA, state); and the San Joaquin Valley Unified Air Pollution Control District (regional). The state and federal regulatory framework is described below.

Federal Regulations – General Hazardous Materials

The U.S. EPA is the lead agency responsible for enforcing federal regulations that affect public health or the environment. The primary federal laws and regulations include: the Resource Conservation and Recovery Act of 1974 (RCRA); the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA); and the Superfund Amendments and Reauthorization Act of 1986 (SARA). Federal statutes pertaining to hazardous materials and wastes are contained in Title 40 of the Code of Federal Regulations.

RCRA was enacted to provide a general framework for the national hazardous waste management system, including the determination of whether hazardous wastes are being generated, techniques for tracking wastes to eventual disposal, and the design and permitting of hazardous waste management facilities. In 1984, the Hazardous and Solid Waste Amendment was enacted to better address hazardous waste; this amendment began the process of eliminating land disposal as the principal hazardous waste disposal method. Other specific areas covered by the amendment include the regulation of carcinogens, listing and delisting of hazardous wastes, permitting for hazardous waste facilities, and leaking underground storage tanks. CERCLA, also known as Superfund, was enacted to ensure that a source of funds was available to clean up abandoned hazardous waste sites, compensate victims, address releases of hazardous materials, and establish liability standards for responsible parties. SARA amended CERCLA in 1986 to increase the Superfund budget, modify contaminated site clean up criteria and schedules, and revise settlement procedures. SARA also provides a regulatory program and fund for underground storage tank cleanups and the Emergency Planning and Community Right-to-Know Program.

In 1976, Congress passed the Toxic Substances Control Act (TSCA) which was implemented in 1979. This act governs the manufacture, processing, distribution in commerce, use, cleanup, storage, and disposal of polychlorinated biphenyls (PCBs). Since 1978, the U.S. EPA has promulgated numerous rules further addressing all aspects of the life cycle of PCBs. The most recent rule was the "Final Rule: Amendments to the TSCA PCB Disposal Regulations Including Amendments to the PCB Notification and Manifesting Rule" promulgated on June 24, 1999. This rule is deregulatory in nature and provides individuals with more flexibility in their PCB disposal practices while continuing to provide protection from unreasonable risk.

State and Regional Regulations – General Hazardous Materials

The California DTSC and the RWQCB are the primary state agencies regulating hazardous materials in California. These agencies are part of the Cal-EPA. The RWQCB is authorized by the State Water Resources Control Board to enforce provisions of the Porter-Cologne Water Quality Control Act of 1969. This act gives the RWQCB authority to require groundwater investigations when the quality of groundwater or surface waters of the state is threatened, and to require remediation of the site if necessary. The DTSC is authorized by the U.S. EPA to regulate the management of hazardous substances, including the remediation of sites contaminated by hazardous substances. California hazardous materials laws incorporate federal standards but are often stricter than federal laws. The primary state laws include: the California Hazardous Waste Control Law (HWCL), the state equivalent of RCRA; and the Carpenter-Presley-Tanner Hazardous Substances Account Act (HSAA), the state equivalent of CERCLA. State hazardous materials and waste laws are contained in the California Code of Regulations, Titles 22 and 26.

The HWCL, enacted in 1972 and administered by the DTSC, is the basic hazardous waste statute in California and has been amended several times to address current needs, including bringing the state law and regulations into conformance with federal laws. This act implements the RCRA "cradle-to-grave" waste management system in California but is more stringent in its regulation of non-RCRA wastes, spent lubricating oil, small-quantity generators, transportation and permitting requirements, as well as in its penalties for violations. The HWCL also exceeds federal requirements by mandating the recycling of certain wastes, requiring certain generators to document a hazardous waste source reduction plan, requiring permitting for federally exempt treatment of hazardous wastes by generators, and implementing stricter regulation of hazardous waste facilities.

The HSAA, enacted in 1981, addresses similar concerns as CERCLA. The primary difference is in how liability is assigned for a site with more than one responsible party. This is important for petroleum cleanup sites because federal law is usually used to force responsible-party cleanups; state law is used for petroleum cleanup sites that are exempt from CERCLA.

Other relevant State of California statutes include:

- The Toxic Pit Cleanup Act of 1984 and the Toxic Injection Well Act of 1985, which were established to provide a regulatory framework for open pits or injection wells as a means of hazardous waste or disposal.

- The Hazardous Waste Management Act of 1986, which coordinates the state's implementation of federal landfill bans and authorizes landfill bans for non-RCRA hazardous wastes.

- The Aboveground Petroleum Storage Act of 1989, which requires the owner or operator of aboveground petroleum storage tanks to file a storage statement with the State Water Resources Control Board if tank storage exceeds 10,000 gallons and holds petroleum or petroleum product that is liquid at ambient temperatures. In addition, the tank or tanks must be registered if they are subject to federal requirements; this potentially expands the requirement for a storage statement to any tank over 660 gallons or aggregate storage of 1,320 gallons.

- The Hazardous Waste Source Reduction and Management Act which, beginning in 1991, required large-quantity generators to document the hazardous wastes being generated and to prepare a documented waste reduction plan.

- The Hazardous Waste Treatment Permitting Reform Act of 1992, which required a permit for any hazardous waste treatment by a generator beginning on April 1, 1993. This statute established a new, tiered permitting program whereby onsite treatment facilities are permitted or authorized to operate subject to different levels of regulatory requirements, depending on the nature and size of the treatment activity. Amendments to this statute adopted in 1993–1996 have enacted certain exemptions and modified compliance requirements.

- The Hazardous Waste Management Reform Act of 1995, which required the DTSC to revise its regulations to more closely conform to federal hazardous waste identification criteria and essentially eliminate land disposal restrictions for California-only hazardous wastes, among other major changes. However, many of these changes have been deferred to a DTSC advisory committee for further study and are not expected to be implemented for several years, and in certain cases, not at all.

Use and Storage of Hazardous Materials and Fuels

In accordance with Chapter 6.11 of the California Health and Safety Code (Section 25404 et seq.), local regulatory agencies enforce many federal and state regulatory programs through the CUPA program, including:[5]

[5] Local regulatory agencies also regulate USTs under Chapter 6.7 of the California Health and Safety Code, Section 25280 et seq. However, no USTs would be installed under the proposed project.

- Hazardous materials business plans (Chapter 6.95 of the Health and Safety Code, Section 25501 et seq.)
- The California accidental release prevention program for acutely hazardous materials (Chapter 6.95 of the Health and Safety Code, Section 25531 et seq.)
- State Uniform Fire Code requirements (Section 80.103 of the Uniform Fire Code as adopted by the state fire marshal pursuant to Health and Safety Code, Section 13143.9)
- Aboveground storage tanks (Health and Safety Code Section 25270.5[c])
- Hazardous waste generator requirements (Chapter 6.5 of the Health and Safety Code, Section 25100 et seq.)

Hazardous Materials Business Plans

Businesses that handle specified quantities of chemicals are required to submit a Hazardous Materials Business Plan (HMBP) in accordance with community right-to-know laws. This plan allows local agencies to plan appropriately for a chemical release, fire, or other incident. The HMBP must include the following:

- An inventory of hazardous materials with specific quantity data, storage or containment descriptions, ingredients of mixtures, and physical and health hazard information
- Site and facility layouts that must be coded for chemical storage areas and other facility safety information
- Emergency response procedures for a release or threatened release of hazardous materials
- Procedures for immediate notification of releases to the administering agency
- Evacuation plans and procedures for the facility
- Descriptions of employee training in evacuation and safety procedures in the event of a release or threatened release of hazardous materials consistent with employee responsibilities, and proof of implementing such training on an annual basis
- Identification of local emergency medical assistance appropriate for potential hazardous materials incidents

The HMBP is filed with and administered by the CUPA agency, which ensures review by and distribution to other potentially affected agencies. The SFPUC has prepared and implemented HMBPs for its facilities, including Tesla Portal and Thomas Shaft, that use hazardous materials above threshold limits.

HMBPs specify response procedures to be implemented in the event of a chemical emergency, in accordance with the applicable local regulations. These procedures include notification requirements in the event of a spill; measures to be taken to control and cleanup a spill;

procedures for coordination of emergency response personnel; and procedures to be followed should emergency evacuation be required. Plant personnel maintain a comprehensive inventory of emergency response equipment at the facilities concerned, and emergency response equipment is regularly inspected and maintained. In accordance with community right-to-know laws, a copy of the HMBP is on file with local fire departments to assist them in responding to chemical emergencies. These emergency response procedures would apply to the proposed project.

Aboveground Storage of Petroleum Products

The Aboveground Petroleum Storage Act of 1990 requires facilities storing petroleum products in a single tank greater than 1,320 gallons or facilities storing petroleum in aboveground tanks or containers with a cumulative storage capacity of greater than 1,320 gallons to file a storage statement with the State Water Resources Control Board (SWRCB) and prepare a spill prevention, control, and countermeasure plan. The plan must identify appropriate spill containment or equipment for diverting spills from sensitive areas, and discuss facility-specific requirements for the storage system, inspections, record keeping, security, and personnel training.

The SWRCB requires registration of an aboveground fuel storage tank at a construction site only if the tank is 20,000 gallons or larger, or if the aggregate volume of aboveground petroleum storage is over 100,000 gallons. These large tanks would not be present at the project sites. For smaller temporary tanks used during construction, methods for controlling a release and measures to clean up an accidental release and prevent degradation of water quality are addressed in the construction stormwater pollution prevention plan prepared for the project, as described in Section 4.5, Hydrology and Water Quality.

Hazardous Materials Worker Safety Requirements

The federal Occupational Safety and Health Administration (Fed-OSHA) and the California Occupational Safety and Health Administration (Cal-OSHA) are the agencies responsible for assuring worker safety in the handling and use of chemicals in the workplace. The federal regulations pertaining to worker safety are contained in Title 29 of the Code of Federal Regulations, as authorized in the Occupational Safety and Health Act of 1970. They provide standards for safe workplaces and work practices, including standards relating to hazardous materials handling. In California, Cal-OSHA assumes primary responsibility for developing and enforcing workplace safety regulations; Cal-OSHA standards are generally more stringent than federal regulations.

The state regulations concerning the use of hazardous materials in the workplace are included in Title 8 of the California Code of Regulations, which contain requirements for safety training, availability of safety equipment, accident and illness prevention programs, hazardous substance exposure warnings, and emergency action and fire prevention plan preparation. Cal-OSHA also enforces hazard communication program regulations, which contain worker safety training and hazard information requirements, such as procedures for identifying and labeling hazardous

substances, communicating hazard information relating to hazardous substances and their handling, and preparation of health and safety plans to protect workers and employees.

The California Public Resources Code, beginning with Section 4427, includes fire safety regulations that: restrict the use of equipment that may produce a spark, flame, or fire; require the use of spark arrestors[6] on construction equipment that use an internal combustion engine; specify requirements for the safe use of gasoline-powered tools in fire hazard areas; and specify fire suppression equipment that must be provided onsite for various types of work in fire prone areas.

4.13.3 Impacts

Significance Criteria

The City and County of San Francisco (CCSF) has not formally adopted significance standards for impacts related to hazards, but generally considers that implementation of a proposed project would have a significant impact if it were to:

- Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials
- Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment
- Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within 1/4 mile of an existing or proposed school
- Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would create a significant hazard to the public or the environment
- For a project located within an area covered by an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, result in a safety hazard for people residing or working in the project area
- For a project within the vicinity of a private airstrip, result in a safety hazard for people residing or working in the project area
- Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan

[6] A spark arrestor is a device that prohibits exhaust gases from an internal combustion engine from passing through the impeller blades where they could cause a spark. A carbon trap is commonly used to retain carbon particles from the exhaust.

- Expose people or structures to a significant risk of loss, injury, or death involving fires

Areas of No Project Impact

Several of the above significance criteria are *not applicable* to the proposed project, as there either is no potential for the impact to occur, or the applicable environmental resource does not occur within the project area. The proposed project sites are not within 1/4 mile of an existing or proposed school, are not listed on the Cortese List, are not located within two miles of a public airport or within an area covered by an airport land use plan, and are not located in the vicinity of a private airstrip. Therefore, the proposed project would have no impact with respect to these significance criteria.

Approach to Analysis

The analysis of hazardous materials evaluates potential short-term and long-term impacts associated with the construction and operation of the proposed project at the Tesla Portal and Thomas Shaft sites in regards to:

- The potential for accidental hazardous materials release from construction equipment
- The potential risk of fires during construction
- The potential for interference with an emergency response plan

Construction Impacts

Impact 4.13-1: Potential to encounter hazardous materials in soil and groundwater (Tesla Portal: LS; Thomas Shaft: LS)

Existing water treatment operations and site maintenance at the Tesla Portal and Thomas Shaft sites involve the use of chemicals. Also, since the sites are located in areas of past agricultural use, it is possible that historical uses of pesticide, herbicides, or other hazardous materials occurred at the sites. If hazardous materials were released to soil or groundwater, workers and persons outside the facility fencelines could be exposed to such materials during excavation and other construction operations, and a further release to the environment could occur. Depending on the nature and extent of any contamination encountered, adverse health and environmental effects could result if proper precautions are not taken. If encountered, contaminated soil and groundwater could also require disposal as hazardous waste.

Tesla Portal Site

Although no known contamination exists in the vicinity of where construction would occur, the possibility remains that unrecorded hazardous materials contamination from past operations may have occurred at the Tesla Portal site. If contaminated soil or groundwater were encountered at this site, implementation of standard SFPUC construction measures, which are part of the project,

would address previously unidentified hazardous substances. SFPUC Construction Measure #7 for hazardous materials requires that a site assessment be conducted by a qualified environmental professional no more than three months before construction, and that a contingency plan be prepared identifying measures to be taken should unanticipated contamination be identified during construction. If actual or suspected hazardous substances (e.g., soils with fuel or chemical odors) were discovered, activities would proceed in accordance with the contingency plan (e.g., sampling would be necessary to identify the substances present, and the appropriate regulatory agencies would be notified).

Based on the existing conditions at the Tesla Portal site as documented in the Phase I ESA (AGS, 2007), the likelihood that contaminated soil or groundwater would be encountered during construction of the proposed project at that site is low; therefore, the impact would be considered less than significant.

Thomas Shaft Site

Due to the small scale of current and historic operations at the Thomas Shaft site, its remote location, and the limited scope of proposed improvements and excavation, a Phase I ESA was not performed at this site. The likelihood that contaminated soil or groundwater would be encountered during construction at the Thomas Shaft site is low; therefore, the impact would be considered less than significant.

Impact 4.13-2: Accidental hazardous materials release from construction equipment (Tesla Portal: LS; Thomas Shaft: LS)

Construction operations would include the use of hazardous materials such as motor fuels, oil, solvents, and lubricants. An accidental release of hazardous materials could occur from storage of such hazardous materials at the Tesla Portal and Thomas Shaft sites. Apart from contaminating soil, releases could reach the wetland area at the Tesla Portal site, and degrade water quality.

The potential that an accidental release would occur would be reduced by the use of standard operating procedures for the safe storage and use of hazardous materials. All users of hazardous materials would be required to comply with state and federal occupational safety and health codes and regulations, and any unused hazardous material would be removed from the site when work is complete. Nonhazardous waste would be disposed of at an approved landfill.

In addition, the project would comply with SFPUC Construction Measure #3 for water quality, which requires the implementation of erosion control measures, including preparation and implementation of a Storm Water Pollution Prevention Plan (SWPPP) as required by the RWQCB. The SWPPP is required for all projects disturbing more than one acre of land and therefore would be required for the Tesla Portal site. The SWPPP would include protection measures for the temporary onsite storage of diesel fuels used during construction, including

requirements for secondary containment and berming of the diesel storage area or any chemical storage areas to contain a potential release and to prevent any such release from reaching an adjacent waterway or stormwater collection system.

Based on the above factors, impacts from accidental releases would be less than significant.

Impact 4.13-3: Risk of fires during construction (Tesla Portal: LS; Thomas Shaft: LS)

The use of construction equipment could pose a wildland fire risk at the Tesla Portal site and, to a lesser extent, at the Thomas Shaft site, as vegetation (mostly grasses) is present at both sites. The time of the greatest fire danger is during the clearing phase, when people and machines are working among vegetative fuels that can be highly flammable; if piled onsite, the cleared vegetative materials could also become a fire fuel. Potential sources of ignition include equipment with internal combustion engines, gasoline-powered tools, and equipment or tools that produce a spark, fire, or flame. Such sources include sparks from blades or other metal parts scraping against rock, overheated brakes on wheeled equipment, friction from worn or unaligned belts and drive chains, and burned-out bearings or bushings. Sparking as a result of scraping against rock is difficult to prevent. The other hazards result primarily from poor maintenance of the equipment. Smoking by onsite construction personnel is also a potential source of ignition during construction.

Fire protection services, at both the Tesla Portal and Thomas Shaft sites, are provided by the City of Tracy Fire Department. Two fire stations, Station 95 and Station 93, provide fire protection services to both project sites. Station 95 is approximately four miles from Tesla Portal and eight miles from Thomas Shaft. Station 93 is approximately 5.5 miles from Tesla Portal and 10 miles from the Thomas Shaft site (refer to Public Services Section 4.11 for further information regarding fire protection services). Additionally, the new facilities at the Tesla Portal site would include a combination of conventional water sprinklers, dry chemical systems and fire hydrants for onsite fire protection. Water for the building sprinkler systems would be provided by gravity from existing utility water tanks. The site also includes on-site fire hydrants supplied by fire pumps fed directly from the San Joaquin Pipelines that enter the site. The Thomas Shaft site has an existing 5,000-gallon water tank with a pump for onsite fire protection.

Regulations governing the use of construction equipment in fire prone areas are designed to minimize the risk of wildland fires during construction activity. In accordance with the Public Resources Code, the construction contractor would be required to comply with the following requirements during construction activities:

- Earthmoving and portable equipment with internal combustion engines would be equipped with a spark arrestor to reduce the potential for igniting a wildland fire (Public Resources Code [PRC] Section 4442).

- Appropriate fire suppression equipment would be maintained during the highest fire danger period – from April 1 to December 1 (PRC Section 4428).

- On days when a burning permit is required, flammable materials would be removed to a distance of 10 feet from any equipment that could produce a spark, fire, or flame, and the construction contractor would maintain the appropriate fire suppression equipment (PRC Section 4427).

- On days when a burning permit is required, portable tools powered by gasoline-fueled internal combustion engines would not be used within 25 feet of any flammable materials (PRC Section 4431).

Compliance with the Public Resources Code would ensure that impacts related to wildland fires would be less than significant.

Impact 4.13-4: Interference with emergency response plan (Tesla Portal: LS; Thomas Shaft: LS)

Project construction would not require the use of public roadways for construction staging and equipment parking. Additionally, no lane or road closures are anticipated. Thus, it is not likely that project construction activities could impede access for emergency response vehicles, interfere with an emergency response plan or emergency evacuation plan. In addition, SFPUC Construction Measure #5, which includes preparation and implementation of a traffic control plan, would be implemented as part of the project to minimize impacts on traffic flow. Therefore, impacts associated with interference with an emergency response plan would be less than significant.

Operational Impacts

Impact 4.13-5: Increased use of hazardous materials during operation (Tesla Portal: LS; Thomas Shaft: LS)

Existing water treatment operations and site maintenance at the Tesla Portal and Thomas Shaft sites involve the use of chemicals. At both Thomas Shaft and Tesla Portal sites, the primary potential hazardous materials impacts posed by the proposed project are increased risks of spillage of liquid chemicals, particularly the sodium hypochlorite described above. Chemical spillage could occur during normal operations, due to equipment malfunction or operator error, or be caused by natural hazards, such as seismic events. If acids were to mix with sodium hypochlorite (a base chemical), a dangerous chemical reaction could occur (e.g., chlorine gas could be produced). Whether singly or mixed, if accidentally released, these chemicals could

cause health effects to workers, and less likely, to persons outside the facility fencelines. Releases also could cause adverse environmental effects.

These risks would be minimized in several ways:

Regulatory compliance. Both Tesla Portal and Thomas Shaft sites would comply with all applicable hazardous materials regulations, as well as SFPUC standard construction measures. Regulatory requirements also affect the design features discussed below.

Protective design features. The proposed improvements at both the Tesla Portal and Thomas Shaft sites would incorporate design features to reduce the chances that spillage would occur, and reduce the consequences of such spills.

The Uniform Fire Code and the California Fire Code, Article 80 (Hazardous Materials), include specific requirements for the safe storage and handling of hazardous materials. These requirements reduce the potential for a release of hazardous materials and for mixing of incompatible chemicals. Design of chemical storage facilities at the Tesla Portal and Thomas Shaft sites would comply with the current Uniform Fire Code and other applicable federal, state, and local regulations, including the following specific design features that would reduce the potential for a release of hazardous materials that could affect public health or the environment.

Both projects would be subject to:

- A requirement to separate incompatible materials. Acids would be isolated from sodium hypochlorite as required by the Fire Code, kept either in a separate area at least 25 feet away, or separated by a four-hour firewall.

- Spill control in all storage, handling, and dispensing areas.

- Separate secondary containment for each chemical storage system. The secondary containment would hold the entire contents of the tank, plus the volume of water needed to supply the fire suppression system for a period of 20 minutes in the event of a catastrophic spill.

The project includes design provisions for secondary containment for chemical storage tanks and feed pipelines, in accordance with applicable regulations.

Emergency response procedures. The HMBPs for the Tesla Portal and Thomas Shaft sites specify emergency response procedures for spills of liquid materials, releases of compressed gases, and spills of solid or powder materials. As well as procedures for controlling spills (e.g., by applying absorbent material to liquid spill areas) and reducing related hazards (e.g., by removing sources of ignition), the HMBPs include procedures for contacting emergency responders, such as the Tracy Fire Department; notifying regulatory agencies; alerting employees and other people within the facilities of emergencies; and evacuating personnel. No evacuations in response to spills or other emergencies have been necessary at either facility, and no evacuation drills are considered

necessary. No problems that would necessitate alerting people outside the facilities (e.g., in Chrisman) are anticipated.

Emergency response equipment is periodically inspected and tested, and employees are trained in environmental compliance and health and safety compliance. In accordance with community right-to-know laws, a copy of the HMBP is on file with the local fire department to assist them in responding to chemical emergencies at the SFPUC chemical storage facilities.

Transportation hazards. The expansion of operations at both project sites would increase the number and quantities of hazardous materials used. This would increase the number of chemical deliveries over baseline levels and indirectly result in an incremental increase in the potential for accidents during transport. These increases would have less than significant effects. The transport of hazardous materials and wastes is regulated by the California Department of Transportation and the California Highway Patrol. These agencies regulate container types and packaging requirements as well as licensing and training for truck operators, chemical handlers, and hazardous waste haulers. Because the SFPUC and all service providers are and would continue to be required to comply with existing and future hazardous materials laws and regulations for the transport of hazardous materials, the risk of accidental releases of hazardous materials during normal transport operations would be low and would not constitute a significant hazard.

Tesla Portal Site

Regulatory compliance. To meet regulatory guidelines, the SFPUC would be required by the local CUPA agency (San Joaquin County Environmental Health Department) to prepare an updated HMBP for the new facilities at Tesla Portal to reflect the changes in chemical storage. Currently, the Tesla Portal site has two 13,000 gallon and four 4,000 gallon ASTs containing sodium hypochlorite. Other hazardous materials at the Tesla Portal site include a 1,000 gallon propane AST, sodium thiosulfate, and small quantities of chemicals used for maintenance activities. The proposed project would include three 16,000-gallon sodium hypochlorite tanks, two 10,000 gallon fluoride tanks, two 3,000 gallon food grade acid tanks, two 15,000 gallon aboveground diesel fuel tanks, two 12,500 gallon CO_2 tanks, and 12 UV reactors each containing minimal amounts of mercury. The addition of the three 16,000 gallon hypochlorite tanks represents a total increase of 6,000 gallons of sodium hypochlorite stored at the site. The addition of fluoride, diesel fuel, food grade acid, CO_2, and UV reactors would represent new materials that are not currently present or used at the site.

The installation of a UV disinfection system (12 UV reactors) at the Tesla Portal site would introduce a new potential hazard, as the UV lamps that would be used in the project contain small amounts of mercury.[7] There have been few lamp breakages at existing UV facilities, and in the judgment of the U.S. EPA, the risk to human health and the environment from the mercury in UV lamps used in the treatment of drinking water is very small. Risks can be addressed through

[7] The mercury content in a single UV lamp typically ranges from 0.005 – 0.4 grams. In comparison, the mercury content of a typical oral/rectal/baby thermometer that uses mercury is 0.61 grams (U.S. EPA, 2002).

engineering and administrative methods to prevent UV lamp breaks, and exposure to mercury if breaks do occur (U.S. EPA, 2006). Appendix E of the U.S. EPA, *Ultraviolet Disinfection Guidance Manual For The Long Term 2 Enhanced Surface Water Treatment Rule,* November 2006, provides direction on how to prevent breakage of UV lamps during transport and operation and guidance on how operators may limit exposure to mercury if a break should occur while the water treatment system is on or offline. Some of these methods include, but are not limited to:

- Installation of spring actuated valves with a short closure time on the reactor inlet and outlet piping in order to isolate the mercury in the reactor downstream

- Installation of a strainer on the reactor outlet piping to collect condensed mercury and quartz fragments should a break occur

- The preparation and implementation of an On-line Lamp Break Response Plan

In addition to compliance with the engineering and administrative measures prescribed in Appendix E of the *Ultraviolet Disinfection Guidance Manual For The Long Term 2 Enhanced Surface Water Treatment Rule,* November 2006, the SFPUC has included its own protection measures in the Draft Design Criteria for the proposed Tesla Portal Treatment Facility (SFPUC 2006). These measures would further limit potential hazards associated with UV lamp breakage. The Design Criteria state that, "the UV system shall be designed to prevent dissolved mercury from entering the Hetch Hetchy Aqueduct system in the case of lamp breakage. Mercury minimization shall include the following measures:

- Provision of a slow velocity / in-line baffle / quiescent zone downstream of the UV reactors on the main outlet pipe manifold for each UV train to help mitigate the risk from a potential mercury release and settle out glass fragments and solid-state mercury. The zone shall have a blowoff for removal of settled materials.

- The UV lamps shall not be installed until a designated volume of water has passed through the UV reactors at startup. This limits the risk of breaking lamps due to construction debris left in the system.

- Emergency Response Plans shall be developed to address potential hazardous material contamination of the water supply. These plans shall consider the appropriate response to be implemented in the unlikely event of a mercury release to the water supply."

Due to their mercury content, spent UV lamps are considered hazardous waste under RCRA. Expended lamps would be sent to a mercury recycling facility where the mercury is recovered and lamp components are recycled.

Protective design features. At the Tesla Portal site, the loading area would be designed either to have its own secondary containment or to drain to the tank containment area. These measures would provide containment in the event that a chemical spill occurred during transfer or storage.

Chemical loading would occur within a covered area to prevent rain from draining into the containment sump. Any chemical spillage into the secondary containment areas would be pumped and disposed of, depending on the chemical, in accordance with any applicable regulations.

Sodium hypochlorite deteriorates with exposure to heat. At the new Chemical Process Building, passive cooling would be used to keep storage areas cool. The chemical storage tank area would have an exhaust ventilation rate corresponding to Hazardous (H) Occupancy of the California Building Code.

At the Tesla Portal site, fire protection would be provided for the new facilities by a combination of conventional water sprinklers, dry chemical systems and fire hydrants. Water for the sprinklers would be provided by gravity from existing utility water tanks. The fire hydrants would be supplied by fire pumps fed directly from the San Joaquin Pipelines that enter the site.

Transportation hazard. At the Tesla Portal site, deliveries of sodium hypochlorite would remain about the same as current levels, about one delivery every one to five days. Approximately one to three deliveries per week apiece of fluoride, sulfuric acid, and food-grade acid would occur.

Though the proposed project would provide a marginal increase in the amount of hazardous materials stored at the Tesla Portal Site, implementation of regulatory requirements, project design features, and protective measures described above would reduce potential impacts to a less-than-significant level.

Thomas Shaft Site

Regulatory compliance. The Thomas Shaft site currently has three 6,000-gallon sodium hypochlorite tanks which would remain unchanged with implementation of the proposed project. The project would, however, add two UV reactors which contain minimal amounts of mercury. Thus, the HMBP for the existing Thomas Shaft facility would require updating.

To comply with Fire Code, fire extinguishers would continue to be available for use. The site also has an existing 5,000-gallon water tank with a pump for fire protection.

Transportation hazard. The Thomas Shaft site would continue to receive deliveries of food grade acid once a month including acid needed to clean the UV system. Therefore, the number of monthly delivery trips would remain unchanged.

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4.14 Energy Resources

4.14.1 Setting

California's Electricity Supply

California's electricity is supplied by a number of sources, including natural gas (41 percent), coal (21 percent), large hydroelectric plants (15 percent), and nuclear (13 percent) (CEC, 2005). The remaining 10 percent is supplied from geothermal, biomass, small hydroelectric, wind, and solar sources. Despite California policies aimed at diversifying the state's electrical supply, dependence on natural gas is continuing to grow, from 30 percent in 1999 to 36 percent in 2002 to 41 percent in 2004. Electricity generation accounted for 50 percent of the natural gas usage in 2004. In 2002, California imposed a requirement that electrical corporations increase procurement of eligible renewable energy resources by at least 1 percent per year so that 20 percent of its retail sales are procured from renewable resources by 2017 (Public Utilities Code, Section 399.15), and publicly owned utilities have been asked to consider establishing a similar target.

Electrical Utility Providers

SFPUC Power Enterprise

San Francisco Public Utilities Commission (SFPUC) Power Enterprise (formerly part of Hetch Hetchy Water and Power Enterprise) provides electricity, primarily from power generated by the SFPUC's hydroelectric facilities in the Hetch Hetchy system, to all City and County of San Francisco (CCSF) facilities (including tenants), including the Tesla Portal and Thomas Shaft sites. The Hetch Hetchy system comprises 400 megawatts of hydroelectric power generation plants on the Tuolumne River and 150 miles of high-voltage transmission lines linking Hetch Hetchy power to California's electricity grid at Newark.

Energy production varies by season and by year depending on hydrologic conditions. The long-term annual average production is approximately 1.7 billion kilowatt-hours (kWh); historical production has ranged from a low of 1.2 billion kWh per year to a high of 2.2 billion kWh per year (SFPUC, 2002).

Pacific Gas and Electric Company

Pacific Gas and Electric Company (PG&E) provides natural gas and electricity to most of Northern California. It provides SFPUC Power Enterprise with transmission and distribution services from Newark to the west, pursuant to an Interconnection Agreement regulated by the Federal Energy Regulatory Commission. Under this agreement, PG&E also transmits and distributes electricity to SFPUC Power Enterprise customers, including the Tesla Portal and Thomas Shaft sites.

Current Energy Use

While per capita electricity consumption in the United States has increased by nearly 50 percent over the past 30 years, per capita California energy use during this period has been approximately flat (CEC, 2005). This achievement is the result of continued progress in cost-effective building and appliance standards and ongoing enhancements in efficiency programs. These combined efforts have reduced peak capacity needs by more than 12,000 megawatts and continue to save about 40,000 gigawatt-hours (GWh) per year of electricity.

Electricity consumption in California grew from 250,241 GWh in 2001 to 270,927 GWh in 2004. Electricity use is forecast to grow between 1.2 and 1.5 percent annually, from 270,927 GWh in 2004 to between 310,716 and 323,372 GWh by the end of 2016. Overall, electricity demand in California increases most dramatically in the summer, driven by high air-conditioning usage. The electricity generation system must accommodate high summer peaks in addition to demand swings caused by weather variability and the economy. Although peak demand periods total only 50 to 100 hours per year, they impose huge burdens on the electrical system. The state's dependence on natural gas to generate electricity is escalating, as is the demand for natural gas in the residential and commercial sectors, with California's natural gas consumption second only to that of Texas.

Despite improvements in power plant licensing, energy efficiency programs, and continued technological advances, development of new energy supplies is not keeping pace with the state's increasing demand (CEC, 2005). Construction of new power plants has lagged, and the number of new plant permit applications has decreased. Transmission lines are frequently running at capacity, forcing system operators to reduce generation to avoid overloading the system, and transmission line outages sometimes result in rolling blackouts. In addition, the development of new renewable resources has been slower than anticipated, due in part to the state's approval process. Additional actions are still needed for California to achieve its energy efficiency potential.

In September 2004, the California Public Utilities Commission (CPUC) adopted aggressive energy savings goals for both electricity and natural gas. In achieving these targets, the state will save an additional 5,000 megawatts and 23,000 GWh per year of electricity and 450 million therms per year of natural gas by 2013.

The Hetch Hetchy system provides 400 megawatts of hydroelectric power. SFPUC Power Enterprise customer base and generation base are distinguishable from other power supplies, and its load profile is relatively flat (i.e., not dramatically higher in the summer) because it is not driven by air-conditioning usage. Despite the overall surplus of energy produced, CCSF typically supplements its power supply with PG&E produced power during fall and summer months in order to allow water to be stored while continuing to meet its municipal demand and contractual obligations for power supply.

- Existing energy usage by the SFPUC's regional water system, including energy use at the Tesla Portal and Thomas Shaft sites, is nearly 44 million kWh per year. This is less than four percent of the energy produced by the Hetch Hetchy system (historical low energy production rate), and less than three percent of the long-term annual average production rate (SFPUC, 2008c). Within the SFPUC San Joaquin Region, which encompasses all SFPUC facilities from the western boundary of Tuolumne County through Stanislaus and San Joaquin counties, almost to the east boundary of Alameda County, existing power usage is approximately 200,000 kWh, a fraction of the regional water system's total energy use (SFPUC, 2002).

Tesla Portal

The Tesla Portal site currently uses approximately 175,000 kWh per year for operation of existing facilities.

Thomas Shaft

Operation of existing facilities at the Thomas Shaft site has an average annual energy usage of 70,800 kWh.

4.14.2 Regulatory Framework

2005 California Energy Action Plan II

The *Energy Action Plan II* is the state's principal energy planning and policy document (CPUC and CEC, 2005). The plan continues the goals of the original *Energy Action Plan*, describes a coordinated implementation plan for state energy policies, and identifies specific action areas to ensure that California's energy is adequate, affordable, technologically advanced, and environmentally sound. In accordance with this plan, the first-priority actions to address California's increasing energy demands are energy efficiency and demand response (i.e., reduction of customer energy usage during peak periods in order to address system reliability and support the best use of energy infrastructure). Additional priorities include the use of renewable sources of power and distributed generation (i.e., the use of relatively small power plants near or at centers of high demand). To the extent that these actions are unable to satisfy the increasing energy and capacity needs, clean and efficient fossil-fired generation is supported. The *Energy Action Plan II* includes the following energy efficiency action specific to water supply systems:

- Identify opportunities and support programs to reduce electricity demand related to the water supply system during peak hours, and opportunities to reduce the energy needed to operate water conveyance and treatment systems. In 2002, California established its Renewable Portfolio Standard program,[1] with the goal of increasing the percentage of renewable energy

[1] The Renewable Portfolio Standard is a flexible, market-driven policy to ensure that the public benefits of wind, solar, biomass, and geothermal energy continue to be realized as electricity markets become more competitive. The policy ensures that a minimum amount of renewable energy is included in the portfolio of electricity resources serving a state or country. By increasing the required minimum amount over time, the Renewable Portfolio Standard puts the electricity industry on a path toward increasing sustainability.

in the state's electricity mix to 20 percent by 2017. The CPUC subsequently accelerated that goal to 2010 for electrical corporations, and the CEC further recommended that the state increase the target for all retail electricity sellers to 33 percent by 2020. Because much of electricity demand growth is expected to be met by increases in natural-gas-fired generation, reducing consumption of electricity and diversifying electricity generation resources are significant elements of plans to reduce natural gas demand.

Building Energy Efficiency Standards

The Energy Efficiency Standards for Residential and Nonresidential Buildings, as specified in Title 24, Part 6, of the California Code of Regulations (CCR), were established in 1978 in response to a legislative mandate to reduce California's energy consumption. The standards are updated periodically to allow consideration and possible incorporation of new energy efficiency technologies and methods. The current version of the standards was adopted in October 2005, and the CEC has begun development of an update, which is planned for adoption in 2008.

California's building efficiency standards (along with those for energy-efficient appliances) have saved more than $56 billion in electricity and natural gas costs since 1978 (CEC, 2007). It is estimated that the standards will save an additional $23 billion by 2013.

San Francisco Plans

Section 4.2 describes CCSF plans and policies related to energy resources, including the Sustainability Plan for San Francisco.

4.14.3 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to energy resources, but generally considers that implementation of a proposed project would have a significant energy resource impact if it were to:

- Encourage activities that result in the use of large amounts of fuel, water, or energy, or use these in a wasteful manner

Approach to Analysis

This analysis evaluates the proposed project in terms of energy demand during construction and operation, and assesses the potential for long-term increases in energy demand and/or the wasteful use of energy. For energy used during construction, the analysis discusses how construction operations would be conducted to minimize the use of fuels and ensure that they are not used in a wasteful manner. For energy used during operation, the analysis evaluates energy

efficiency measures associated with project operations, consistent with the California *Energy Action Plan II.* Although any increase in energy demand would be considered potentially significant, implementation of measures to increase energy efficiency would ensure that energy is not used in a wasteful manner and would reduce potential impacts on the state's limited energy supply and aging energy infrastructure.

Construction Impacts

Impact 4.14-1: Construction-related energy use (Tesla Portal: LS; Thomas Shaft: LS)

Project construction would extend over an approximately 24-month period at the Tesla Portal site and an approximately six-month period at the Thomas Shaft site. Construction of the proposed project would require the use of fuels (primarily gas, diesel, and motor oil) for a variety of construction activities, including excavation, grading, and vehicle travel. During these activities, fuel use for construction worker trips to the project sites would be minor compared to the fuel consumption by construction equipment (refer to Table 4.8-1, Tesla Portal Construction Related Trips, and Table 4.8-2, Thomas Shaft Construction Related Trips in Section 4.8, Traffic, Transportation, and Circulation). The wasteful use of fuels during construction would not be economically sustainable for the SFPUC or its contractors. Additionally, as part of the proposed project, actions would be implemented that would reduce greenhouse gas emissions (see Section 3.4.2 of the Project Description); these actions include requiring all contractors to maintain tire inflation to the manufacturers' specifications, which would help to improve fuel efficiency. Certain exhaust control measures specified under Mitigation Measure 4.9-1b (San Joaquin Valley Air Pollution Control District Exhaust Controls), such as limiting idling time and performing monthly maintenance on construction vehicles, would also ensure that fuels are not used in a wasteful manner. Given the scope of the project and associated construction-related vehicle trips, the impact of energy consumption due to fuel use would be less than significant even without implementation of Mitigation Measure 4.9-1b. Therefore, this impact would be less than significant.

Operational Impacts

Impact 4.14-2: Long-term energy use during operation (Tesla Portal: PSM; Thomas Shaft: PSM)

Operation of the proposed project would increase the long-term consumption of energy at both project sites. The SFPUC Power Enterprise currently provides electrical power service to the project sites and would continue as the service provider with project implementation. Although the Hetch Hetchy system produces far greater power than is currently used at the Tesla Portal and Thomas Shaft sites, and that would be used in the operation of the new proposed facilities, the increase in power use associated with the project could result in a higher reliance on nonrenewable energy resources. This is because less hydroelectric power would be available,

particularly during the fall and summer months when power generation under the Hetch Hetchy system is reduced and power supplies are supplemented by PG&E.

Tesla Portal Site

- SFPUC Power Enterprise provides power to the SFPUC's regional water system facilities, which use an estimated total energy usage of approximately 44 million kWh per year. This annual estimate includes the Tesla Portal facilities, which has a current demand of approximately 175,000 kWh per year. Operation of the new facilities at the Tesla Portal site could substantially increase overall on-site energy consumption. The SFPUC estimates that, in total, operation of the proposed improvements at the Tesla Portal site would require approximately six million kWh per year. This estimate includes approximately 1,800,000 kWh for operation of the three new buildings (UV building, Chemical Process building and Office/Control building), approximately 3,550,000 kWh for the UV reactors, and approximately 650,000 kWh for the proposed pumps). Accounting for current energy use at the Tesla Portal site, the project would result in a net increase of approximately 5,825,000 kWh, which represents roughly 13 percent of the regional water system's current annual energy use. As described in the setting, the energy use by the regional water system is a fraction (less than 3 percent) of the long-term annual average energy production of the Hetch Hetchy system, and would remain at approximately three percent including the project's increased operational energy use.

To accommodate the additional demand generated by the proposed improvements, SFPUC would install a ground-mounted transformer adjacent to the UV Building, and an above-ground power line would extend from the existing power pole to the new transformer. Underground lines from the transformer to the Chemical Office/Control Building would also be installed.

The proposed project would be required to meet energy efficiency standards contained in Title 24 of the CCR. SFPUC has also drafted energy efficiency measures that are included in the Draft Design Criteria manual for the Tesla Treatment Facility. The Draft Design Criteria manual provides guidelines for energy and resource use at the Tesla Treatment Facility, which would ensure that energy would not be used in a wasteful manner. The Design Criteria would require improvements at the Tesla Portal site to meet and/or exceed Title 24 energy efficiency standards by a minimum of 5 percent.[2] SFPUC would also consider methods for reducing the carbon footprint[3] of the proposed project by requiring review of the final design by the Power Enterprise Energy Efficiency Group. This review would ensure that any features that would improve energy sustainability are incorporated, as feasible, into the design. SFPUC would also incorporate the use of energy efficient lighting, heating, ventilation, and air conditioning (HAVC) systems.

[2] This minimum 5 percent reduction in energy use includes lighting systems, which would also meet the recommendations of the Illuminating Engineering Society Handbook.

[3] Carbon footprint is a measure of the impact human activities have on the environment in terms of the amount of greenhouse gases produced, measured in units of carbon dioxide. www.carbonfootprint.com

- The project's energy impacts would be reduced to less than significant with implementation of the project design features, described above, and implementation of Mitigation Measure 4.14-1, which would ensure that energy efficient equipment is used in the proposed project at the Tesla Portal site. It would also require the preparation of a repair and maintenance plan for each facility to minimize power use and the use of renewable energy, such as solar power, at the Tesla Treatment Facility.

The two standby power generators that would be installed at the Tesla Portal site would be fueled by diesel, a nonrenewable energy source. However, standby power would only be used in the event of a disruption in power service and, therefore, impacts related to the use of large amounts of energy would be less than significant for these generators.

Thomas Shaft Site

Current average annual consumption at the Thomas Shaft site is 70,800 kWh per year and would increase to 110,800 kWh annually with implementation of the project. This increase in energy use would represent a potentially significant increase in energy use. However, implementation of Mitigation Measure 4.14-1, which requires energy efficiency measures consistent with the California *Energy Action Plan II*, would reduce this impact to a less-than-significant level.

4.14.4 References

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CEC, California's Energy Efficiency Standards for Residential and Nonresidential Buildings, available online at http://www.energy.ca.gov/title24, June 8, 2007.

California Public Utilities Commission (CPUC) and California Energy Commission (CEC), *Energy Action Plan II*, Implementation Roadmap for Energy Policies, September 21, 2005.

Carbon Footprint, *What is a Carbon Footprint*, available online at http://www.carbonfootprint.com/carbonfootprint.html, August 2008.

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SFDE and SFPUC, *Climate Action Plan for San Francisco*, Local Actions to Reduce Greenhouse Emissions, September 2004.

San Francisco Public Utilities Commission (SFPUC), *Long Term Strategic Plan for Capital Improvements*, May 2002.

- SFPUC, *Draft Combined Design Criteria for Advanced Disinfection and Tesla Portal Disinfection Station,* January 2008b.

- SFPUC. Power Enterprise Billing Data (Actual Consumption), May 2007 – April 2008c.

4.15 Cumulative Effects

4.15.1 Introduction

As defined in the California Environmental Quality Act (CEQA) Guidelines Section 15355, a cumulative impact refers to two or more individual effects that, when considered together, are considerable or that compound or increase other environmental impacts. CEQA Guidelines Section 15130(a) requires that an environmental impact report (EIR) include a discussion of cumulative impacts "…when the project's incremental effect is cumulatively considerable." According to the Guidelines, cumulatively considerable means a project's incremental effects are significant when viewed in connection with the effects of past, present, and reasonably foreseeable (i.e., probable) future projects (CEQA Guidelines Section 15065(a)(3)). If a lead agency determines that an incremental effect is not "cumulatively considerable," it does not need to consider that effect significant, but it is required to briefly describe its basis for concluding that the incremental effect is not cumulatively considerable (CEQA Guidelines Section 15130(a)).

CEQA Guidelines Section 15130(b) states, "The discussion of cumulative impacts shall reflect the severity of impacts and their likelihood of occurrence, but the discussion need not provide as great [a level of] detail as is provided for the effects attributable to the project alone. The discussion should be guided by standards of practicality and reasonableness, and should focus on the cumulative impact to which the identified other projects contribute rather than the attributes of other projects which do not contribute to the cumulative impact." Section 15130(b) further describes what the discussion of cumulative impacts should include:

- Either: (1) a list of past, present, and probable future projects producing related or cumulative impacts; or (2) a summary of projections contained in an adopted general plan or similar document, or in an adopted or certified environmental document, that described or evaluated conditions contributing to a cumulative impact
- A discussion of the geographic scope of the area affected by the cumulative impact
- A summary of expected environmental effects to be produced by these projects
- Reasonable, feasible options for mitigating or avoiding the project's contribution to any significant cumulative effects

The analysis in this section addresses the cumulative impacts associated with construction and operation of the proposed project. Chapter 6 addresses the cumulative effects associated with growth inducement and the secondary effects of growth resulting from project implementation. Section 4.1 of Chapter 4 describes the overall approach to the assessment of project impacts.

4.15.2 Cumulative Impact Analysis Methodology

The cumulative impact analysis considers the impacts of the project in combination with past projects, projects currently under construction, and probable future projects including: (1) San

Francisco Public Utilities Commission (SFPUC) projects or activities in the project area; and (2) non-SFPUC projects or activities in the project area under the jurisdiction of other local agencies that meet the following criteria:

- The cumulative project and impacts potentially occur within the same geographic location as the project sites
- The cumulative project has or could potentially result in similar impacts as those resulting from the construction and/or operation of the proposed project
- The cumulative project and impacts would occur within the same general timeframe as the proposed project

Analysis of cumulative impacts requires estimation in many cases, because specific quantification of impacts is not always possible, due to variations in the status and timing of projects and environmental conditions that may exist when cumulative projects are developed. The CEQA Guidelines state that the discussion of cumulative impacts should be guided by standards of practicality and reasonableness (CEQA Guidelines, 15130 [b[). As such, the analysis presented below addresses impacts that might compound or interrelate with those of the proposed project.

4.15.3 Cumulative Projects Considered

Table 4.15-1 lists the cumulative projects considered in this analysis. The table presents the planning jurisdictions, a brief description of each project, the potential cumulative impact areas, the estimated construction schedule associated with each cumulative project, the distance of the cumulative project to the project sites, and the project site potentially affected by the cumulative project. The column titled "Potential Cumulative Impact Areas" generally summarizes the anticipated cumulative impacts; site-specific environmental review was not conducted for each listed project. Project information listed in Table 4.15-1 is based on information supplied by the SFPUC, consultations with the Community Development and Public Works/Engineering Departments of San Joaquin and Stanislaus Counties as well as the City of Tracy Community Development Department, and review of available environmental documents and information posted on agency websites.

TABLE 4.15-1
Cumulative Projects Considered

Jurisdiction	Project Title	Project Summary	Potential Cumulative Impact Areas	Estimated Construction Schedule	Approximate Distance to Project Sites	Site Potentially Affected
CCSF (SFPUC)	Thomas Shaft Roadway Improvement Project	The project consists of modifying and improving the existing 1.5-mile Thomas Shaft Road, between Corral Hollow Road and the Thomas Shaft Chlorination Facility. The project would realign or widen some portions of the roadway and improve the roadway surface. Also, as part of the project, an existing temporary concrete water flow structure would be replaced with a 50-foot arch span bridge, one existing culvert would be replaced, and two new culverts installed along the road.	Construction-related traffic on access roads and associated air quality, noise and biological resource impacts	Construction is estimated to occur between August 2008 – January 2009	Approximately 4.4 miles downstream from the Tesla Portal site, and within the Thomas Shaft site	Thomas Shaft
CCSF (SFPUC)	Thomas Shaft Security Upgrades	The existing fence would be modified (made higher, card readers and intrusion alarms installed, and locking mechanism changed) and fencing should be installed around the transformer and the enclosures adjacent to the transformer (across from the Chlorination Building).	Construction-related traffic on access roads and associated air quality, noise and biological resource impacts	Expected to occur 2010 – 2011.	Within the Thomas Shaft site	Thomas Shaft
CCSF (SFPUC)	Thomas Shaft Chlorination Facility Phase 2 Project	The proposed improvements would better meet current operational needs at the existing Thomas Shaft Chlorination Facility. The existing above-ground metal vent stack would be demolished and replaced with a larger 20-foot high 16-foot by 35-foot reinforced concrete vent structure on top of the existing vent shaft. The down-shaft well casing and at-grade shaft cover of Sampling Station No. 1 would be replaced. A new pump assembly would be added to Sampling Station No. 2 that can be lowered into the shaft. Another new pump would be installed within the existing third well casing at the construction shaft. Access ladders, guardrails, and kickboards for three existing hypochloride tanks would be installed. The floor slab in the generator room would be repaired and a new exterior steel staircase	Construction-related traffic on access roads and associated air quality, noise and biological resource impacts	Construction is estimated to occur begin summer of 2008 and should be completed in approximately four to six months.	Within the Thomas Shaft site	Thomas Shaft

TABLE 4.15-1
Cumulative Projects Considered

Jurisdiction	Project Title	Project Summary	Potential Cumulative Impact Areas	Estimated Construction Schedule	Approximate Distance to Project Sites	Site Potentially Affected
		would be installed. Additional ductwork would be added, modifications to the electrical system would be made, and the closed-circuit TV system would be replaced. The underground double containment piping from the existing building to the existing waste liquid storage tank would be replaced. The south fence and automated sliding gate would be replaced, and new pavement would be added within the existing gravel parking area along with a mobile restroom trailer—the waste would be cleaned out by a contractor on a regular basis. A new trench connecting the vent shaft with the construction shaft would contain a 4-inch-diameter below-grade pipe and communication /control lines. The maximum depth of excavation for the trenching would not exceed three-feet. About 120 cubic yards of soil would be excavated for the footing of the vent structure, the maximum depth of which would not exceed 4.5 feet. The spoils from the excavation would be evenly redistributed over the adjacent previously disturbed relocation site.				
CCSF (SFPUC)	San Joaquin Pipeline (SJPL) System	This project is located along the existing SJPL right of way and includes condition assessment and rehabilitation/replacement of a 6.5-mile-long segment of SJPL No. 3 from Oakdale Portal to the west; and a new approximately 11-mile-long pipeline parallel to the existing SJPL System west of the San Joaquin River to Tesla Portal. The project also includes construction of two additional crossover facilities. These improvements would provide the SJPL System the capacity to deliver a flow of 313 mgd with all pipelines in service, and an estimated combined average maintenance flow	Possible overlap of onsite construction activities and staging area. Construction-related traffic on access roads and associated air quality and noise impacts, as well as biological resource impacts	2010-2014	Nearest improvements would occur within the Tesla Portal site	Tesla Portal

TABLE 4.15-1
Cumulative Projects Considered

Jurisdiction	Project Title	Project Summary	Potential Cumulative Impact Areas	Estimated Construction Schedule	Approximate Distance to Project Sites	Site Potentially Affected
		of 271 mgd when one pipeline reach is out of service for planned maintenance, inspection, or emergency repair.				
CCSF (SFPUC)	Rehabilitation of Existing SJPLs	The Rehabilitation of Existing SJPLs Project consists of condition assessment, monitoring, and rehabilitation of the existing SJPLs. The purpose of this project is to establish a program of intensified condition assessment, monitoring, and rehabilitation that will minimize unplanned outages. The detailed condition assessment of the pipelines is ongoing. Although specific rehabilitation measures have not all been identified, a portion of the work has been identified to include a corrosion monitoring system, replacement and installation of cathodic protection, and repair crown crack on SJPL No. 3.	Possible overlap of onsite construction activities; construction-related traffic on access roads and associated air quality and noise impacts, as well as biological resource impacts	2008-2014	Nearest project activities could occur within the Tesla Portal site.	Tesla Portal
City of Tracy	Tracy Gateway PUD	Phased construction of 5.8 million square feet of office, commercial, and retail uses with an anticipated population of 20,000 employees. A multi-story hotel and a golf course are also proposed for the 538-acre development area. The City has not received any development applications to date (11/2007) (City of Tracy, Bell, 2007).	Increased surface runoff and water quality impacts during construction; visual resources, biological resources, air quality, traffic, public services, utilities, and noise	TBD (Some utility, roadway, and other infrastructure improvements could start in spring/ summer of 2008 or 2009); construction of new homes could not occur until 2012 when the current growth ban lifts; some commercial development could occur before then, but it has not yet been determined by the City.	Approximately 10 miles to the northwest of the Tesla Portal site, and approximately 10 miles to the north of the Thomas Shaft site	Tesla Portal and Thomas Shaft

TABLE 4.15-1
Cumulative Projects Considered

Jurisdiction	Project Title	Project Summary	Potential Cumulative Impact Areas	Estimated Construction Schedule	Approximate Distance to Project Sites	Site Potentially Affected
City of Tracy	Tracy Hills Specific Plan	The Tracy Hills Specific Plan area consists of 6,175 acres. Approximately 2,700 fall within the City limits and are planned for a maximum of 5,499 residential units, 6 million square feet of commercial, office, and industrial uses, and approximately 800 acres of neighborhood parks, schools, recreational uses, other open space, roads, and canals. The approximately 3,550 acres located within the City's Sphere of Influence are planned as permanent open space for habitat conservation and managed grazing. Because of the City's Slow Growth Initiative, development permits would not be granted for three to six years from now (11/2007) (City of Tracy, Bell, 2007).	Increased surface runoff and water quality impacts during construction; construction-related traffic impacts on local roads (e.g., Corral Hollow Road) and associated air quality and noise impacts; visual resources biological resources operational traffic, air quality, noise, public services, and utilities impacts	TBD (Some utility, roadway, and other infrastructure improvements could start in spring /summer of 2008 or 2009); construction of new homes could not occur until 2012 when the current growth ban lifts; some commercial development could occur before then, but it has not yet been determined by the City.	Approximately 3.5 miles to the northwest of the Tesla Portal site, and approximately 3.5 miles to the northeast of the Thomas Shaft site	Tesla Portal and Thomas Shaft
City of Tracy	Ellis Specific Plan	The Ellis Specific Plan provides comprehensive land use policy, zoning, and design guidelines for the future development of approximately 320-acres in the City of Tracy. Implementation of the plan would allow a mix of residential, commercial, office/professional, institutional, and recreational uses. The plan would accommodate up to 2,250 residential units; 180,000 square feet of commercial use; approximately 40-acres of parks; and, a 20-acre swim center.	Increased surface runoff and water quality impacts during construction; construction-related traffic impacts on local roads (e.g., Corral Hollow Road) and associated air quality and noise impacts, biological resource impacts, operational traffic, air quality, and noise impacts	TBD (Infrastructure improvements and construction of the 20-acre swim center could start in spring and/or summer of 2009 or 2010); construction of new homes could not occur until 2012 when the current growth ban lifts; some commercial development could occur before then, but it has not yet been determined by the City.	Approximately 4 miles to the northwest of the Tesla Portal site, and approximately 5 miles to the northeast of the Thomas Shaft site	Thomas Shaft and Tesla Portal

TABLE 4.15-1
Cumulative Projects Considered

Jurisdiction	Project Title	Project Summary	Potential Cumulative Impact Areas	Estimated Construction Schedule	Approximate Distance to Project Sites	Site Potentially Affected
San Joaquin County	Corral Hollow Road Improvements Project	The County of San Joaquin Department of Public Works is planning a roadway safety improvement project on Corral Hollow Road, which would install guardrails approximately two miles west of I-580.	Construction-related water quality impacts; traffic impacts on local roads (e.g., Corral Hollow Road) and associated air quality and noise impacts	Construction scheduled to start in July of 2008; anticipated schedule of completion is end of 2008 or early 2009.	Approximately 2 miles northeast of the project site.	Thomas Shaft
San Joaquin County and Stanislaus County	RMC Pacific Vernalis Quarry Mining and Reclamation Project	The project proposes the expansion of an existing quarry that would include sand and gravel extraction and processing of construction aggregate on 688 acres, with permitted active mining for 26 to 60 years on a 659-acre site in San Joaquin County (590 acres) and Stanislaus County (98 acres).	Construction-related traffic impacts on regional roads (e.g., Highway 132) and associated air quality and noise impacts, as well as operational traffic, air quality, and noise impacts	Construction scheduled to start in 2008	Approximately 2.5 miles to the southeast of the Tesla Portal site, and approximately 7 miles to the southeast of the Thomas Shaft site	Tesla Portal
San Joaquin County	Bird Road/Highway 132 Interchange	Replacement of four-way stop with interchange facility at the intersection of Bird Road and Highway 132 to improve operations and increase safety.	Construction-related water quality impacts; traffic impacts on regional roads (e.g., Highway 132) and associated air quality and noise impacts	2008–2009	Approximately 3.5 miles east of the Tesla Portal site, and approximately 10 miles northeast of the Thomas Shaft site	Tesla Portal
Lawrence Livermore National Laboratory	LLNL Site 300 Pipeline Connection	This project proposes to connect to the SFPUC Thomas Shaft water supply through an existing 7000' (length) by 10" (diameter) pipeline that is located along the Thomas Shaft Roadway. The existing connection to the Thomas Shaft and LLNL Site 300 would be opened to flush any existing water and disinfect the pipeline prior to connection. Depending on the quality of the water, LLNL would seek a permit or permits to either discharge the water to Corral Hollow Creek or infiltrate it into the ground. If the water quality does not meet the discharge requirements of the federal Clean Water Act or	Possible biological impacts	2009	Pipeline originates at Thomas Shaft Facility	Thomas Shaft

TABLE 4.15-1
Cumulative Projects Considered

Jurisdiction	Project Title	Project Summary	Potential Cumulative Impact Areas	Estimated Construction Schedule	Approximate Distance to Project Sites	Site Potentially Affected
		California Water Code, the water may be treated prior to discharge or may be disposed at an offsite facility. Any wastes would be disposed of according to federal state and local laws and approved LLNL policies and procedures for hazardous and non-hazardous waste, as appropriate.				
California State Parks	Carnegie State Vehicular Recreational Area Alameda-Tesla Expansion Project	The project would expand the off-highway vehicle (OHV) use at Carnegie State Vehicular Recreational Area (SVRA). In 1998, the state purchased over 3,000 acres west of the current riding area for inclusion in the Carnegie SVRA. This proposal would increase OHV recreational opportunities at Carnegie SVRA, including an extensive multiple use (for example, motorcycles, all terrain vehicles, 4x4 vehicles, sports utility vehicles) trail system, a 4x4 vehicle obstacle course, a day-use staging area, and interpretive and informational facilities. This project may also provide non-OHV recreational opportunities, such as mountain biking, horseback riding, and hiking, provided there is no conflict between these activities and OHV users.	Increased surface runoff and water quality impacts during construction; construction-related traffic impacts on local roads (e.g., Corral Hollow Road) and associated air quality and noise impacts, as well as traffic, air quality, noise, erosion, and biological resource impacts associated with operations	Construction is scheduled to start in May 2009.	Approximately one mile to the west of the Thomas Shaft site, and approximately 5.5 miles southwest of the Tesla Portal site	Thomas Shaft

4.15.4 Impacts

Significance Criteria

The City and County of San Francisco (CCSF) has not formally adopted significance standards for impacts related to cumulative effects, but generally considers that implementation of a proposed project would have significant cumulative impacts if it were to:

- Have impacts that would be individually limited but cumulatively considerable ("cumulatively considerable" means that the incremental effects of a project are significant when viewed in connection with the effects of past, present, and probable future projects)

Project impacts that would be "individually limited" are based on the impact analyses and significance criteria presented in Sections 4.3 through 4.14 for the various environmental resource topics. Following is a discussion of potential cumulative effects for each of the environmental resource topics, including the geographic area of cumulative effect.

Land Use

With respect to land use impacts, the geographic scope of potential cumulative impacts encompasses both project sites and their immediate vicinities, including their construction staging areas. However, major developments in the region are considered when characterizing overall regional land use impacts.

Because the project would not change the general use of either the Tesla Portal or Thomas Shaft sites, and the proposed improvements would be confined to a relatively small portion of each site, with the remainder of each site left as undeveloped open space, neither project construction or operation would substantially alter existing land use patterns. Furthermore, since the project would occur on existing SFPUC lands, which are 0.5 mile away from the nearest established community, the construction of the proposed improvements and their on-going operation would not disrupt established communities.

As indicated in Table 4.15-1, reasonably foreseeable cumulative development in the project area would result in the development of new residential, commercial, office, industrial, and institutional uses, as well as transportation projects (including highway improvements), infrastructure improvements (including utilities and roadways), and quarry expansion. Reasonably foreseeable future development could disrupt established communities and substantially alter existing land use patterns. Table 4.15-1 also identifies several other SFPUC projects that would occur within either the Tesla Portal site, the Thomas Shaft site, or in proximity to either site. These projects in combination with the proposed project could contribute incrementally to cumulative temporary land use disruption during construction (a combination of noise, vibration, dust, traffic congestion, and/or access disruption constitutes a temporary land use disruption).

Due to the relative remote location of both sites, undeveloped nature of the project areas, and the distances of each site from nearby uses, the project in combination with other projects located at

or near either site would not create a cumulative land use impact. Thus, the project would not contribute to cumulative community disruption or alteration of existing land use patterns. Moreover, implementation of SFPUC standard construction measures would ensure that the combined effects of the project and other SFPUC projects at the Tesla Portal and Thomas Shaft sites would result in less than significant land use disruption. Therefore, the project's contribution to cumulative impacts on land use would not be cumulatively considerable.

Visual Quality

With respect to visual quality impacts, the geographic scope of potential cumulative impacts encompasses both project sites and the immediate vicinities, including construction staging areas. Major developments in the region are also considered when characterizing overall regional visual quality impacts.

The proposed improvements at the Thomas Shaft site would not contribute to changes to the viewshed during construction or operation, since the site is not visible from any scenic vistas or scenic roadways; the new UV system would be installed within the existing Chlorination Facility building; the new prefabricated building would be designed to be visually compatible with the existing facility; the closest residence is approximately 1.25 miles northeast of the nearest rural residence; and no additional exterior lighting would be installed at the site.

Improvements proposed for the Tesla Portal site would have a less than significant impact during construction due to the distance of the site from I-580 and the implementation of Standard Construction Measure #10, which would reduce the visibility of staging areas, require the SFPUC to maintain a clean and orderly site, and redirect nighttime lighting away from residential areas during construction. After construction, the proposed improvements at the Tesla Portal site would have less than significant impacts on the visual character and quality of the site, as they would be confined to a small portion of the site with the majority retaining its existing rural visual character and qualities; all the facilities would be of a similar visual scale and character as existing facilities; areas disturbed by construction would be re-vegetated to restore the pre-existing natural vegetative cover; and, few homes have direct views of the site. Post construction at the Tesla Portal site, new buildings would be visible from I-580 (a State Designated Scenic Highway from I-5 to the Alameda County line) and the structures would not be shielded from view by trees or any other vegetation, resulting in a potentially significant impact that could be mitigated to a less than significant level through Mitigation Measure 4.3-5b (landscape screens such as berms or trees). Other proposed improvements at the Tesla Portal site would either not be visible from offsite locations or would not be visually prominent, resulting in less than significant operational impacts on the scenic vista.

The cumulative projects listed in Table 4.15-1 include several major development projects that could substantially affect scenic vistas or resources, alter the visual character of areas within the project vicinity, and introduce new sources of light or glare within the project area. Cumulative development associated with major development projects in Table 4.15-1 would occur in or adjacent to the City of Tracy, and the nearest proposed development project (Tracy Hills) would be approximately 3.5 miles to the northwest of the Tesla Portal site, and approximately 3.5 miles

to the northeast of the Thomas Shaft site. The potential for significant cumulative changes in visual quality, including the introduction of light and glare would be minimized because these development projects are in proximity to the City of Tracy and, therefore, these major development projects would add to the existing urban/developed character of the City of Tracy. Other projects listed in Table 4.15-1 include roadway improvements, improvements or modifications to existing public utility infrastructure or other public facilities, and expansion of a quarry and OHV recreation area. These projects would create a permanent change in the landscape. When combined with cumulative projects identified in Table 4.15-1, the project would not contribute considerably to cumulative visual quality impacts because both sites are located in relatively remote and isolated locations that are not readily visible from many sources and are separated from cumulative development by expanses of undeveloped land that would remain visually unchanged. The project's incremental contribution to cumulative visual quality impacts would not be cumulatively considerable.

Geology, Soils and Seismicity

The geographic scope of potential cumulative geologic and seismic impacts incorporates the project sites and immediate vicinities. Geologic and seismic impacts are generally site specific and depend on local geologic and soil conditions**.**

As discussed in Section 4.4, Geology, Soils and Seismicity, native soils found within the project sites are potentially corrosive or expansive, exhibiting a high shrink/swell potential and may exhibit a high risk of corrosion to concrete and uncoated steel, resulting in a potentially significant impact. None of the projects listed on Table 4.15-1 that would occur at another location could contribute cumulatively to the potential local corrosive or expansive soil hazard (or any other geologic hazard). However, the SJPL System Project and the Rehabilitation of Existing SJPLs project would occur at the Tesla Portal site during the same time period as the proposed improvements at that location and would both involve rehabilitation/replacement of pipelines. Consequently, these two projects in combination with the improvements proposed at the Tesla Portal site could result in cumulative corrosion and expansive soil hazard impacts. With implementation of Mitigation Measure 4.4-9, which would characterize the extent of expansive and corrosive soils and incorporate the results of the investigation into the final project design, the project impact would be less than significant and the project would not contribute to any cumulative impact related to corrosive or expansive soil hazard. Furthermore, the project would not affect the availability of known or locally important mineral resources individually. Consequently it could not incrementally contribute to the loss of the availability of known or locally important mineral resources.

As described in the Project Description, the proposed project includes an upgrade to the existing disinfection facilities at the Tesla Portal Hypochlorite Station to meet current seismic, safety/fire, and building code standards to help protect the water system from the effects of earthquakes and other hazards. In addition, several cumulative SFPUC projects would also contribute to improving the seismic safety of water system facilities, including pipeline repairs and replacements. These improvements in combination with the project work at the Tesla Portal site

would contribute to beneficial cumulative effects related to the safety of the regional water system during a seismic event**.**

Hydrology and Water Quality

The geographic scope of potential cumulative hydrology and water quality impacts encompasses adjacent undeveloped areas, as the surface runoff from both sites currently drains to open areas adjacent to paved surfaces on each site.

Although less than significant, construction activities at the Tesla Portal could affect the artificial wetland and unnamed ephemeral drainage located on the site. There would be a relatively small area of impact (disturbed areas) at Tesla Portal. Work conducted at the site would be done in compliance with NPDES General Permit requirements, including preparation of a SWPPP, and SFPUC Construction Measures #3 and #10 would be implemented, which would incorporate erosion control measures as necessary and return the site to its general pre-construction condition. Construction and tie-in of the new SJPL facilities during the regularly scheduled Hetch Hetchy shutdown of SJPL pipelines would preclude discharges of large volumes of water.

The cumulative projects listed in Table 4.15-1 have the potential to affect hydrology and water quality. Table 4.15-1 identified several development projects which would increase impervious areas in the region and have the potential to increase surface runoff. Operational activities associated with the Carnegie State Vehicular Recreational Area Alameda-Tesla Expansion Project and construction activities associated with several other cumulative projects have the potential to increase erosion and impact water quality. However, all of the projects would be required to comply with federal (Clean Water Act [CWA]), state (National Pollutant Discharge Elimination System [NPDES]) and local (municipal stormwater regulations) permitting requirements.

NPDES and other discharge regulations are designed to protect water quality on a regional basis and incorporate measures to protect beneficial uses of water bodies based on overall consideration of past, present, and future conditions within the region. The regulations require that projects implement best management practices (BMPs) for erosion control and construction-related discharges, and corrective actions in the event that permit exceedances occur during construction. BMPs are designed to reduce impacts associated with increased erosion, sedimentation, and pollutant discharges to the environment during construction. Several of the cumulative projects in Table 4.15-1 were identified as SFPUC projects, including the Thomas Shaft Roadway Improvement Project, Thomas Shaft Security Upgrades, Thomas Shaft Chlorination Facility Phase 2 Project, the San Joaquin Pipeline (SJPL) System, and the Rehabilitation of Existing SJPLs. The SFPUC projects must also comply with the SFPUC Standard Construction Measures that complement the NPDES and General Permit provisions. Therefore, the project's contribution to cumulative impacts on hydrology and water quality would not be cumulatively considerable.

Biological Resources

The geographic scope for potential cumulative impacts on biological resources is the grassland areas adjacent to the project sites and the project sites of the other cumulative projects listed in Table 4.15-1.

Project construction activities would result in temporary degradation of the bed and bank of the ephemeral drainage located at the Tesla Portal site, as well as sedimentation and erosion of its down stream portions; less than 0.001 acre of the ephemeral drainage would be impacted. Of the projects identified in Table 4.15-1, only the SFPUC SJPL System and Rehabilitation of Existing SJPL projects would have the ability to affect the ephemeral drainage. The project's impacts on the ephemeral drainage combined with the ephemeral drainage impacts of these two projects would be potentially significant. Mitigation Measures 4.6-1a and 4.6-1b require participation in the San Joaquin County Multi-Species Habitat Conservation and Open Space Plan (SJMSCP) for the replacement of habitat that would be equal to that of the temporary loss of <0.001 acre of ephemeral drainage, as well as the implementation of best management practices (i.e., fencing, erosion control and re-contouring of the impact area). As such, the project's mitigated impact on the ephemeral drainage is less than significant. Due to the minor amount of the drainage that would be affected by the project, and implementation of the measures noted above, the project's contribution to cumulative impacts on the ephemeral drainage would not be cumulatively considerable (less than significant).

Construction staging and other construction-related activities at the Tesla Portal project site could result in the temporary impacts on 11.716 acres of California annual grasslands and 0.846 acre of ruderal/disturbed habitat. Construction at the Thomas Shaft site would result in temporary impacts on 0.110-acre of ruderal/disturbed habitat. In addition, the proposed project would result in the permanent loss of approximately 3.2 acres of California annual grassland at the Tesla Portal site and 0.008-acre ruderal/disturbed habitat at the Thomas Shaft site.

Due to their relative closeness to the project sites, the projects identified in Table 4.15-1 are in generally similar settings as the Tesla Portal and the Thomas Shaft sites, and as such would be expected to have construction activities that could result in impacts on California annual grasslands. In addition, the development associated with many of these projects (residential units, commercial spaces, offices, and industrial developments) would also likely result in the permanent loss of California annual grasslands. Impacts on California annual grasslands would contribute to the degradation of natural habitat in the region and could result in the permanent loss of habitat. The project's temporary impacts on California annual grasslands combined with the loss of California annual grasslands of other projects identified in Table 4.15-1 would be potentially significant. Mitigation Measures 4.6-1a, 4.6-1b, and 4.6-2 (participation in the SJMSCP, implement Best Management Practices, and returning the site to pre-project conditions) would reduce the project's potential temporary construction impacts to less than significant. Implementation of these measures would substantially reduce the project's contribution to cumulative impacts and would not be cumulatively considerable.

Permanent loss of California annual grasslands would contribute incrementally to the statewide loss of this type of habitat. As such, the impact of permanent loss of California annual grasslands from the proposed project combined with the permanent loss of California annual grasslands of other projects identified in Table 4.15-1 would be potentially significant. The project would result in the permanent loss of approximately 3.2 acres of California annual grassland, which is minor in comparison to the permanent loss of California annual grasslands that could be expected from other projects listed in Table 4.15-1. Loss of California annual grasslands resulting from project implementation would be less than significant given the abundance of similar grassland habitats in the immediate area and adjacent to the project sites and the relatively small amount of habitat loss. In addition, the proposed project would not substantially degrade the function of this habitat type in the local context of the project sites, and would not result in severe habitat fragmentation. Therefore, the project's conversion of 3.2 acres of California annual grassland would not have a cumulatively considerable contribution to the statewide loss of this type of habitat.

Project construction could result in temporary loss of foraging and/or breeding habitat for some or all of the special status species known to occur, or with potential habitat present at the project sites. These species include: California Red-Legged Frog, California Tiger Salamander, San Joaquin Whipsnake, California Horned Lizard, San Joaquin Kit Fox, San Joaquin Pocket Mouse, Pallid bat, Townsend bat, Mastiff bat, Burrowing owl, Swainson’s Hawk, White-tailed Kite, Ferruginous Hawk, Golden Eagle, Prairie Falcon, Northern Harrier, Tricolored Blackbird, and California Horned Lark.

The projects identified in Table 4.15-1 are located primarily within five miles of the project sites (ten miles distance at maximum) in similar settings and would be expected to have similar special status species foraging and breeding habitat as the proposed project. Consequently, construction of many of the projects identified in Table 4.15-1 could result in temporary loss of foraging and/or breeding habitat for some or all of the special status species known to occur or with potential habitat present at the project sites. As such, the impact of temporary loss of special status species foraging and/or breeding habitat from the proposed project combined with the temporary loss of special status species foraging and/or breeding habitat of other projects identified in Table 4.15-1 would be potentially significant. The SFPUC will implement Mitigation Measure 4.6-1a, which requires participation in the SJMSCP and requires the implementation of incidental take mitigation measures (ITMMs), to mitigate for impacts on special-status species, thus reducing impacts on biological resources to a less than significant level. As such, construction of the proposed project would not have a cumulatively considerable contribution to temporary loss of foraging and/or breeding habitat for some or all of the special status species known to occur, or with potential habitat present at the project sites.

Additionally, operation of the proposed project would result in the permanent reduction of special-status wildlife foraging and/or breeding habitat. In total, the proposed project (Tesla Portal and Thomas Shaft) would convert 3.2 acres of California annual grasslands. The conversion of this habitat would result in the permanent loss of breeding and/or foraging habitat for all the 18 special-status wildlife species (identified above) with the potential to be present on either project site.

Permanent conversion of special species habitat would contribute incrementally to the statewide loss of special species habitat. As such, the impact of the project's permanent conversion of habitat for the 18 special status species identified above combined with the permanent conversion of this type of habitat resulting from other projects identified in Table 4.15-1, would be potentially significant. The project would result in the permanent conversion of approximately 3.2 acres of special species habitat. However, this amount is minor in comparison to the permanent loss of special species habitat that could be expected from other projects listed in Table 4.15-1. Loss of special species habitat resulting from project implementation would be less than significant given the abundance of higher quality special-status species habitat in the proximity of the proposed project sites, as well as the relatively small size of the proposed project footprints. In addition, the SFPUC would participate in the SJMSCP (Mitigation Measure 4.6-1a). Therefore, the project's conversion of 3.2 acres of potential special species habitat would not have a cumulatively considerable contribution to the statewide conversion of this type of habitat.

Operation of the proposed project would result in the permanent loss of 0.3 acre of artificial wetland when water from the analyzer equipment at Tesla Portal is no longer discharged to the artificial wetland area. Wetland functions and values (i.e., the only year-round source of water in the project area and surrounding valley bottom) would be lost, resulting in substantial degradation or reduction of habitat values for dependent plant and wildlife species. Cumulative loss of wetlands could result due to development of residential units, commercial spaces, offices, and industrial developments (identified in Table 4.15-1). As such, the impact of wetlands loss from the proposed project combined with the potential for loss of wetlands due to other projects identified in Table 4.15-1 would be potentially significant. Mitigation Measure 4.6-1a requires participation in the SJMSCP for the replacement of the artificial wetland habitat that would be permanently lost. Implementation of this mitigation measure would substantially reduce the project’s contribution to permanent wetland loss to a less than cumulatively considerable level and project operation would not have a cumulatively considerable contribution to regional permanent wetland loss.

Cultural Resources

The geographic scope of potential cumulative impacts on cultural resources encompasses the project sites and their immediate vicinities, and other cumulative projects near the project sites.

Project construction activities would exceed historic ground disturbance by six feet at the Tesla Portal site. This could result in disturbance of native sediments and bedrock containing paleontologically sensitive geologic units within the Tesla Portal area of potential effect (APE), resulting in the potentially significant, but mitigable impact of disturbing or destroying paleontological resources. Due to their relative closeness to the Tesla Portal site, the projects identified in Table 4.15-1 are in generally similar geologic settings as the Tesla Portal site, and as such, their construction has the potential to disturb or destroy the same paleontologically sensitive geologic units as the project would, potentially disturbing or destroying paleontological resources. The project's impacts on paleontological resources combined with the paleontological resource impacts of projects identified in Table 4.15-1 would be potentially significant. Mitigation Measures 4.7-1a and 4.7-1b require monitoring construction, relocating construction

work away from the area if a paleontological resource is identified, and having the site inspected by a qualified paleontologist. As such, the project's mitigated impact on the paleontological resources would be less than significant. Construction of the proposed project would not have a cumulatively considerable contribution to disturbance or loss of paleontological resources.

The project has the potential to encounter unanticipated subsurface archaeological deposits or human remains at either site because their subsurface presence cannot be conclusively ruled out. This also holds true for projects identified in Table 4.15-1. The project's impacts on unanticipated subsurface archaeological deposits combined with the archaeological resource impacts of projects identified in Table 4.15-1 could be potentially significant. Mitigation Measure 4.7-2a requires all work to halt within 100 feet of a find until a qualified archaeologist can evaluate the find and make recommendations. Measure 4.7-2b requires that the County Coroner notify the Native American Heritage Commission within 24 hours if human remains of Native American origin are encountered, and requires that their treatment conforms with State laws. Implementation of these mitigation measures would reduce the project's contribution to a level that is not cumulatively considerable (less than significant).

At the Tesla Portal site, the Southwest Valve House and the San Joaquin Pipelines (SJPLs) Nos. 1 and 2 are potentially eligible historic architectural resources that could be directly or indirectly affected by project construction. Project construction activities would take place approximately 25 feet from the Southwest Valve House, and a small portion (300 feet) of the approximately 47.5 mile long SJPLs Nos. 1 and 2 would be modified by the project. These construction activities could potentially significant impacts on these historic resources.

Of the projects identified in Table 4.15-1, two SFPUC projects (SJPL System and Rehabilitation of Existing SJPLs) have the potential to also affect these resources during construction. The project's impacts in combination with the two SFPUC cumulative projects could be potentially significant. Project implementation of Mitigation Measure 4.7-3 (Architectural Resources Protection Plan) would ensure protection of identified resources at the Tesla Portal site during construction activities and would reduce impacts to a less-than-significant level. Given that the project impacts would be relatively minor and would be fully mitigated, the project's contribution to cumulative impacts on historic architectural resources would not be cumulatively considerable (less than significant).

Traffic, Transportation, and Circulation

The geographic scope of potential cumulative traffic impacts includes regional facilities (e.g., highways and freeways) and local roads providing access to the project sites.

The impact of short-term cumulative traffic increases from the project construction combined with cumulative traffic increases of other projects associated with construction and operation identified in Table 4.15-1 would be potentially significant. Construction of the project in combination with projects listed in Table 4.15-1 could result in short-term cumulative traffic increases, particularly when travel routes of individual drivers utilize roadways affected by other projects listed in Table 4.15-1. The project's contribution to cumulative construction-related

impacts would be temporary, and would occur during the project construction period (2009 to 2011). Cumulative impacts on regional roads would include increased travel times, although the extent and duration of delay would vary depending on individual driver origins and destinations, time of travel, and use of alternate routes. Localized cumulative construction-related traffic impacts could occur as a result of: 1) cumulative projects that generate increased traffic at the same time on the same roads as the proposed project, causing increased congestion and delays; and 2) infrastructure projects in roads used by project construction workers and trucks, which could delay project-generated vehicles past the work zones of the other projects. Consequently, development of the project in conjunction with other cumulative developments in the project area could result in cumulative increases in construction-related traffic on regional roadways (e.g., SR 132 and I-580). Furthermore, construction of the project in combination with other SFPUC projects could result in cumulative increases in traffic on local roadways providing access to both the Tesla Portal site and Thomas Shaft site. Implementation of SFPUC Construction Measure #5, in combination with implementation of Mitigation Measures 4.15-1a through 4.15-1c would reduce the project's contribution to region-wide and localized cumulative traffic impacts to a less-than-significant level. These mitigation measures require the SFPUC to identify a construction coordinator responsible for coordinating project-specific traffic control plans, the development of a San Joaquin Regional Traffic Control Plan to coordinate project-specific traffic control plans developed for individual WSIP projects in the San Joaquin Region, and coordinate with other agencies, as appropriate. With implementation of these measures, the project's contribution to cumulative traffic impacts would not be cumulatively considerable.

The project would have minor long-term increases in traffic generated by the addition of two new full time equivalent (FTE) employees and additional maintenance, operation, and deliveries to and from the Tesla Portal site, for a total of seven additional round-trips per day at most (two round-trips per day for the two new employees and four maintenance, operation and delivery related round trips); these additional trips are not significant. The Thomas Shaft site would not generate any new vehicle trips, resulting in no long-term traffic impacts associated with this site. Other cumulative development projects listed in Table 4.15-1 would result in greater long-term cumulative traffic increases generated by the development of new residential units, as well as commercial, office, industrial, and institutional uses. The project-related increases in operational traffic would not likely be discernible from future background increases in traffic. Because this increase in vehicle trips on the roadway network would be minimal, the project's contribution to cumulative traffic increases during project operation would not be cumulatively considerable.

Air Quality

The relevant geographical area for cumulative air quality impacts would be the San Joaquin Valley Air Basin (SJVAB) when analyzing regional impacts, and haul routes and traffic roadways/intersections when analyzing localized impacts. The San Joaquin Valley Air Pollution Control District (SJVAPCD) recommends evaluating the following for cumulative air quality impacts:

- Regional
  - Cumulative ozone impacts (NO_X and ROG)

  - Cumulative PM_{10} impacts
- Local
  - Cumulative CO impacts
  - Cumulative hazardous air pollutant impacts, using ,diesel particulate matter (DPM) as a measure for evaluation

Construction of the proposed project would temporarily generate emissions and contribute to both regional (NO_X, ROG, and PM_{10}) and local (CO and DPM) air impacts. Many of the projects identified in Table 4.15-1 would have construction activities overlapping with the project's construction activities. As such, the impact of construction emissions from the proposed project combined with the construction emissions of other projects identified in Table 4.15-1 would be potentially significant.

Implementation of Mitigation Measures 4.9-1a and 4.9-1b (incorporate SJVAPCD recommended fugitive dust and exhaust mitigation, including enhanced measures, into project construction) would reduce construction emission impacts from the proposed project to a less than significant level. Therefore, construction of the project would not have a cumulatively considerable contribution to regional (NO_X, ROG, and PM_{10}) cumulative emissions.

Construction of the project would generate local CO and DPM emissions. These emissions would be generated primarily from equipment exhaust, employee vehicles, and construction trucks and would be mitigated in accordance with Mitigation Measure 4.9-1b to less than significant. DPM emissions resulting from the proposed project would be less than significant based on traffic volumes, duration, and the distant location of receptors. As such, construction of the proposed project would not have a cumulatively considerable contribution to local CO and DPM cumulative emissions.

As detailed in Section 4.9, operational emission increases from the project are expected to be minor compared to existing conditions and are less than significant. The increases in operational air pollutant emissions from the identified cumulative projects would largely result from regional traffic increases. The proposed project would generate minor vehicle emissions, in addition to minor emissions from the generators and tanks. As such, operation of the proposed project would not have a cumulatively considerable contribution to regional (NO_X, ROG, and PM_{10}) cumulative emissions.

Operation of the proposed project would also generate local CO and DPM emissions. CO and DPM emissions would be generated from the programmatic testing and operation of emergency generators and from increased vehicles trips. As detailed in Section 4.9, operational emission increases (including traffic trips) from the proposed are expected to be minor compared to existing conditions and are less than significant. Therefore, operational vehicle and generator emissions would not have a cumulatively considerable contribution to local (CO, and DPM) cumulative emissions.

Greenhouse Gas (GHG) Emissions

The current statewide annual net GHG inventory is estimated at 479.74 million metric tons of CO_2e (CARB, 2007b). CARB has identified 427 million metric tons of CO_2e as the total statewide greenhouse gas 1990 emissions level and, therefore, the 2020 emissions limit. The limit is a cumulative statewide limit, not a sector or facility specific limit (CARB, 2007a). Therefore, the state's goals are to reduce GHG emissions by 52.74 million metric tons of CO_2e by the year 2020.

The proposed project consists of improvements to existing water system operations and would result in few new operational activities associated with GHG emission increases. GHG emissions from the proposed project would be generated from construction, operations, and secondary operational increases in GHG emissions resulting from electricity generation. The proposed project's emissions would overlap with similar sources of GHG emissions from other cumulative projects. The increase in GHG emissions during project construction and operation would be minimal in comparison to statewide totals.

The project's reasonable worst-case annual construction emissions of GHG are estimated at 5,289 metric tons of CO_2e per year, which represents only 0.0011 percent of the statewide total.

The proposed project would also result in secondary operational increases in GHG emissions as a result of electricity generated to meet the project's increase in energy demand. Although electricity for the proposed project would be derived primarily from hydroelectric sources, power would need to be purchased from other sources when less hydroelectric power is available, particularly during the summer and fall months. Power generation is regional in nature and could occur outside the SJVAB or outside of California. Therefore, the project's incremental increase in power demand during project operations (the portion that is not from hydroelectric sources) would indirectly serve to sustain rather than reduce current GHG emissions.

A very minor amount of GHG emissions (relative to statewide totals) would be emitted during construction and operation of the proposed project. Furthermore, with compliance with federal and state mobile and stationary source regulations, continuing compliance with federal and state GHG regulations (including CARB's Early Action Measures and the CEC's greenhouse gases emission performance standard for local, public owned electric utilities when they become effective), and implementation of GHG reduction actions by the City and County of San Francisco and SFPUC, the project would not conflict with the state goal of reducing GHG emissions in California to 1990 levels by 2020. Therefore, the project's contribution to GHG emissions would not be cumulatively considerable.

Noise and Vibration

The geographic scope of potential cumulative noise impacts encompasses the project sites and their immediate vicinities as well as areas adjacent to the project site's access and haul routes.

The analysis in Section 4.10 concluded that, at the Tesla Portal site, the proposed project would result in a short-term, temporary increase in the ambient noise level during construction but that

impacts are considered less than significant at offsite noise-sensitive receptors. Construction noise from the other SFPUC projects nearby the Tesla Portal site (including the SJPL pipeline system and rehabilitation of the existing SJPLs) could potentially result in a temporary cumulative increase in noise levels at on and offsite receptors. However, even if construction activities were occurring at the same time, noise levels would only increase by 3 dBA. Based on the distance from the cumulative construction activities, sound levels at the community of Chrisman and the residence to the southeast would average 58 dBA, and would average 68 dBA at the uninhabited ranch structures to the west. These levels would be below the 70 dBA daytime speech interference criterion and the 60 dBA nighttime sleep interference criterion at residences; therefore, the project would not contribute considerably to cumulative construction noise impacts at offsite receptors. There could be significant noise impacts at the onsite caretaker's residence. These impacts would be reduced to less than significant by Mitigation Measure 4.10-1, which requires the caretaker's residence be vacated during construction activities that would exceed 70 dBA during the daytime or 60 dBA during the nighttime. Construction activities from the other SFPUC projects would be required to implement the same mitigation measure to avoid cumulative impacts.

The SFPUC Thomas Shaft Roadway Improvement Project and the Thomas Shaft Chlorination Facility Phase 2 projects would both be completed prior to construction of the proposed project. It is possible that six months of noise-generating construction activity at the Thomas Shaft site would occur simultaneously with construction associated with the Carnegie State Vehicular Recreational Area Alameda-Tesla Expansion Project and with the LLNL Site 300 Pipeline Connection project. However, the Carnegie State Vehicular Recreational Area is one mile west of the Thomas Shaft site. The nearest sensitive receptor is a rural residence located about 1.25 miles to the northeast of the Thomas Shaft site, and is separated from the Thomas Shaft site by hills. Given the distance and topography between the Carnegie State Vehicular Recreational Area Alameda-Tesla Expansion Project and the Thomas Shaft site, the project would not contribute considerably to cumulative noise impacts at the Thomas Shaft site.

The roadways that would be part of the common haul route for the Tesla Portal site would be West Vernalis Road and Chrisman Road, while the common haul route for the Thomas Shaft site would be Corral Hollow Road. Cumulative traffic increases on I-580 and SR 132 would not likely alter noise levels significantly along these routes (I-580 and SR 132), given the high ambient noise levels that typically occur along these types of roadways. Because existing and existing plus project noise levels at 50 feet from the centerline of the roadways were calculated to be less than 65 dBA CNEL, noise levels at actual receptors farther away from the road would also be less than the 65 dBA CNEL criterion. Therefore, unless truck traffic associated with the other projects (including SFPUC) is extremely high, (three to four times over the existing levels), it is unlikely that cumulative noise impacts from construction traffic at sensitive receptors would occur.

Public Services and Utilities

The geographic scope of potential cumulative public services and utilities impacts encompasses the project sites, their immediate vicinities, and the service areas of regional service/utility providers.

The tie-in of new facilities at the Tesla Portal site would occur during a regularly scheduled maintenance shutdown between January and February 2010, and would not interrupt service to SFPUC water customers, who would continue to be served by other system sources. Construction of facilities at the Thomas Shaft site would not require any shutdown. Other SFPUC projects identified in Table 4.15-1 could require tie-ins to the SFPUC water supply system. Like the project, these projects would also occur during a regularly scheduled maintenance shutdown, resulting in uninterrupted water service to SFPUC customers. Thus, the project and other SFPUC projects would not contribute to cumulative disruptions in water service for SFPUC customers.

Project construction and operation would generate a minimal amount of solid waste, and the project would not substantially affect the total existing landfill capacity in the San Joaquin region. The construction and operation of other cumulative projects identified in Table 4.15-1 would also generate solid waste; it is anticipated that these projects would be expected to reduce cumulative solid waste impacts through project-specific mitigation requirements. There are three landfills permitted to accept construction and demolition waste in the project vicinity with sufficient capacity that would not be affected by the construction and operation of the project in combination with projects listed in Table 4.15-1. Therefore, the project's contribution to cumulative landfill capacity demand would not be cumulatively considerable (less than significant).

During project operation, the increase in the number of onsite employees would be minimal (two new employees at the Tesla Portal site and no new employees at the Thomas Shaft site), resulting in a minimal increase in the demand for potable water and a minimal increase in the generation of wastewater at the Tesla Portal site. Of the reasonably foreseeable projects listed in Table 4.15-1, the Tracy Gateway PUD, Tracy Hills Specific Plan, and Ellis Specific Plan would require additional water supplies and result in increased wastewater generation. The additional need for water supply generated by these projects may not be able to be reduced to a less than significant level, in which case these cumulative projects could result in cumulatively or individually significant impacts on water supply in the San Joaquin Valley region. The project would not contribute considerably to this cumulative impact, due to its comparatively minor increase in potable water demand. As such, the proposed project would not have a cumulatively considerable contribution to potable water demand. The wastewater generated by the project would be handled onsite by a new proposed septic tank and leachfield at the Tesla Portal site and would not have a cumulatively considerable contribution to wastewater generation.

Agricultural Resources

The geographic scope of potential cumulative agricultural resources impacts encompasses the project sites and their immediate vicinities. However, major developments in non-urban areas are considered when evaluating cumulative regional impacts on agricultural resources.

As indicated in Table 4.15-1, reasonably foreseeable cumulative development in the project area includes new residential, commercial, office, industrial, and institutional uses, as well as transportation projects (highway and roadway improvements), infrastructure improvements (including utilities), and quarry expansion. Cumulative projects involving improvements or

modifications to transportation projects or infrastructure projects could convert some agricultural land, but may not preclude agricultural activity. Various mitigation measures (payment of fees or establishment of offsite agricultural lands in perpetuity) could compensate for such impacts. However, development projects such as the Tracy Gateway PUD, Tracy Hills Specific Plan, Ellis Specific Plan, and the RMC Pacific Vernalis Quarry Mining and Reclamation Project could result in the loss of agricultural land and/or conflict with agricultural zoning or Williamson Act contracts. These projects may not be able to sufficiently mitigate such impacts and, therefore, cumulatively significant impacts on agricultural resources in the project area could occur.

The proposed project would not result in the conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to nonagricultural use; preclude agricultural activities on the undeveloped portion of either site; conflict with Williamson Act contracts; disrupt access to actively farmed parcels; or conflict with zoning for agricultural use. The project is considered an essential public facility, which is allowed under the agricultural zoning designation. As such, the project could not contribute to the cumulative loss of agricultural land.

Hazards

The geographic scope of impacts associated with hazards and hazardous materials encompasses the project sites and their immediate vicinities.

During construction, the proposed project has the potential to encounter hazardous materials in soil and groundwater, accidentally release hazardous materials such as motor fuels, oil, solvents, and lubricants, start a wildfire, impede access for emergency response vehicles, and interfere with an emergency response plan or emergency evacuation plan. Due to the site-specific nature of hazardous materials impacts, only those projects listed in Table 4.15-1 that would occur at or adjacent to the project site, including the SFPUC's SJPL System Project and the SFPUC's Rehabilitation of the Existing SJPL Project, could result in similar hazards and hazardous materials impacts as the project.

The Phase I ESA (AGS, 2007) determined that the likelihood that contaminated soil or groundwater would be encountered during construction of the proposed project at the Tesla Portal site is low. Due to the small scale of current and historic operations at the Thomas Shaft site, its remote location, and the limited scope of proposed improvements and excavation, the likelihood that contaminated soil or groundwater would be encountered during construction at the Thomas Shaft site was also determined to be low. Further, the project would implement SFPUC Construction Measure #7 for hazardous materials, which requires that a site assessment be conducted by a qualified environmental professional no more than three months before construction, and that a contingency plan be prepared identifying measures to be taken should unanticipated contamination be identified during construction. Moreover, the potential that an accidental release would occur at both sites during construction would be reduced by the use of standard operating procedures for the safe storage and use of hazardous materials in compliance with state and federal occupational safety and health codes and regulations.

In addition, the project would comply with SFPUC Construction Measure #3 for water quality, which requires the implementation of erosion control measures, including preparation and implementation of a SWPPP as required by the RWQCB. The project would also comply with regulations governing the use of construction equipment in fire prone areas that are designed to minimize the risk of wildland fires during construction activity in accordance with the Public Resources Code. Project construction would not require the use of public roadways for construction staging and equipment parking. Additionally, no lane or road closures are anticipated. Thus, it is not likely that project construction activities could impede access for emergency response vehicles, interfere with an emergency response plan or emergency evacuation plan. In addition, SFPUC Construction Measure #5, which includes preparation and implementation of a traffic control plan, would be implemented as part of the project to minimize impacts on traffic flow.

Consequently, with compliance with applicable laws and regulations and implementation of SFPUC standard construction measures, the project would result in less than significant hazards and hazardous materials impacts. The construction-related hazards and hazardous materials impacts of the SFPUC's SJPL System Project and the SFPUC's Rehabilitation of the Existing SJPL Project would be anticipated to be reduced to a less-than-significant level as a result of compliance with applicable laws and regulations and implementation of SFPUC standard construction measures, similar to the proposed project. Therefore, the project would not have a cumulatively considerable contribution to hazards and hazardous materials impacts.

The expansion of operations at both project sites would increase the number and quantities of hazardous materials used onsite and thus, would increase the potential for chemical spillage during normal operations due to equipment malfunction or operator error, or be caused by natural hazards, such as seismic events. Such events and accidental chemical release could cause health effects to workers, and less likely, to persons outside the facility fence lines. Releases also could cause adverse environmental effects. Potential impacts related to accidental releases of chemicals stored at the water treatment facilities would be site-specific and not additive. Compliance with hazardous materials regulations (including preparation or updating of hazardous materials business plans) would ensure that site-specific impacts are less than significant. Due to the site-specific nature of these impacts, compliance with applicable laws and regulations, and implementation of SFPUC construction measures and mitigation measures identified in Section 4.13, there would be no potential for region-wide or cumulative effects related to the exposure to hazardous materials during operations at both project sites.

Energy Resources

The geographic scope of impacts associated with energy resources encompasses the project sites, their immediate vicinities, and the SFPUC facilities in the SFPUC Power Enterprise's San Joaquin Region.

- The SFPUC estimates that, in total, the proposed improvements at the Tesla Portal site would require the use of approximately 6,000,000 kWh per year, an increase from the existing annual consumption of 175,000 kWh. Operation of project facilities at Thomas Shaft would result in an

annual energy demand of 110,800 kWh, an increase from its current average annual consumption of 70,800 kWh. The additional energy demand would represent roughly 13 percent of the regional water system's current annual energy use of 44 million kWh per year. Additionally, the energy use by the regional water system is a fraction (less than 3 percent) of the long-term annual average energy production of the Hetch Hetchy system, and would remain at approximately 3 percent, including the project's increased operational energy use.

The operation of other SFPUC projects identified in Table 4.15-1 would not substantially increase energy use in the SFPUC Power Enterprise's San Joaquin Region during operation, because, in general, they are non-energy-intensive improvements to the water system, upgrades related to energy efficiency improvements, or improvements to facility electrical systems. However, the project would have a significant contribution to energy consumption in the SFPUC Power Enterprise's San Joaquin Region. Although the project would primarily receive hydroelectric power from the SFPUC Power Enterprise during the fall and summer months when power generation under the Hetch Hetchy system is reduced, less hydroelectric power would be available and PG&E would supplement power supplies. The project's increase in power use could result in a higher reliance on nonrenewable energy resources during the fall and summer months. Other projects listed in Table 4.15-1 would also rely on PG&E for power during the fall and summer months. As such, the impact of nonrenewable energy consumption during the fall and summer months from the proposed project combined with the nonrenewable energy consumption of other projects identified in Table 4.15-1 would be potentially significant.

- Mitigation Measure 4.14-1 requires energy efficiency measures consistent with the California Energy Action Plan II priorities to be undertaken at both sites. Mitigation Measure 4.14-1 also requires preparation of a repair and maintenance plan for each facility to minimize power use and include the use of renewable energy at the Tesla Treatment Facility. SFPUC would also consider methods for reducing the carbon footprint at each site by requiring review of the final design by the Power Enterprise Energy Efficiency Group, ensuring that any features that would improve energy sustainability are incorporated, as feasible, into the design. SFPUC would also seek to reduce its carbon footprint by incorporating the use of energy efficient lighting, heating, ventilation, and air conditioning (HAVC) systems at each site. Additional specific measures would be undertaken at the Tesla Portal site, such as the incorporation of efficiency measures in the Draft Design Criteria manual for the Tesla Treatment Facility, which would require improvements to meet and/or exceed Title 24 energy efficiency standards by a minimum of five percent.[1] The SFPUC may consider the use of solar power at the Tesla Portal site in the future; however, solar panels are not currently proposed as part of the project and if solar panels were installed at the Tesla Portal site, they would be added after completion of all construction activities at the site. As such, operational energy consumption from the project, with Mitigation Measure 4.14-1 and additional measures to be undertaken by the SFPUC, would be less than significant. Furthermore, any additional power the project may need (above hydroelectric power provided by the SFPUC) during the fall and summer months, when hydroelectric power is reduced, would be negligible and would be purchased from PG&E or other

[1] This minimum five percent reduction in energy use includes lighting systems, which would also meet the recommendations of the Illuminating Engineering Society Handbook.

power generators. Operation of the proposed project would not have a cumulatively considerable contribution to cumulative consumption of nonrenewable energy supplies.

4.15.5 References

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CHAPTER 5
Mitigation Measures

5.1 Introduction

This chapter describes the proposed mitigation measures for the significant and potentially significant environmental impacts identified in Chapter 4, Environmental Setting and Impacts. These measures are designed to be feasible and to ensure that project impacts are avoided or reduced to a less-than-significant level. The SFPUC has adopted Standard Construction Measures (refer to Chapter 3.0, Project Description) that would be implemented as part of the proposed project. If, with implementation of the Standard Construction Measures, the project impact is less than significant, no mitigation measures are identified.

Chapter 4 identifies the level of significance for project impacts. Determinations are one of the following: N/A (not applicable, or no impact), LS (Less than Significant, no mitigation required), and PSM (Potentially Significant Mitigable, impacts can be mitigated to less than significant). The significance determinations are based on the potential effects of the proposed project as they relate to the significance criteria listed in Chapter 4, with consideration of the SFPUC Standard Construction Measures and regulatory requirements. Mitigation measures are identified for impacts determined to be PSM, to the extent that feasible mitigation would be available.

- As previously discussed in Section 1.2, the proposed project is a component of the SFPUC's Water System Improvement Program (WSIP). To address the potential environmental impacts of the proposed WSIP projects at a programmatic level, the San Francisco Planning Department prepared a Program Environmental Impact Report (PEIR) that was certified on October 30, 2008 (Motion No. 17734). The project mitigation measures listed below are based in part on the applicable WSIP PEIR mitigation measures. In some cases, they have been modified based on project-level detail and analysis. Refer to Appendix D for more detailed discussion of the WSIP PEIR program-level mitigation measures as they relate to the proposed project.

CEQA Section 15126.4 states that an EIR shall distinguish between mitigation measures which are proposed by the SFPUC to be included in the project and the measures that are proposed by the lead agency. At this time, the SFPUC intends to incorporate all mitigation measures presented in this EIR into the project and, therefore, all measures are considered to be proposed by the SFPUC. If any mitigation measures are not adopted by the SFPUC, the SFPUC would adopt a finding of overriding consideration before implementing actions that could result in significant impacts.

5.2 Mitigation Measures

This section presents all mitigation measures to address impacts described in Chapter 4. Mitigation measures for impacts identified in Sections 4.2 through 4.14 are presented under the respective environmental resource topic. Mitigation measures for cumulative impacts (Section 4.15) are also presented. All mitigation measures are numbered to correspond to the same impact numbers, although in some cases, the same measure would mitigate more than one impact. The numbering corresponds to the first impact identified and is cross-referenced so that measures are not duplicated. Table 1.1 in Chapter 1 summarizes project impacts and mitigation measures. Table 5-1 summarizes mitigation measures and identifies whether each measure applies to the Tesla Treatment Facility and/or the Lawrence Livermore Water Quality Improvements. A full description of each measure follows the table.

TABLE 5-1
SUMMARY OF APPLICABLE MITIGATION MEASURES BY PROJECT SITE

Mitigation Measures (summarized here – refer to complete text in section below)	Tesla Treatment Facility (Tesla Portal Site)	Lawrence Livermore Water Quality Improvements (Thomas Shaft Site)
Section 4.2 Plans and Policies		
No Mitigation Measures necessary.		
Section 4.3 Land Use and Visual Quality		
Mitigation Measure 4.3-5a – Architectural Design	x	
Mitigation Measure 4.3-5b – Landscape Screens	x	
Section 4.4 Geology and Soils		
Mitigation Measure 4.4-9 – Characterize Extent of Expansive and Corrosive Soil	x	x
Section 4.5 Hydrology and Water Quality		
No Mitigation Measures necessary.		
Section 4.6 Biological Resources		
Mitigation Measure 4.6-1a – Participate in the SJMSCP	x	x
Mitigation Measure 4.6-1b – Implement Best Management Practices	x	
Mitigation Measure 4.6-2 – Return Site to Pre-Construction Condition	x	
Mitigation Measure 4.6-3a – Worker Awareness Program	x	x
Mitigation Measure 4.6-3b – Conduct Pre-Construction Surveys for San Joaquin Whipsnake and California Horned Lizard	x	x
Mitigation Measure 4.6-3c – Implement Incidental Take Minimization Measures for San Joaquin Kit Fox	x	x
Mitigation Measure 4.6-3d – Conduct Pre-Construction Surveys to Determine Presence/Absence of San Joaquin Pocket Mouse	x	x
Mitigation Measures 4.6-3e, 3f and 3g – Conduct Pre-Construction Surveys for Burrowing Owls	x	
Mitigation Measure 4.6-3h – Conduct Pre-Construction Surveys for Swainson's Hawk	x	
Mitigation Measure 4.6-3i – Implement Incidental Take Minimization Measures for White-Tailed Kite	x	x

TABLE 5-1
SUMMARY OF APPLICABLE MITIGATION MEASURES BY PROJECT SITE

Mitigation Measures (summarized here – refer to complete text in section below)	Tesla Treatment Facility (Tesla Portal Site)	Lawrence Livermore Water Quality Improvements (Thomas Shaft Site)
Mitigation Measure 4.6-3j – Implement Incidental Take Minimization Measures for California Horned Lark and Northern Harrier	x	x
Mitigation Measure 4.6-3k – Conduct Pre-Construction Surveys for Golden Eagle	x	x
Mitigation Measure 4.6-3l – Conduct Pre-Construction Surveys for Ferruginous Hawk and Prairie Falcon	x	x
Section 4.7 Cultural Resources		
Mitigation Measures 4.7-1a – Paleontological Monitoring During Excavation	x	
Mitigation Measures 4.7-1b – Suspend Construction Work if Paleontological Resource is Discovered	x	x
Mitigation Measure 4.7-2a – Accidental Archaeological Discovery	x	x
Mitigation Measure 4.7-2b – Treatment of Human Remains	x	x
Mitigation Measure 4.7-3 – Architectural Resources Protection Plan	x	
Section 4.8 Traffic, Transportation and Circulation		
No Mitigation Measures necessary.		
Section 4.9 Air Quality		
Mitigation Measure 4.9-1a – SJVAPCD Dust Control Measures	x	x
Mitigation Measure 4.9-1b – SJVAPCD Exhaust Control Measures	x	x
Section 4.10 Noise and Vibration		
Mitigation Measure 4.10-1 – Vacate SFPUC Caretaker's Residence at the Tesla Portal Site	x	
Mitigation Measure 4.10-2 – Maintain Structural Integrity of San Joaquin Pipelines	x	
Section 4.11 Public Services and Utilities		
No Mitigation Measures necessary.		
Section 4.12 Agricultural Resources		
No Mitigation Measures necessary.		
Section 4.13 Hazards		
No Mitigation Measures necessary.		
Section 4.14 Energy Resources		
Mitigation Measure 4.14-1 – Incorporation of Energy Efficiency Measures	x	x
Section 4.15 Cumulative Effects – Traffic		
Mitigation Measure 4.15-1a – SFPUC WSIP Projects Construction Coordinator	x	x
Mitigation Measure 4.15-1b – Combined San Joaquin Regional Traffic Control Plan	x	x
Mitigation Measure 4.15-1c – Coordination with Other Agencies	x	x

5.2.1 Land Use and Visual Quality

Architectural Design

Mitigation Measure 4.3-5a: The design of the proposed buildings at the Tesla Treatment Facility shall consider the existing visual character of the site and surrounding area, including the visibility of facilities and related structures from I-580. Proposed buildings shall be designed to minimize the intrusion of structures into the natural setting of the site by using colors that are compatible with the existing architecture and visual character of the site.

Landscape Screens (Trees or Berms)

Mitigation Measure 4.3-5b: In addition to revegetation of disturbed areas per SFPUC Standard Construction Measure #10 and Mitigation Measure 4.6-2, new plantings and/or a landscape berm shall be required to screen views of new structures and equipment from I-580 (a designated state scenic highway) to the extent possible, provided that such landscaping does not affect security of SFPUC facilities.

5.2.2 Geology, Soils and Seismicity

Characterize Extent of Expansive and Corrosive Soil

Mitigation Measure 4.4-9: If the screening analysis conducted in accordance with SFPUC Standard Construction Measure #2 identifies a potential for expansive or corrosive soils, the site-specific geotechnical investigation shall include a characterization of the presence and extent of expansive and corrosive soil at the project sites. The results and recommendations of the investigation shall be incorporated into the final project design for the Tesla Treatment Facility. For the Lawrence Livermore Water Quality Improvements, prior to construction, the SFPUC shall obtain soil samples for testing of corrosive/expansive soils and use to adjust the final project design of the pipeline, or, alternatively, the SFPUC shall implement a conservative design approach of the pipeline that shall address potential corrosivity.

5.2.3 Biological Resources

The proposed project would participate in the San Joaquin County Multi-Species Habitat Conservation and Open Space Plan (SJMSCP) to mitigate impacts to aquatic habitat, natural lands and to obtain any necessary incidental take coverage for federally- and state- listed species. The SJMSCP is designed to provide a regional approach to mitigating development impacts on the 97 listed and non-listed plant, fish, and wildlife species covered by the SJMSCP and to compensate for the conversion of open space to non–open space uses. The SJMSCP provides incidental take authorization for covered projects that implement certain approved incidental take mitigation measures (ITMMs) and, if applicable, provides compensation for habitat losses through the collection of fees that are used to preserve habitats elsewhere.

Participate in the SJMSCP

- Mitigation Measure 4.6-1a: Prior to the commencement of construction activities, SFPUC shall coordinate with the Joint Powers Authority (JPA)/Technical Advisory Committee (TAC),

implement relevant ITMMs for applicable species (as identified in Mitigation Measures 4.6-3b through 4.6-3l, below) and pay any necessary fees to fund offsite compensation under the terms of the SJMSCP to provide replacement values that are equal to that of the permanent loss of 3.2 acres of California annual grasslands and 0.01 acre of ruderal/disturbed land, and temporary impacts to 11.72 acres of California annual grassland and 0.96 acre of ruderal/disturbed land, and incidental take authorization for special-status species.

Implement Best Management Practices

Mitigation Measure 4.6-1b: SFPUC shall implement Best Management Practices to ensure that natural flow is maintained in the ephemeral drainage during and after construction of the pipeline at the ephemeral drainage. Natural flow will be maintained by restricting construction to the dry season (e.g., April 15 – October 15) or by diverting water around the construction area (e.g., a dam and a pump) or through the construction area (e.g., a culvert) in the ephemeral drainage during the wet season (e.g., October 16 – April 14). The drainage channel will be restored and recontoured to pre-existing conditions after construction.

In addition, prior to the start of staging, ground disturbing activities, or large-scale materials off-haul or delivery, SFPUC shall require the contractor to implement the following actions intended to avoid or reduce indirect and direct impacts on the ephemeral drainage at the Tesla Portal site.

- SFPUC or its contractor(s) shall install appropriate erosion control (e.g., certified weed free straw bales, silt fencing, straw wattles, erosion and sediment control fabric) at the pipeline crossing and the intersections of the road and the ephemeral drainage to minimize potential for increased sedimentation and turbidity.

- SFPUC shall prohibit its contractor(s) from refueling, washing, and repairing equipment in and near (i.e., within at least 25 feet) the ephemeral drainage at the Tesla Portal project site.

- SFPUC shall require fencing of the ephemeral drainage (e.g., temporary construction "orange mesh" fencing or silt fencing) adjacent to the footprint of the pipeline crossing and the access road crossing, and shall require signage to be placed at the sites indicating that it is a restricted area. SFPUC shall require its contractor(s) to stay out of the fenced and signed area. SFPUC shall require its contractor(s) to limit vehicle speeds to 15 mph on unpaved roads in the vicinity of the fenced area ephemeral drainage to prevent dust effects. SFPUC shall also require its contractor(s) to control dust (i.e., stabilization of dust emissions using water or chemical stabilizer/suppressant) along the existing access road leading to the Tesla Portal project site, as required to control dust (refer also to Mitigation Measure 4.9-1a, SJVAPCD Dust Control Measures).

Return Site to Pre-Project Condition

Mitigation Measure 4.6-2: Vegetation removal and soil disturbance shall be limited to the minimum amount necessary for project implementation, especially where the existing access road comes near the artificial wetland, and where the proposed pipeline would cross both the artificial wetland and the ephemeral drainage. Where soils are disturbed and/or vegetation removed on the project site, such as in the construction staging area, the site shall be returned to pre-project

conditions (i.e., return site contours to pre-project profiles, restore original grades where possible, lightly compact loose soils or aerate compacted soils) where necessary. Where grading occurs, 12 inches of topsoil shall be salvaged and respread in graded areas as appropriate. When natural vegetation is disturbed, small areas (e.g., less than 100 square feet in size) shall be allowed to re-vegetate passively, while larger disturbed areas (e.g., more than 100 square feet in size or in areas prone to erosion such as sloped areas) shall be re-seeded with locally available native grasses and forbs (as needed).

Worker Awareness Program

Mitigation Measure 4.6-3a: Prior to the commencement of construction activities, a qualified biologist shall conduct a worker awareness program (environmental education) to inform project workers of the sensitive habitat and species potentially found onsite and their responsibilities with regards to protecting those sensitive biological resources.

Conduct Pre-Construction Surveys for San Joaquin Whipsnake and California Horned Lizard

Mitigation 4.6-3b: Prior to the start of construction, a qualified biologist shall conduct San Joaquin whipsnake surveys, and surveys for California horned lizard. These species are of very limited distribution within San Joaquin County, primarily isolated locations outside of anticipated development areas. Therefore, if discovered on a project site and prior to ground disturbance, ITMMs shall be formulated by the SJMSCP TAC and approved by the San Joaquin Council of Governments (SJCOG) with the concurrence of the Permitting Agencies' representatives on the TAC. ITMMs may consist of preconstruction surveys, avoidance techniques and/or buffer areas.

Implement Incidental Take Minimization Measures for San Joaquin Kit Fox

Mitigation Measure 4.6-3c: SFPUC shall implement the ITMMs identified for the San Joaquin kit fox under the SJMSCP to reduce the level of impact on the San Joaquin kit fox. Mitigation measures defined by the SJMSCP and the USFWS to protect the San Joaquin kit fox include the following:

- A qualified biologist with demonstrated experience in kit fox biology, identification, and survey techniques shall conduct preconstruction surveys two calendar weeks to 30 calendar days prior to commencement of ground disturbance. Surveys shall be conducted by qualified biologists. When surveys identify potential dens (potential dens are defined as burrows at least four inches in diameter which open up within two feet), potential den entrances shall be dusted for three calendar days to register track of any San Joaquin kit fox present. If no San Joaquin kit fox activity is identified, potential dens may be destroyed.
- If San Joaquin kit fox activity is identified, then dens shall be monitored to determine if occupation is by an adult fox only or is a natal den (natal dens usually have multiple openings). If the den is occupied by an adult only, the den may be destroyed when the adult fox has moved or is temporarily absent. If the den is a natal den, a buffer zone of 250 feet shall be maintained around the den until the biologist determines that the den has been vacated.

- Where San Joaquin kit fox are identified, the provisions of the U.S. Fish and Wildlife Service's published "Standardized Recommendations for Protection of the San Joaquin kit fox Prior to or During Ground Disturbance" shall apply (except that preconstruction survey protocols shall remain as established in this paragraph). These standards include provisions for educating construction workers regarding the kit fox, keeping heavy equipment operating at safe speeds, checking construction pipes for kit fox occupation during construction and similar low or no-cost activities.

Conduct Pre-Construction Surveys to Determine Presence/Absence of San Joaquin Pocket Mouse

Mitigation Measure 4.6-3d: Prior to the start of construction activities, a qualified biologist shall conduct surveys to determine the presence or absence of San Joaquin pocket mouse. If the species is not found, then no other mitigation is required. If the species is found in or near potential work areas, the SFPUC will coordinate with the SJMSCP TAC to formulate avoidance measures, such as buffer areas and limiting the time and extent of construction activities.

Conduct Pre-Construction Surveys for Burrowing Owls

Mitigation Measure 4.6-3e: Breeding Season Surveys.

- Measures to avoid and minimize impacts on the western burrowing owl will be implemented as described below: If project schedule permits, a qualified biologist will survey for burrows and burrowing owls during the breeding season (February 1 to August 31), immediately preceding construction. Surveys will be conducted within 500 feet of the project boundary (access permitting) in accordance with the California Burrowing Owl Consortium (1993) guidelines or as otherwise determined by CDFG. Burrows would be inspected for signs of owl activity (tracks, pellets, feathers, etc.). The locations of burrowing owl sightings, occupied burrows, and burrows with signs of owl activity will be marked on a map of the project area at a scale sufficient to accurately show the distance of active burrows to the limits of construction. Surveys will be conducted on at least four separate dates during the breeding season in areas where suitable burrows are present. If possible, surveys will be conducted during the peak of the burrowing owl breeding season, generally between April 15 and July 15.

- If occupied owl burrows are found within the survey area, a determination will be made by a qualified biologist, in consultation with CDFG, as to whether work will affect the occupied burrows or disrupt reproductive behavior.

- If it is determined that construction will not affect occupied burrows or disrupt breeding behavior, construction will proceed without any restrictions or mitigation measures.

Mitigation Measure 4.6-3f: Winter Surveys. Measures to avoid and minimize impacts on the western burrowing owl will be implemented as described below:

- If birds are not observed during breeding season surveys, or if breeding season surveys are infeasible due to project scheduling, or if construction will occur during the wintering season,

a winter survey will be conducted to identify non-breeding residents of the project site. Winter surveys will be conducted within 500 feet of the project site (access permitting) or as otherwise determined by CDFG during the period when wintering owls are most likely to be present (December 1 to January 31). The locations of burrowing owl sightings, occupied burrows, and burrows with signs of owl activity will be marked on a map of the project area at a scale sufficient to accurately show the distance of active burrows to the limits of construction.

- If occupied owl burrows are found within the survey area, a determination will be made by a qualified biologist, in consultation with CDFG, as to whether or not work will affect the occupied burrows.

- If it is determined that construction will not affect occupied burrows, construction will proceed without any restrictions or mitigation measures.

- If it is determined that construction will affect occupied burrows, the subject owls will be passively relocated from the occupied burrow(s) using one-way doors prior to the onset of breeding season. Owls will be encouraged to relocate to alternate burrows that are at least 160 feet from the construction limits. One alternate natural or artificial burrow for each burrow excavated will be in place at least one week before one-way doors are installed on occupied burrows. One-way doors will be in place for a minimum of 48 hours before burrows are excavated.

Mitigation Measure 4.6-3g: Fall Surveys. Measures to avoid and minimize impacts on the western burrowing owl will be implemented as described below:

- If surveys must be conducted between September 1 and November 30 (which is outside of the time windows specified above), a qualified biologist will conduct a survey for burrows and burrowing owls no more than thirty (30) days prior to ground-disturbing activity. If necessary, resident owls will be passively relocated from occupied burrows, as described above. If construction activities are still ongoing beyond November 30, then winter surveys will be conducted during December and January.

Conduct Pre-Construction Surveys for Swainson's Hawk

Mitigation Measure 4.6-3h: A qualified biologist shall conduct a preconstruction survey for Swainson's hawk, prior to the commencement of any ground disturbing construction activities (e.g., grass/vegetation/brush/tree removal, soil excavation, grading, vehicle access, staging of materials or vehicles, large scale materials off-haul or delivery, construction of temporary or permanent access roads).

In the case that Swainson's hawks are found nesting in the area, the SFPUC will notify CDFG. At a minimum, the following mitigations regarding Swainson's hawk, as listed from the SJMSCP, will be implemented:

- If a nest tree becomes occupied during construction activities, then all construction activities shall remain a distance of two times the dripline of the tree, measured from the nest.

- If any nest trees need to be removed, they may be removed between September 1 and February 15, when the nests are unoccupied.

- The following two measures will also be implemented:

  - If any unoccupied nests are found during preconstruction surveys, these nests may be removed when the nests are unoccupied.

- - If any occupied nests are found during preconstruction surveys, then all construction activities shall remain at a distance of ¼ mile (1,320 feet), unless CDFG agrees to other equally effective measures (e.g., monitor occupied nest during construction in the buffer zone, limit hours of construction, restrict construction activities, etc).

Implement Incidental Take Minimization Measures for White-Tailed Kite

Mitigation Measure 4.6-3i: SFPUC shall implement the ITMM identified for the white-tailed kite under the SJMSCP, which consists of the following:

- A qualified biologist shall conduct preconstruction surveys and investigate all potential nesting trees on the project site (e.g., especially tree tops 15-59 feet above the ground in oak, willow, eucalyptus, cottonwood, or other deciduous trees), during the nesting season (February 15 to September 15) whenever white-tailed kites are noted on site or within the vicinity of the project site during the nesting season.

- - If the species is found nesting, a setback of 100 feet from nesting areas shall be established and maintained during the nesting season for the period encompassing nest building and continuing until fledglings leave nests, unless CDFG agrees to other equally effective measures (e.g., monitor occupied nest during construction in the buffer zone, limit hours of construction, restrict construction activities, etc.) and CDFG shall be notified of the proposed buffer zone. This setback applies whenever construction or other

ground-disturbing activities must begin during the nesting season in the presence of nests which are known to be occupied. Setbacks shall be marked by brightly colored temporary fencing.

Implement Incidental Take Minimization Measures for California Horned Lark and Northern Harrier

Mitigation Measure 4.6-3j: SFPUC shall implement the ITMM identified for the California horned lark and northern harrier under the SJMSCP, which consists of the following:

- A qualified biologist shall conduct a preconstruction survey and investigate all potential nesting trees to determine the presence or absence of the species on the project site.

- If species are found, a setback of 500 feet from nesting areas shall be established and maintained during the nesting season (February 16 – August 31) for the period encompassing nest building and continuing until fledglings leave nests, unless CDFG agrees to other equally effective (e.g., monitor occupied nest during construction in the buffer zone, limit hours of construction, restrict construction activities, etc.), or offsite compensation shall be provided and CDFG shall be notified of the proposed buffer zone. If a setback is used, this setback would apply whenever construction or other ground-disturbing activities must begin during the nesting season in the presence of nests which are known to be occupied. Setbacks shall be marked by brightly colored temporary fencing.

Conduct Pre-Construction Surveys for Golden Eagle

Mitigation Measure 4.6-3k: Prior to the start of construction, a qualified biologist shall conduct golden eagle surveys as required by the SJMSCP. Additionally, SFPUC shall implement the ITMM identified for the golden eagle under the SJMSCP, which consists of the following:

- When a site inspection indicates the presence of a nesting golden eagle, CDFG will be notified and a setback of 500 feet from the nesting area shall be established and maintained during the nesting season (normally approximately February 1 – June 30) for the period encompassing nest building and continuing until fledglings leave nests, unless CDFG agrees to other equally effective measures (e.g., monitor occupied nest during construction in the buffer zone, limit hours of construction, restrict construction activities, etc). This setback applies whenever construction or other ground-disturbing activities must begin during the nesting season in the presence of nests which are known to be occupied. Setbacks shall be marked by brightly colored temporary fencing.

Conduct Pre-Construction Surveys for Ferruginous Hawk and Prairie Falcon

- Mitigation 4.6-3l: Prior to the start of construction, a qualified biologist shall conduct surveys for ferruginous hawk and prairie falcon as required by the SJMSCP. These species currently do not nest in San Joaquin County and are not expected to nest in the County over the life of the SJMSCP. Therefore, in the highly unlikely event that one of these species is found nesting on a project site, SFPUC shall notify CDFG of the proposed buffer zone and setback of 500 feet from

the nesting area shall be established and maintained for the period encompassing nest building and continuing until fledglings leave the nests, unless CDFG agrees to other equally effective measures. ITMMs shall be formulated prior to ground disturbance by the TAC and approved by the JPA with the concurrence of the Permitting Agencies' representatives on the TAC in

accordance with the SJMSCP's Adaptive Management Plan. ITMMs may consist of preconstruction surveys, avoidance techniques, and buffer areas.

5.2.4 Cultural Resources

Paleontological Monitoring During Excavation

Mitigation Measure 4.7-1a: The SFPUC shall retain a qualified professional paleontologist to monitor excavations starting at the depth of 10 feet deep during construction at the Tesla Portal site for paleontological resources. Monitoring shall continue at the Tesla Portal site until the supervising qualified paleontologist determines that no native sediments are present or that significant paleontological resources are not likely to be discovered.

Suspend Construction Work if Paleontological Resource is Discovered

Mitigation Measure 4.7-1b: This mitigation measure builds on SFPUC Construction Measure #9 for cultural resources, which requires that construction work will be suspended immediately if there is any indication of a paleontological resource. When a paleontological resource (fossilized invertebrate, vertebrate, plant or micro-fossil) is discovered at any of the project sites, an appointed representative of the SFPUC will notify a qualified paleontologist, who will document the discovery as needed, evaluate the potential resource, and assess the significance of the find under the criteria set forth in Section 15064.5 of the CEQA Guidelines. When a fossil is found during construction, excavations within 50 feet of the find will be temporarily halted or diverted until the discovery is examined by a qualified paleontologist, in accordance with Society of Vertebrate Paleontology standards (Society of Vertebrate Paleontology, 1995). The paleontologist will notify the SFPUC to determine procedures to be followed before construction is allowed to resume at the location of the find. If the SFPUC determines that avoidance is not feasible, the paleontologist will prepare an excavation plan for mitigating the effects of the project.

Accidental Archaeological Discovery

Mitigation Measure 4.7-2a: SFPUC Standard Construction Measure #9 for cultural resources requires that construction activities be suspended immediately if there is any indication of an archaeological resource.

- To avoid any potential adverse effect from the proposed project on accidentally discovered buried or submerged historical resources as defined in CEQA Guidelines Section 15064.5(a)(c), the SFPUC shall distribute the Planning Department archaeological resource "ALERT" sheet to the project prime contractor; to any project subcontractor (including demolition, excavation, grading, foundation, pile driving, etc. firms); or utilities firm involved in soil disturbing activities within the project site. Prior to any soil disturbing activities being undertaken, each contractor is responsible for ensuring that the "ALERT" sheet is circulated to all field personnel including, machine operators, field crew, pile drivers, supervisory personnel, etc. The SFPUC shall provide the Environmental Review Officer (ERO) with a signed affidavit from the responsible parties

(prime contractor, subcontractor(s), and utilities firm) confirming that all field personnel have received copies of the "ALERT" sheet.

Should any indication of an archaeological resource be encountered during any soils disturbing activity of the project, the contractor and/or the SFPUC will immediately notify the ERO and will immediately suspend any soils disturbing activities within 100 feet of the discovery until the ERO has determined what additional measures should be undertaken.

- If the ERO determines that an archeological resource may be present within the project site, the SFPUC shall retain the services of a qualified archeological consultant. The archeological consultant shall advise the ERO as to whether the discovery is an archeological resource that retains sufficient integrity, and is of potential scientific/historical/cultural significance. If an archeological resource is present, the archeological consultant shall identify and evaluate the archeological resource. The archeological consultant shall make a recommendation as to what action, if any, is warranted. Based on this information, the ERO may require, if warranted, specific additional measures to be implemented by the SFPUC.

- Measures might include: preservation in situ of the archeological resource; an archaeological monitoring program; or an archeological evaluation program. If an archeological monitoring program or archeological evaluation program is required, it shall be consistent with the MEA WSIP Archaeological Guidance (San Francisco Planning Department, 2008) for such programs. The ERO may also require that the SFPUC immediately implement a site security program if the archeological resource is at risk from vandalism, looting, or other damaging actions.

- The project archeological consultant shall submit an accidental discovery Archaeological Data Recovery Report (ADRR) to the ERO, which, in addition to the usual contents of the ADRR, includes evaluation of the historical significance of any discovered archeological resource, as well as describing the archeological and historical research methods employed in the archeological monitoring/data recovery program(s) undertaken, and presenting, analyzing, and interpreting the recovered data. Information that may put at risk any archeological resource shall be provided in a separate removable insert within the final report.

- Once approved by the ERO, copies of the ADRR shall be distributed as follows: the relevant California Historical Resources Information System Information Center shall receive one (1) copy and the ERO shall receive a copy of the transmittal letter of the ADRR to the Information Center. The MEA shall receive three copies of the ADRR along with copies of any formal site recordation forms (CA DPR 523 series) and/or documentation for nomination to the National Register of Historic Places/California Register of Historical Resources. The SFPUC shall receive copies of the ADRR in the number requested. In instances of high public interest in or the high interpretive value of the resource, the ERO may require a different final report content, format, and distribution than that presented above.

Treatment of Human Remains

- Mitigation Measure 4.7-2b: The treatment of human remains and of associated or unassociated funerary objects discovered during any soils disturbing activity shall comply with applicable State

laws. This shall include immediate notification of the San Joaquin County Coroner and in the event of the coroner's determination that the human remains are Native American, notification of the California State Native American Heritage Commission (NAHC) who shall appoint a Most Likely Descendant (MLD) (Public Resources Code Section 5097.98). The

archaeological consultant, SFPUC, and MLD shall make all reasonable efforts to develop an agreement for the treatment of, with appropriate dignity, human remains and associated or unassociated funerary objects (CEQA Guidelines Section 15064.5(d)). The agreement should take into consideration the appropriate excavation, removal, recordation, analysis, custodianship, curation, and final disposition of the human remains and associated or unassociated funerary objects. California Public Resources Code allows 24 hours to reach agreement on these matters. If the MLD and the other parties do not agree on the reburial method, the project will follow Section 5097.98(b) of the California Public Resources Code which states, "the landowner or his or her authorized representative shall reinter the human remains and items associated with Native American burials with appropriate dignity on the property in a location not subject to further subsurface disturbance."

Architectural Resources Protection Plan

Mitigation Measure 4.7-3: The SFPUC shall retain a qualified historian to prepare a plan that specifies procedures for protecting historical resources at the Tesla Portal site during construction activities. The plan shall include a monitoring method to be employed by the construction contractor while working near these resources. At a minimum, the plan shall address the operation of construction equipment near or adjacent to the historical resource, storage of construction materials away from the resource, and education/training of construction workers about the significance of the historical resources. The plan shall also require the construction of a temporary protective barrier around the Southwest Valve House, such as construction fencing and/or vertical and horizontal netting to prevent physical damage to the valve house.

5.2.5 Air Quality

SJVAPCD Dust Control Measures

Mitigation Measure 4.9-1a: The following applicable general San Joaquin Valley Air Pollution Control District (SJVAPCD) recommended mitigation measures will be implemented to reduce emissions of fugitive PM_{10} dust from construction activities at both project sites, as specified in the Guide to Assessing and Mitigating Air Quality Impacts (GAMAQI), and in accordance with Regulation VIII Rules addressing construction (Rules 8011, 8021, 8031, 8041, 8051, 8061 and 8071).

SJVAPCD Regulation VIII Basic Control Measures:

- Adhere to the recordkeeping requirements specified in Rule 8011 (Section 6.2) for days that control measures are implemented

- Submit a Dust Control Plan (form available from SJVAPCD) in accordance with Rule 8021.

- All disturbed areas, including storage piles that are not being actively utilized for construction purposes, shall be effectively stabilized of dust emissions using water, chemical stabilizer/suppressant, covered with a tarp or other suitable cover, or vegetative ground cover in accordance with Rule 8031.

- All onsite unpaved roads and offsite unpaved access roads shall be effectively stabilized of dust emissions using water or chemical stabilizer/suppressant in accordance with Rule 8031.

- All land clearing, grubbing, scraping, excavation, land leveling, grading, cut and fill, and demolition activities shall be effectively controlled of fugitive dust emissions utilizing application of water or by presoaking in accordance with Rule 8021.

- Limit Visible Dust Emissions (VDE) to 20% opacity by applying water or chemical/organic stabilizers/suppressants or construct and maintain wind barriers sufficient to limit VDE to 20% opacity. If utilizing wind barriers, water or chemical suppressants shall also be implemented.

- When materials are transported offsite, all material shall be covered, or effectively wetted to limit visible dust emissions, and at least 6 inches of freeboard space from the top of the container shall be maintained in accordance with Rule 8031.

- All operations shall limit or expeditiously remove the accumulation of mud or dirt from adjacent public streets at the end of each workday. The use of dry rotary brushes is expressly prohibited except where preceded or accompanied by sufficient wetting to limit the visible dust emissions. Use of blower devices is expressly forbidden in accordance with Rule 8041.

- Following the addition of materials to, or the removal of materials from, the surface of outdoor storage piles, said piles shall be effectively stabilized of fugitive dust emissions utilizing sufficient water or chemical stabilizer/suppressant in accordance with Rule 8031.

- A trackout control device shall be installed and maintained at all access points to paved public roads or a carryout and trackout prevention procedure, which as been demonstrated to the satisfaction of the APCO and U.S. EPA, shall be implemented in accordance with Rule 8041.

- Trackout shall be immediately removed when it extends 50 or more feet from the nearest unpaved surface exit point of the site and at the end of each workday in accordance with Rule 8041.

SJVAPCD Enhanced Control Measures

- Traffic speeds on unpaved roads shall be limited to 15 mph and speed limit signs shall be posted in accordance with Rule 8021, Section 5.3.

SJVAPCD Exhaust Control Measures

Mitigation Measure 4.9-1b: The following mitigation measures will be implemented during construction of the proposed project to reduce exhaust emissions:

(1) SJVAPCD Guide to Assessing and Mitigating Air Quality Impacts Mitigation Measures:

To limit exhaust emissions within the San Joaquin Region, the SJVAPCD specifies the following exhaust controls for heavy-duty equipment (scrapers, graders, trenchers, earthmovers, etc.). The SFPUC will include these measures, where feasible and applicable, in contract specifications:

- Idling time (e.g., 5-minute maximum) shall be minimized.

- The hours of operation of heavy-duty equipment and/or the amount of equipment in use shall be limited.

- Activity management (e.g., rescheduling activities to reduce short-term impacts) shall be implemented.

(2) *Regulation IX – Mobile and Indirect Sources, Rule 9510 Mitigation Measures:*

Rule 9510 applies to any project subject to discretionary approval by a public agency that ultimately results in the construction of a new building, facility, or structure or reconstruction of a building, facility, or structure for the purpose of increasing capacity or activity and also involving 9,000 square feet of space. Rule 9510 requires exhaust emissions for construction equipment greater than 50 horsepower used or associated with a development project to be reduced by the following amounts from the statewide average as estimated by the California Air Resources Board (CARB):

- 20% of the total NO_X emissions
- 45% of the total PM_{10} exhaust emissions

An applicant may reduce construction emissions on-site by using less polluting construction equipment, which can be achieved by utilizing add-on controls, cleaner fuels, or newer lower emitting equipment. The requirements listed above can also be met through the payment of an off-site emissions reduction fee.

The following mitigation measures will be selectively applied to achieve compliance with the emission reductions set forth by Rule 9510:

- Selected construction equipment with engines equal to or greater than 50 horsepower will:
  - Be equipped with Tier 2 diesel engines as defined in Title 13, CCR, §2423

- Must be equipped with verified Level 3 (at least 85% reduction of PM from the baseline emission level) Diesel Emission Control Strategies as defined in Title 13, CCR, §2700 through 2710

- All construction vehicles will undergo monthly maintenance. Preventive maintenance includes complying with the manufacturer's service recommendations, using recommended types of fuel, maintaining proper fluid levels (such as oil, coolant, brake, and transmission), ensuring proper tire pressure, working signals, lights (including headlamps, turn-signal lights, tail lights, and brake lights), and brakes.

5.2.6 Noise and Vibration

Vacate SFPUC Caretaker's Residence at the Tesla Portal Site

Mitigation Measure 4.10-1: The SFPUC caretaker's residence at Tesla Portal shall be vacated during hours when construction activities at the site would produce daytime sound levels in excess of the speech interference criterion (an exterior noise level of 70 dBA) or nighttime sound levels in excess of the sleep interference criterion (an exterior noise level of 60 dBA).

Maintain Structural Integrity of San Joaquin Pipelines

Mitigation Measure 4.10-2: The construction contractor shall perform construction (cutting and connecting a new manifold) at the tie-in of the proposed UV Building to San Joaquin Pipelines 1 and 2 to maintain the structural integrity of the pipelines.

5.2.7 Energy Resources

Incorporation of Energy Efficiency Measures

Mitigation Measure 4.14-1: Consistent with the Energy Action Plan II priorities for reducing energy usage, the SFPUC shall ensure that energy efficient equipment is used in the proposed project at the Tesla Portal and the Thomas Shaft sites. A repair and maintenance plan shall also be prepared for each facility to minimize power use. Cooling, heating and ventilation rates will meet the standards of the American Society of Heating, Refrigeration and Air-Conditioning Engineers, California Building Code and the California Building Energy Efficiency Code. All ductwork will comply with Sheet Metal and Air Conditioning Contractors' National Association objectives. The SFPUC shall also include the use of renewable energy, such as solar power, at the Tesla Treatment Facility.

5.2.8 Cumulative Effects – Traffic

SFPUC WSIP Projects Construction Coordinator

Mitigation Measure 4.15-1a: Due to the potential for overlapping project activities in the SFPUC Western San Joaquin Region near the project sites, and the potential for construction vehicles to affect travel within and across different WSIP regions, the SFPUC shall identify a qualified construction coordinator responsible for coordinating project-specific traffic control plans, and for developing a public information campaign (e.g., internet website, radio and newspaper updates) to inform the public of construction activities, detour routes, and alternate routes.

Throughout the seven-year construction schedule for the San Joaquin WSIP projects, the SFPUC construction coordinator shall work with local and regional agencies to pursue additional traffic mitigation measures to minimize local and regional traffic impacts and will incorporate these measures into the project-specific traffic control plans, as appropriate.

Combined San Joaquin Regional Traffic Control Plan

Mitigation Measure 4.15-1b: Due to the potential for overlapping project schedules in the San Joaquin Region near the project sites, the SFPUC will develop, or the SFPUC's construction contractor(s) shall be required to develop, a San Joaquin Regional Traffic Control Plan. This plan will coordinate the project-specific traffic control plans that shall be developed for individual WSIP projects in the San Joaquin Region, and identify additional measures, if necessary, to minimize the combined impacts of multiple WSIP project construction traffic on I-580, Chrisman Road, and West Vernalis Road. As applicable, these measures shall be developed consistent with the standards of San Joaquin County, Stanislaus County, and Caltrans and could include:

- Additional traffic control devices, such as traffic signals at key intersections providing access to local roadways and land uses
- Additional traffic control personnel at key locations to facilitate vehicular traffic flow during peak periods of truck activity
- Adjustments in truck arrival and departure schedules for the various facilities (e.g., staggering departures)

Coordination with Other Agencies

Mitigation Measure 4.15-1c: The SFPUC WSIP construction coordinator shall coordinate with Caltrans, other county agencies, and local jurisdictions responsible for reviewing and/or approving the construction of other identified private and public development projects. Coordination efforts will be focused on minimizing traffic impacts on local access roads, particularly local streets where sensitive receptors (e.g., schools, residences, or hospitals) are located.

5.3 References

California Burrowing Owl Consortium, *Burrowing Owl Survey Protocol and Mitigation Guidelines*, 1993.

California Department of Fish and Game (CDFG), *Staff Report on Burrowing Owls*, June 1995.

San Francisco Planning Department, MEA WSIP Projects Archaeological Guidance Documents, 2008a.

Society of Vertebrate Paleontology, Assessment and Mitigation of Adverse Impacts to Nonrenewable Paleontologic Resources: Standard Guidelines, 1995.

CHAPTER 6
Growth-Inducement Potential and Indirect Effects of Growth

6.1 Introduction and Overview

This chapter, as supplemented by Appendix B.2, analyzes the growth inducement potential and associated secondary effects of growth impacts of the proposed project, as required by the California Environmental Quality Act (CEQA). CEQA requires that an environmental impact report (EIR) evaluate the growth-inducing impacts of a proposed project.[1] A growth-inducing impact is defined as follows:

> [T]he ways in which the proposed project could foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment. Included in this are projects which would remove obstacles to population growth…. It must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment.

- The PEIR on the San Francisco Public Utilities Commission's (SFPUC's) Water System Improvement Program (WSIP) concluded that the WSIP as a whole would support growth in the existing SFPUC service area. And, as explained in Chapter 3, Project Description, the proposed project is a component of the WSIP and thus contributes to its indirect growth inducement effect. By providing additional water supply to SFPUC customers within the SFPUC service area, the WSIP, and the proposed project, as part of the WSIP, would have an indirect growth-inducing effect according to the CEQA definition above.[2]

- Implementation of the WSIP would meet customer purchase requests through the year 2018, as discussed in the PEIR. Meeting additional purchase requests would provide water to serve additional residential and business customers in the existing SFPUC service area.

- The proposed project would not directly induce population or economic growth, nor would it tax existing community service facilities or encourage other activities that could significantly affect the environment. However, the proposed project is one of several improvement projects that comprise the WSIP, and implementation of the WSIP would support growth in the SFPUC service area, thereby contributing indirectly, to environmental impacts caused by that growth (see

[1] CEQA Guidelines Section 15126.2(d).

[2] The WSIP would not *directly* induce growth as it does not involve the development of new housing to attract additional population, nor would it indirectly induce growth by establishing substantial permanent or even short-term construction employment opportunities that could stimulate population growth. Construction of the WSIP projects is not expected to involve employment opportunities substantially beyond what would normally be available to construction workers in the area, and workers are expected to be drawn from the local labor pool.

below, Indirect Effects of Growth). The SFPUC service area spans seven counties—Tuolumne, Stanislaus, San Joaquin, Alameda, Santa Clara, San Mateo, and San Francisco.

- The project is primarily proposed to ensure that the SFPUC maintains high-quality water that meets or exceeds regulatory standards for drinking water into the future and, therefore, would contribute to the WSIP's water quality goal. The proposed project would also contribute to the WSIP's seismic reliability goal by reducing the system's vulnerability to earthquakes through the construction of a new chlorination facility at the Tesla Portal site designed to meet current seismic standards, and designed to treat additional water supply up to 313 million gallons per day consistent with the WSIP. Because the proposed project is part of the WSIP, the project would also contribute indirectly to the WSIP's growth inducement impact.

  A variety of factors influence new development or population growth in the area served by SFPUC water, including economic conditions of the region, adopted growth management policies in the affected communities, and the availability of adequate infrastructure (e.g., water service, sewer service, public schools, and roadways, etc.), with economic factors generally the lead driver. While water service is only one of many factors affecting the growth potential of a community, it is one of the chief public services needed to support urban development, and lack of a reliable water supply as well as a service capacity deficiency could constrain future development.

  Pursuant to CEQA, growth *per se* is not assumed to be necessarily beneficial, detrimental, or of little significance to the environment; it is the secondary, or indirect, effects of growth that can cause adverse changes to the physical environment. The indirect effects of population and/or economic growth and accompanying development can include increased demand on community services and public service infrastructure; increased traffic and noise; degradation of air and water quality; and conversion of agricultural land and open space to urban uses. Local land use plans (e.g., general plans and specific plans) of the jurisdictions served by the SFPUC establish land use development patterns and growth policies that are intended to allow for the orderly expansion of urban development supported by adequate public services, including water supply, roadway infrastructure, sewer service, and solid waste service. Local jurisdictions conduct CEQA environmental review on their general and specific plans to assess the secondary effects of their planned growth. A project that would induce growth that is inconsistent with local land use plans and policies could indirectly cause adverse environmental impacts, as well as impacts on public services, that the local land use jurisdictions have not previously addressed in the CEQA review of their land use plans and development proposals.

- By removing the lack of a reliable water supply and water system (as one potential obstacle to growth within the SFPUC service area) and providing and assisting in development of additional water supply sources, such as recycled water and groundwater projects as well as promotion of more efficient use of water through conservation measures, the WSIP would have an indirect growth-inducing effect according to the CEQA definition above. The WSIP would support growth in the SFPUC service area through 2018, although it appears that some growth would occur irrespective of the WSIP due to increased water delivery efficiencies (e.g., plumbing code changes), conservation, and other water supply sources. Growth would in turn result in indirect effects. In

most cases, the effects of population and employment growth have been identified and addressed in the EIRs for the general plans and associated area plans and specific plans adopted by the jurisdictions in the service area. Some of the identified indirect effects of growth are potentially significant and unavoidable; others are significant but can be mitigated.

- Potentially significant and unavoidable impacts as a result of growth in the SFPUC service area could occur in the following areas: traffic congestion, air pollution, traffic noise, construction noise, increased demand for public schools and other public services, loss of recreational opportunities and impacts on visual quality resulting from the loss of open space, cumulative effects on over-utilized parks, loss of wildlife habitat and wetlands and impacts on other biological resources, cumulative impacts on cultural resources, increased flooding potential, increased urban runoff pollutants, seismic hazards, induced population growth, failure to meet housing demand for projected population growth, exposure of new development to contaminated soil or groundwater, insufficient water supply, insufficient wastewater disposal capacity, loss of agricultural resources, land use conflicts, conflicts with existing land use plans or policies, and changes in density, scale, and character of an area.

- The adopted WSIP would have growth-inducement potential through 2018 because the SFPUC (with the cooperation of the wholesale customers) would provide the additional water supply to meet purchase requests though 2018. The WSIP would support much of the growth through 2018 in the jurisdictions served by the SFPUC regional water system. In general, development that was planned and approved through the general plan process in the SFPUC service area would have environmental impacts. The environmental consequences of this planned growth have been largely addressed in local plans and the associated CEQA review as well as in other, project-specific documentation. In a number of jurisdictions, negative declarations or mitigated negative declarations were prepared for general plans and related planning documents that were found not to have significant environmental effects.

- With the exception of the No Purchase Request Alternative, all of the alternatives analyzed in the PEIR contribute in similar ways to growth inducement impacts, since each of the alternatives provides different ways of meeting future water supply demand as one of the WSIP objectives. It is also likely that the water customers would find alternate sources of water to meet future demand under the alternatives that are not effective in meeting demand like the Aggressive Conservation and Recycling Alternative. Under this scenario, the alternative itself may not be growth-inducing, but growth could still occur. No mitigation measures were proposed for implementation by the SFPUC that could substantially decrease or eliminate growth-inducing impacts because the SFPUC does not have control over the decisions that each local agency will make with respect to growth in their jurisdictions. Individual agencies' general plans and environmental documents contain actions, limitations and mitigation measures that will be implemented in the individual jurisdictions with local development project or program approvals. These types of mitigation measures were identified in the PEIR (see Appendix B of this EIR.)

- To assess the growth inducement potential of the WSIP and characterize the secondary effects of growth, the PEIR investigated the following questions:

- *What assumptions did the SFPUC and its wholesale customers make regarding growth (population and employment) in projecting future (2030) total water demand and customer purchases from the SFPUC?*

- *Are these assumptions consistent with forecasts prepared and used by local and regional planning agencies (e.g., ABAG, counties and cities) within the service area? What are the growth trends in the Bay Area region?*

- *Are there any notable inconsistencies between the population and employment forecasts used by the SFPUC and the wholesale customers and those of the local and regional planning agencies that suggest that the water supply planning efforts are inconsistent with land use planning efforts?*

- *Is the level of growth projected for 2030 consistent with that identified and planned for in existing adopted general plans?*

- *What are the potential environmental impacts (secondary effects) associated with growth projected to occur in the service area? Have these impacts been evaluated in previous CEQA review documents on existing general and specific plans?*

- *What mitigation measures and findings have the local jurisdictions adopted as part of approving their future growth plans?*

The issues raised in these questions are summarized below and addressed in detail in Appendix B.2.

- *SFPUC Projections (Section 7.2 in Appendix B.2)*. Accurate demand projections are important in ensuring that future water supplies will be adequate while not surpassing the needs of planned growth. SFPUC and its customers used computer models to forecast future water demand. Section 7.2 presents an overview of the SFPUC water service area, and describes key factors (assumptions, inputs, and methodologies) used in estimating future demand that relate to growth and inform comparisons between water demand and land use planning projections. These factors include baseline population, methodology used to determine existing water usage by land use/account type, the current water supply agreement between the SFPUC and its wholesale customers, and assumptions regarding future land use patterns, water conservation and recycling, and water from other (non-SFPUC) sources through 2030. The demand estimates, in conjunction with estimates of savings from conservation and use of other water sources, provide the basis for the 2030 purchase estimates.

- *Growth Inducement Potential (Section 7.3 in Appendix B.2)*. This section analyzes the WSIP's growth inducement potential: whether the demand to be met by the WSIP would be consistent with local plans and policies or could contribute to growth in the service area beyond that called for in the existing general plan. To gauge the consistency of the WSIP with growth planned in the jurisdictions served by the SFPUC, the analysis compares the growth assumed in the SFPUC projections with growth forecasts (a) developed by ABAG and (b) reflected in adopted land use plans in the service area. With respect to ABAG, this section also describes ABAG's changing expectations about growth as reflected in its updated projections issued in 2002, 2003 and 2005.

- *Indirect Effects of Growth (Section 7.4 in Appendix B.2)*. Growth (whether planned or unplanned) can cause environmental impacts. Section 7.4 describes the potential impacts of growth that could be supported, in part, by implementation of the WSIP. This section also identifies measures adopted to reduce, eliminate or otherwise mitigate the impacts of planned growth.

6.2 Summary of Conclusions

- A review of historical growth trends of a selection of jurisdictions in the service area, based primarily on information in general plans and Bay Area Water Supply and Conservation Association profiles, shows that:

  - Cities in the service area are largely urbanized, most having experienced their most rapid growth in the postwar decades through the 1970s.

  - Milpitas and East Palo Alto have experienced high rates of growth more recently.

  - San Francisco's population fluctuated somewhat but on average has been essentially stable over the past 50 years.

  - Many jurisdictions cannot grow laterally and their general plans include policies to manage growth; many general plans identify strategies consistent with "smart growth" principles, such as encouraging infill development and the redevelopment of previously developed areas, as means to accommodate future growth.

  - The SFPUC's wholesale customers vary widely, in a variety of ways: by size, overall demand projected for 2030, the change that the 2030 demand represents in absolute terms and as a percentage of 2001 demand, and the degree to which the customers depend on the SFPUC for their water supply. As such, the WSIP would remove growth obstacles to varying degrees within the service area.

- As stated above, the complete growth inducement analysis is included in this EIR as Appendix B.2.

6.2.1 Indirect Effects of Growth

The indirect effects of growth expected in the general plans of jurisdictions in the service area have been identified in the EIRs prepared for those plans. A table of impacts commonly identified as significant and unavoidable and those commonly identified as significant but mitigable is presented in Section 7.4 in Appendix B.2.

- The most commonly identified significant and unavoidable impacts of growth are:

  – Increased traffic congestion

  – Deterioration of air quality

  - Cumulative effects of increased air pollutant emissions and noise

- Mitigation measures have been adopted by local jurisdictions as part of their general plan approval processes to address the secondary effects of planned growth. These measures are summarized in Appendix B.2.

- Two cities identified increased demand for potable water supply as a significant and unavoidable effect of growth; the WSIP would address this issue in those two cities by providing for increased supply and related water treatment facility and storage upgrades to reliably meet projected demand.

- Overriding considerations commonly adopted by the decision-making bodies in adopting their general plans include the following:

  - Accommodation of growth in an orderly, fiscally sound manner

  - Economic diversification and job generation

  - Creation of housing, furtherance of regional housing share objectives, and provision of affordable housing

  - Improvements of the local jobs/housing balance

  - Increased sales revenue and positive fiscal impact

  - Promotion of alternative modes of travel to reduce reliance on private vehicles

  - Establishment of policies to preserve natural areas and open space lands

- For many cities that receive water from the SFPUC regional system, the supply to be provided under the WSIP supports and is consistent with the planned growth reflected in their existing adopted general plans. For other communities, it appears that the WSIP supply (in combination with other supply sources available to those communities), could serve a level of growth beyond that identified in the existing general plans. In those cases, secondary effects of such growth could include impacts related to increased density and impacts related to development of new land areas.

  - Density related impacts could include, e.g., increased traffic congestion, air pollution, traffic noise, construction noise, and demand on public services.

  - Land area related impacts could include, e.g., loss of open space and agricultural land, loss of and degradation of water quality due to increases in impervious surface area.

- See Appendix B.2 in this EIR for additional detail on the proposed project's growth inducement effects.

CHAPTER 7

Significant Environmental Effects That Cannot Be Avoided if the Proposed Project Is Implemented

In accordance with Section 21067 of the California Environmental Quality Act (CEQA) and with Sections 15126(b) and 15126.2(b) of the CEQA Guidelines, the purpose of this section is to identify environmental impacts that cannot be eliminated or reduced to a level of less than significant by mitigation measures. Chapter 4, Environmental Setting and Impacts, and Chapter 5, Mitigation Measures, describe the potential environmental impacts of the proposed project and recommend feasible mitigation measures to reduce those impacts. The recommended mitigation measures would reduce potentially significant project-specific impacts identified in Chapter 4 to less-than-significant levels.

- However, as discussed in this EIR, the proposed project is one of several improvement projects that comprise the San Francisco Public Utilities Commission (SFPUC) Water System Improvement Program (WSIP).Insofar as the proposed project is a component of the WSIP, it would contribute to the WSIP's unavoidable water supply and growth-inducement impacts, as follows:

- **Potentially Significant and Unavoidable WSIP Water Supply Impacts**

- • Fisheries (Upper and Lower Crystal Springs Reservoir): Effects in the Peninsula watershed on fishery resources in Crystal Springs Reservoir in San Mateo County; and

- • Growth Inducement: Indirect growth-inducement impacts in the SFPUC service area.

- **Significant and Unavoidable WSIP Water Supply Impacts**

- • Streamflow (Alameda Creek below Alameda Creek Diversion Dam): Effects on stream flow in Alameda Creek between the diversion dam and the confluence with Calaveras Creek.

CHAPTER 8
Significant Irreversible Environmental Changes

In accordance with Section 21100(b)(2)(B) of CEQA and with Sections 15126(c) and 15126.2(c) of the CEQA Guidelines, the purpose of this section is to identify significant irreversible environmental changes that would be caused by the proposed project. Construction and operational impacts associated with improvements proposed at the Tesla Portal and Thomas Shaft sites would result in an irretrievable and irreversible commitment of natural resources through the use of power supply, and construction materials.

Improvements proposed at both the Tesla Portal and Thomas Shaft sites would require the commitment of energy resources to fuel and maintain construction equipment (such as gasoline, diesel, and oil) during the construction process. Construction of the Tesla Treatment Facility project would commit resources, such as concrete and steel, to be used for the proposed Chemical Process Building, Office/Control Building, and UV Building as well as new piping and other related site improvements. However, concrete and steel from projects constructed above ground can generally be reused or recovered. The Tesla Treatment Facility would also commit asphalt materials for the construction of roadway and parking lot improvements.

Operational impacts at the Tesla Treatment Facility would increase demand for energy use resulting from the installation of 12 ultraviolet reactors to be used for water treatment. Overall, the SFPUC would have the ability to provide for the increased energy demand anticipated for the project. However, SFPUC may need to supplement its energy supply during the summer and fall months[1] with PG&E power, which is generated in large part by fossil fuel based sources.

Construction and operation of the Lawrence Livermore Water Quality Improvements at the Thomas Shaft site would not require a significant commitment of resources given the relatively small scope of the project.

[1] SFPUC energy production varies by season and year depending on hydrologic conditions. During summer and fall months SPFUC often supplements its power supply with PG&E produced power in order to allow water to be stored while continuing to meet its municipal demand and contractual obligations for power supply.

CHAPTER 9
CEQA Alternatives

9.1 Introduction

California Environmental Quality Act (CEQA) Guidelines Section 15126.6(a) requires environmental impact reports (EIRs) to describe and evaluate the comparative merits of a range of reasonable alternatives to projects, or to project locations, which would: (1) feasibly attain most of the basic project objectives; and (2) avoid or substantially lessen any of the projects' significant effects. An EIR need not consider every conceivable alternative. Rather, it must consider a reasonable range of potentially feasible alternatives that will foster informed decision-making and public participation. The CEQA Guidelines set forth the following criteria for selecting and evaluating alternatives:

- The discussion of alternatives shall focus on alternatives to the project or its location which are capable of avoiding or substantially lessening any significant effects of the project, even if these alternatives would impede to some degree the attainment of the project objectives, or would be more costly (Section 15126.6(b)).

- The range of potential alternatives shall include those that could feasibly accomplish most of the basic objectives of the project and could avoid or substantially lessen one or more of the significant effects (Section 15126.6(c)).

- The EIR should also identify any alternatives that were considered by the lead agency but were rejected as infeasible during the scoping process and briefly explain the reasons underlying the lead agency's determination, e.g., (i) failure to meet most of the basic project objectives, (ii) infeasibility, or (iii) inability to avoid significant environmental impacts (Section 15126.6(c)).

- The specific alternative of "no project" shall also be evaluated along with its impact (Section 15126.6(e)(1)).

- If the environmentally superior alternative is the "no project" alternative, the EIR shall also identify an environmentally superior alternative among the other alternatives (Section 15126.6(e)(2)).

- The alternatives shall be limited to ones that would avoid or substantially lessen any of the significant effects of the project. Of those alternatives, the EIR need examine in detail only the ones that the lead agency determines could feasibly attain most of the basic objectives of the project (Section 15126.6(f)).

- The proposed project is a component of the San Francisco Public Utilities Commission's (SFPUC) Water System Improvement Program (WSIP). As required by CEQA, the Program EIR (PEIR) evaluated a range of alternatives to the WSIP. This proposed project, which is listed as three separate projects in the PEIR: the Tesla Portal Disinfection Facility, the Hetch Hetchy Advanced Disinfection, and the Lawrence Livermore Supply Improvements, is included in all of the WSIP alternatives. The PEIR No Program Alternative includes the Hetch Hetchy Advanced Disinfection as it is an improvement to comply with the new federal drinking water regulatory requirements contained in the Long Term 2 Enhanced Surface Water Treatment Rule. The remainder of the proposed project evaluated in this EIR is not included in the PEIR No Program Alternative. The WSIP alternatives are summarized in Section 9.2 and are analyzed in detail in Chapter 9 of the PEIR, which is included in Appendix B.3 of this document.

9.2 WSIP Alternatives

- The PEIR evaluated seven alternatives to the WSIP, summarized below, because of their apparent ability to meet most of the WSIP's goals, their ability to reduce one or more of the potentially significant impacts associated with program implementation, their potential feasibility, and their collective ability to provide a reasonable range of alternatives to foster informed decision-making and public participation. Analysis of the No Program Alternative is included as required by CEQA. Appendix B.3 includes more detailed descriptions of these WSIP alternatives, and also presents the associated program-level environmental analysis.

- The WSIP that was ultimately adopted by the SFPUC incorporates elements of three alternatives to the originally proposed WSIP: the No Purchase Request Alternative, the Aggressive Conservation/Water Recycling and Groundwater Alternative, and the Modified WSIP Alternative.

9.2.1 No Program Alternative

Under the No Program Alternative, the SFPUC would implement only those facility improvement projects driven by regulatory requirements including the ultraviolet (UV) building proposed as part of the San Joaquin Regional Water Quality Improvement Project, or existing agreements with regulatory agencies thus meeting only the water quality goals of the WSIP. It would endeavor to meet increasing customer purchase requests through the year 2030 by diverting additional Tuolumne River water only when available under City and County of San Francisco's (CCSF) existing water rights. The wholesale customers would have to pursue supplemental supply sources and/or conservation measures to make up the supply shortfall/reduced reliability under this alternative. Compared to the WSIP, this alternative would develop less in terms of new water supplies for the regional system and would implement fewer of the proposed facility improvement projects.

9.2.2 No Purchase Request Increase Alternative

The No Purchase Request Increase Alternative is designed to serve wholesale customers only the amount of water required under the existing Master Water Sales Agreement between the CCSF and each of the wholesale customers; therefore, this alternative would not fully meet the purchase request increase by the SFPUC wholesale customers for an additional 35 million gallons per day (mgd) supply through 2030. This alternative is included in the alternatives analysis in an effort to avoid or minimize potential growth-inducing effects and secondary effects of growth associated with providing more water to the SFPUC's regional customers.

9.2.3 Aggressive Conservation/Water Recycling and Local Groundwater Alternative

- Under the Aggressive Conservation/Water Recycling and Local Groundwater Alternative, the SFPUC would implement all of the WSIP facility improvement projects, but would endeavor to serve the projected increase in customer purchase requests through 2030 only through additional conservation, water recycling, and local groundwater projects. Under this Alternative the SFPUC would have to either: (a) limit future customer purchase deliveries to the level that can be met, short of 2030 requests (approximately 294 mgd instead of 300 mgd average annual) and increase the level of rationing to 25 percent or more during droughts, or (b) provide a supplemental supply to make up the delivery shortfall to meet the 300 mgd.

9.2.4 Lower Tuolumne River Diversion Alternative

- Under the Lower Tuolumne River Diversion Alternative, the SFPUC would implement all of the proposed facility improvement projects and would serve the projected increase in customer purchase requests through 2030 through diversions from the lower Tuolumne River near its confluence with the San Joaquin River, assuming an agreement can be reached with the Turlock Irrigation District and the Modesto Irrigation District. This alternative would include construction and operation of additional conveyance and treatment facilities to divert, transport, treat, and blend the new supply into the regional water system.

9.2.5 Year-round Desalination at Oceanside Alternative

Under the Year-round Desalination at Oceanside Alternative, the SFPUC would implement all of the proposed WSIP facility improvement projects and would construct a 25-mgd desalination plant in San Francisco to serve the projected increase in customer purchase requests through 2030. The desalination plant would provide year-round supplies during all hydrologic year types to blend into the regional system at the Sunset Reservoir in San Francisco. Compared to the WSIP, this alternative represents an alternative source of supply and is evaluated to address the impacts to the Tuolumne River, Alameda Creek, and Peninsula Watersheds, including Pilarcitos Creek, and related resources.

9.2.6 Regional Desalination for Drought Alternative

Under the Regional Desalination for Drought Alternative, the SFPUC would implement all of the proposed WSIP facility improvement and would partner with other Bay Area water agencies to construct and operate a regional desalination plant that would provide the SFPUC with supplemental supply during drought years.

9.2.7 Modified WSIP Alternative

- Under the Modified WSIP Alternative, the SFPUC would implement all of the proposed facility improvement projects, but would modify proposed system operations to minimize environmental effects. This alternative would include the implementation of key mitigation measures identified in the PEIR.

9.2.8 Comparison of Alternatives to the WSIP

The seven alternatives analyzed in the PEIR would have varying abilities to meet the goals and objectives established by the SFPUC for the WSIP and would have a wide range of additional environmental effects. The No Program, No Purchase Request Increase, and Aggressive Conservation/Water Recycling and Local Groundwater Alternatives would fail to meet one or more key program objectives, while the Lower Tuolumne River Diversion, Year-round Desalination at Oceanside, Regional Desalination for Drought, and Modified WSIP Alternatives would meet most of the basic program objectives. The SFPUC found that many of the Alternatives would have greater environmental impacts than the adopted WSIP. (See SFPUC Resolution No. 08-0200.)

9.3 Alternatives Analysis

This section describes and evaluates five project-specific alternatives to the proposed project (including two No Project Alternatives) selected for detailed analysis and comparison with the proposed project (see Table 9-1). The project objectives, as listed in Chapter 3, consist of:

- Tesla Treatment Facility (Tesla Portal Site)
  - Replace existing water treatment facilities that are not currently seismically safe with new facilities that are designed to meet current seismic, safety/fire, and building code standards
  - Construct new water treatment facilities to meet U.S. Environmental Protection Agency (U.S. EPA) requirements for *Cryptosporidium* reduction/inactivation in drinking water, as required under the U.S. EPA's Long Term-2 Enhanced Surface Water Treatment Rule (LT2ESWTR)
  - Improve current water quality management capabilities such as pH control
- Lawrence Livermore Water Quality Improvements (Thomas Shaft Site)
  - Construct new water treatment facilities to meet U.S. EPA requirements under the Surface Water Treatment Rule (SWTR) for the reduction/inactivation of *Giardia*, as well as assist in meeting LT2ESWTR *Cryptosporidium* requirements to enable delivery of potable water to LLNL from the Thomas Shaft of the Coast Range Tunnel.

In addition to the five alternatives analyzed below, Section 9.4 presents 11 additional alternatives that were considered as alternatives to the proposed project, but were not carried forward for further consideration because they did not meet most of the project's basic objectives or because they would clearly result in significant environmental impacts beyond those of the proposed project.

The five alternatives were selected for detailed analysis because they: 1) would meet most or all of the project's basic objectives; and 2) would avoid or reduce significant impacts associated with the proposed project (refer to Table 9-2). The five alternatives are:

- Alternative 1: No Project Alternative (Status Quo)
- Alternative 2: No Project Alternative (Compliance with Safe Drinking Water Regulations)

- Alternative 3: Continue Water Source to Artificial Wetland at Tesla Portal Site
- Alternative 4: Combine Office/Control Building and UV Building at Tesla Portal Site
- Alternative 5: Retrofit of Existing Tesla Portal Hypochlorite Station Building

TABLE 9-1

SUMMARY OF COMPONENTS OF ALTERNATIVES

Project Components	Proposed Project	Alternative 1: No Project (Status Quo)	Alternative 2: No Project (Compliance with Safe Drinking Water Regulations)	Alternative 3: Continue Water Source to Wetland	Alternative 4: Combine Office and UV Buildings	Alternative 5: Retrofit of Existing Building
New Buildings (with area of ground disturbance in sf)	• Chemical Bldg (14,000 sf) • Office Bldg (3,500 sf) • UV Bldg (20,000 sf)	• None	• UV Bldg (20,000 sf)	• Chemical Bldg (14,000 sf) • Office Bldg (3,500 sf) • UV Bldg (20,000 sf)	• Chemical Bldg (14,000 sf) • UV/Office Bldg (20,000 sf)[1]	• Office Bldg (3,500 sf) • UV Bldg (20,000 sf)
Retrofit Facilities	None	None	None	None	None	Hypochlorite Station Building retrofitted
Temporary Facilities	None	None	None	None	None	Chemical feed facility (400 sf)
Year-round water source to wetland	No	Yes	Yes	Yes	No	No
Meets project objectives?	Yes	No	Partially	Yes	Yes	Partially

[1] This alternative would combine the office/control building with the UV building in a single two-story structure instead of two separate single-story structure as under the Proposed Project.

Note: Proposed project components at the Thomas Shaft Site are the same under all alternatives (except the No Project Alternative).

A detailed discussion of each of the selected project alternatives and a comparison of the significant impacts of the proposed project to the impacts of each alternative follows. In those cases where an alternative may result in additional significant impacts (relative to the proposed project), these impacts are also identified. A comparative summary of the impacts associated with the alternatives is presented in Table 9-3.

TABLE 9-2

SELECTED ALTERNATIVES FOR CEQA ANALYSIS

Alternative/Description	How does this Alternative differ from the project?	What project impact(s) is this Alternative intended to reduce?
Alternative 1: No Project Alternative (Status Quo) – The existing Tesla Portal and Thomas Shaft sites would remain in their current condition; the same amount of chemical deliveries would be made to the Tesla Portal site; the same number of employees would continue to work at the Tesla Portal site; runoff from sampling points at the existing Tesla Portal Hypochlorite Station would continue to feed the artificial wetland.	There would be no construction of new facilities, modification of existing facilities, new water discharges, trenching, or operational changes at either site. Additionally, there would be no roadway improvements, new lighting, or a new transformer at the Tesla Portal site. The current disinfection facility at the Tesla Portal site would be non-compliant with seismic, safety/fire, and building code standards; the SFPUC drinking water supply would not meet federal standards, resulting in monitoring, testing, or treatment violations; and the Thomas Shaft facility would not fulfill contractual requirements with LLNL.	Required by CEQA. However, this alternative is unrealistic, given that the SFPUC would violate state and federal safe drinking water regulations, and delivery to customers after the compliance date would be prohibited under this alternative.
Alternative 2: No Project Alternative (Compliance with Safe Drinking Water Regulations) – The 20,000-square-foot UV building would be constructed; no other aspects of the project would occur.	Only the 20,000-square-foot UV building would be constructed.	Required by CEQA, but unlike the No Project Alternative (Status Quo), this alternative would allow the SFPUC to comply with state and federal safe drinking water regulations and continue to provide customers with water supply.
Alternative 3: Continue Water Source to Artificial Wetland at Tesla Portal Site Alternative – New analyzer equipment would supply the artificial wetland at the Tesla Portal site with a year round source of water roughly proportionate to the current amount; all other aspects of the proposed project remain the same.	The water supply to the artificial wetland area at the Tesla Portal site would not be cut-off.	Permanent loss of 0.308 acre of artificial wetland habitat at the Tesla Portal site and associated loss of habitat value to dependent plant and wildlife species.
Alternative 4: Combine Office/Control Building and UV Building at Tesla Portal Site Alternative – The 3,500-square-foot Office/Control Building and the UV Building would be combined in a single, two-story structure; all other aspects of the proposed project remain the same.	The building footprint at the Tesla Portal site would be smaller.	Severity of biological and cultural resource impacts Severity of fugitive dust impacts Severity of erosion and sedimentation Reduction in land suitable for grazing purposes
Alternative 5: Retrofit of Existing Tesla Portal Hypochlorite Station Building Alternative – The existing building that contains the Tesla Portal Hypochlorite Station would be retrofitted and a new Chemical Process Building would not be constructed at the Tesla Portal site. All other aspects of the proposed project remain the same.	The building footprint at the Tesla Portal site would be smaller.	Severity of biological and cultural resource impacts Severity of fugitive dust impacts; Severity of erosion and sedimentation Reduction in land suitable for grazing purposes

9.3.1 Alternative 1: No Project Alternative (Status Quo)

Description

CEQA Guidelines Section 15126.6(e)(3)(B) describes the "No Project" Alternative as the circumstance under which the proposed project does not proceed. Consideration of the No Project Alternative is required under Section 15126(f) of the CEQA Guidelines. The purpose of describing and analyzing a No Project Alternative is to allow decision-makers to compare the impacts of approving the proposed project with the impacts of not approving the proposed project (CEQA Guidelines Section 15126.6(e)(1)). The existing conditions for the No Project Alternative are the same as those described in the Notice of Preparation for the proposed project (refer to Appendix A).

The No Project Alternative includes those activities that would reasonably be expected to occur in the foreseeable future if the proposed project were not approved. These activities include the following:

- Continued operation and maintenance of the Tesla Portal and Thomas Shaft facilities
- Continued deliveries of chemicals to the Tesla Portal and Thomas Shaft facilities
- Continued staffing of three full-time equivalent personnel at the Tesla Portal site
- Continued discharge to the artificial wetland

The No Project Alternative would not include seismic upgrades to minimize the vulnerability of the existing disinfection facilities at the Tesla Portal site from the threat of a seismic event. According to the Hetch Hetchy Water Treatment Project Tesla Portal Chlorination System Evaluation, prepared by the San Francisco Water Team in September 2001, "it is important to note that many elements of the existing facility are at least 60 years old (e.g., the building itself) and cannot perform to the same standards as new facilities when considered from high risk adverse situations, such as a major seismic event, fire, or malicious vandalism."

Furthermore, the No Project Alternative would not include improvements to inactivate *Cryptosporidium* and *Giardia* in drinking water to meet U.S. EPA requirements. Compliance with the U.S. EPA's Long Term-2 Enhanced Surface Water Treatment Rule (LT2ESWTR) is based on the population served by the water supply system. For systems that serve 100,000 people or more, such as the SFPUC's Hetch Hetchy system, compliance with additional LT2ESWTR treatment technique requirements must be completed by April 1, 2012 (U.S. EPA, 2006). The result of this alternative is that the SFPUC would violate state and federal safe drinking water regulations, and delivery to customers after the compliance date could be prohibited.

Impact Analysis

Land Use

The No Project Alternative would not result in any land use changes or land use impacts, as there would be no construction or change of use at either site.

Visual Quality

This alternative would not directly result in any changes to the existing visual environment because no new facilities would be constructed, nor would any modifications to the existing sites be implemented, including the installation of new lighting at the Tesla Portal site. However, an indirect impact could occur in the event of a seismic event at the Tesla Portal. A seismic event could damage the existing disinfection facilities. Repair of these facilities could include exterior modifications or more likely, construction of new buildings. Construction of new buildings could affect views along a scenic route. However, this impact would be similar to the proposed project.

Geology, Soils and Seismicity

This alternative would not result in any direct impacts since no construction activities would occur. Potentially significant indirect environmental impacts from the No Project Alternative could occur if existing disinfection facilities at the Tesla Portal site were to be damaged during a seismic event. Damage to disinfection facilities at the Tesla Portal disinfection facilities could affect the ability of the SFPUC to provide treated water to its customers. Because of the potential failure of the existing disinfection facilities at the Tesla Portal site during a seismic event, an indirect significant impact could occur. This indirect impact could affect the ability of the SFPUC to provide treated water to its customers. This indirect impact is significant and an increase in impact relative to the proposed project.

Hydrology and Water Quality

There would be no construction or alteration at the project sites under the No Project Alternative, and as such, it would not have any direct environmental impacts. Similar to the other resource areas, this alternative could have indirect impacts should a seismic event occur. A seismic event could damage existing facilities that are not up to current safety standards, necessitating the construction of replacement facilities. The construction of replacement facilities could result in the alteration of site topography and increase the potential for erosion. However, like the proposed project, this would be a less-than-significant impact.

Biological Resources

This alternative would not result in any direct impacts on biological resources since new facilities would not be constructed and other associated site improvements would not be implemented. However, if existing disinfection facilities were to be damaged during a seismic event, significant indirect impacts would be expected. These impacts would be associated with construction of replacement facilities, which could affect special status species or their habitat. Nonetheless, the indirect biological resource impacts would be expected to be similar to the proposed project.

Cultural Resources

This alternative would not involve any direct impacts since there would be no construction associated with its implementation. However, if the existing disinfection facilities were to be damaged during a seismic event, construction of replacement facilities may result in discovery of or effects on cultural resources. This indirect impact would be similar to the proposed project.

Traffic, Transportation, and Circulation

This alternative would not result in any increases in traffic in the project area compared to existing conditions and, thereby, would not have any direct traffic impacts. If existing disinfection facilities were to be damaged during a seismic event, indirect impacts from construction of replacement facilities would be expected to be less than significant, like the proposed project.

Air Quality

This alternative would not result in any direct impacts on air quality since no additional emissions would occur over what currently exists. However, if the existing disinfection facilities were to be damaged during a seismic event, indirect significant impacts could occur. These indirect impacts would be associated with emissions from construction equipment used for construction of replacement facilities. However, these indirect impacts would be similar to those of the proposed project.

Noise and Vibration

This alternative would not directly result in any changes in the existing environment and would not, therefore, result in any direct impacts. However, indirect impacts could occur if the existing disinfection facilities would be damaged during a seismic event. Replacement of disinfection facilities would be expected to result in construction activities at the Tesla Portal site. Compared to the proposed project this would result in similar noise impacts.

Public Services and Utilities

The No Project Alternative would not construct new structures, implement any improvements, or make any changes at either project site. Consequently, it would not have any direct environmental impacts. This alternative could have indirect impacts if a seismic event were to take place. A seismic event could damage existing facilities that are not up to current safety standards, which could affect the SFPUC's ability to deliver water to its customers and require the construction of replacement facilities. The construction of replacement facilities could result in the production of construction debris and materials. However, as with the proposed project, this would be a less-than-significant impact.

Agricultural Resources

No construction would occur with this alternative and it would not have direct impacts on agricultural resources. Even if a seismic event damages existing disinfection facilities not up to current safety codes, requiring the construction of replacement facilities, this alternative would not have indirect impacts on agricultural resources. Construction of new facilities would be permitted at either site under the existing agricultural land use and zoning designations. Furthermore, construction of replacement facilities would not preclude agricultural activities from occurring on the undeveloped portion of either site. Indirect impacts of this alternative would be comparable to the proposed project.

Hazards

This alternative would not result in any direct hazard impacts because it would not construct new facilities or implement other associated site improvements. However, if existing disinfection facilities were damaged during a seismic event, this alternative would be expected to have less-than-significant

indirect impacts related to construction of replacement facilities, similar to the proposed project. Energy Resources

Given there would be no construction associated with this alternative, it would not produce any direct impacts. Should the existing disinfection facilities be damaged during a seismic event, construction of replacement facilities may result in temporary and long-term increased energy consumption. Relative to the proposed project, these indirect impacts would be similar to the proposed project.

Conclusions

- The No Project Alternative (Status Quo) would reduce potentially significant, but mitigable direct impacts associated with construction and operation of the proposed project, including, alteration of views as viewed from a scenic route and nighttime light and glare at the Tesla Portal site, impacts on biological and cultural resources, and noise, and air quality impacts. This alternative would also avoid the project's contribution to the SFPUC's WSIP potentially significant and unavoidable program-level impacts associated with growth inducement. However, under the No Project Alternative (Status Quo), if existing disinfection facilities at the Tesla Portal site were to become damaged during a seismic event, impacts similar to the proposed project, or potentially greater since facility replacement would occur during emergency conditions, would be expected. Damage to existing disinfection facilities resulting from a seismic event could also affect the SFPUC's ability to deliver water to meet demands in the Sunol Valley, Bay Division, Peninsula, and San Francisco sub-regions of its regional water service area. The No Project Alternative (Status Quo) would not meet any of the project objectives and would not meet contractual obligations to LLNL. Furthermore, under the No Project Alternative (Status Quo), the SFPUC would not comply with LT2ESWTR.[1]

[1] Lack of compliance with LT2ESWTR would make the SFPUC subject to monitoring, testing, and treatment violations (71 Fed. Reg. 653 [2006]) According to the Federal Register Vol. 71, No. 3, Thursday, January 5, 2006, beginning on page 653, National Primary Drinking Water Regulations: Long Term 2 Enhanced Surface Water Treatment Rule, public water systems (PWSs) are required "to provide a Tier 3 public notice for violation of monitoring and testing procedure requirements, including the failure to collect one or two source water Cryptosporidium samples. If a PWS fails to collect three or more Cryptosporidium samples, other than in specifically exempted situations the PWS must provide a Tier 2 special public notice. Violations for failing to monitor persist until the State determines that the PWS has begun sampling on a revised schedule that includes dates for the collection of missed samples." Further, "Failure by a PWS in any month to demonstrate treatment...equal to or greater than its Cryptosporidium treatment requirements is a treatment technique violation. This violation lasts until the PWS demonstrates that it is meeting criteria for sufficient treatment credit to satisfy its Cryptosporidium treatment requirements."
Tier 1 public notifications are for violations and situations with significant potential to have serious adverse effects on human health as a result of short-term exposure. Notice is required within 24 hours of the violation. Tier 2 public notifications are for other violations and situations with potential to have serious, but not immediate, adverse effects on human health. Notice is required within 30 days, or as soon as possible, with extension of up to three months for resolved violations at the discretion of the State or primacy agency. Tier 3 public notifications are for all other violations and situations not included in Tier 1 and Tier 2. Notice is required within 12 months of the violation, and may be part of a single annual report, including in some cases the annual CCR already required by the U.S. EPA (U.S. EPA Website, accessed 2008).

9.3.2 Alternative 2: No Project Alternative (Compliance with Safe Drinking Water Regulations)

Description

Under this No Project Alternative, none of the project elements would be implemented other than the construction of the 20,000-square-foot UV building at the Tesla Portal site, and there would be no construction at the Thomas Shaft site. This No Project Alternative is considered in this EIR because it is unrealistic that the SFPUC would proceed with the No Project Alternative (Status Quo) described in Section 9.3.1. Furthermore, other available water treatment processes to address compliance with LT2ESWTR were found to result in greater environmental impacts (see Section 9.4.3, Use Ozone Disinfection in Place of UV Disinfection). The Status Quo Alternative would not upgrade existing water treatment capabilities at the Tesla Portal, which would be in violation of state and federal safe drinking water regulations. While Alternative 2 would make water treatment improvements (the UV building), it would not include seismic upgrades to minimize the vulnerability of the existing disinfection facilities at the Tesla Portal site from the threat of a seismic event. Similar to the Status Quo Alternative, reasonably expected activities include the continued operation and maintenance of the Tesla Portal and Thomas Shaft facilities; continued deliveries of chemicals to the Tesla Portal and Thomas Shaft facilities; continued staffing of three full-time equivalent personnel at the Tesla Portal site; and continued discharge to the artificial wetland.

Impact Analysis

Land Use

This alternative would not result in any land use changes or land use impacts at the Thomas Shaft site, as there would be no construction or change of use at that site. It would likely require slightly less time to construct and possibly a smaller staging area at the Tesla Portal site, reducing the project's temporary land use disruption at the Tesla Portal site.

Visual Quality

No changes would occur to the existing visual environment at the Thomas Shaft site. Construction activities under this alternative would not last as long as under the project reducing the amount of time construction activities would affect the visual character and quality of the Tesla Portal site compared to the project. During the operational stage, this alternative's visual quality impacts would be reduced compared to the project as the Tesla Portal site would have two less buildings and less lighting. However, an indirect impact could occur in the event of a seismic event at the Tesla Portal and damage to existing disinfection facilities. Repair of these facilities could include exterior modifications, or more likely, construction of new buildings, and this construction could affect views along a scenic route resulting in an impact similar to the proposed project.

Geology, Soils and Seismicity

This alternative would not result in any direct impacts at the Thomas Shaft site since no construction activities would occur at this site. Potentially significant indirect environmental impacts from this

alternative could occur if existing disinfection facilities at the Tesla Portal site were to be damaged during a seismic event. Damage to disinfection facilities at the Tesla Portal disinfection facilities could affect the ability of the SFPUC to provide treated water to its customers. This indirect impact would be significant and an increase in impact relative to the proposed project.

Hydrology and Water Quality

There would be no construction or alteration at the Thomas Shaft site. Consequently, there would be no direct environmental impacts at this site. Compared to the proposed project, this alternative would have a reduced building footprint at the Tesla Portal site. Thus, less soil would be disturbed during construction, reducing the amount of eroded soil that could reach the artificial wetland and ephemeral drainage. While the project was determined to have less-than-significant construction impacts associated with erosion and sedimentation, comparatively, the construction impact of this alternative would be less than the proposed project. Additionally, this alternative would have more pervious surface area than the proposed project. The increase of pervious surfaces would reduce peak flow runoff rates and velocities compared to the project, resulting in reduced onsite and offsite erosion, and an incremental decrease in runoff volume and related stormwater pollutants.

Similar to the other resource areas, this alternative could result in indirect impacts should a seismic event occur and damage existing facilities. The construction of replacement facilities could result in the alteration of site topography and increase the potential for erosion; however, similar to the proposed project, this would be a less-than-significant impact.

Biological Resources

This alternative would not result in any direct impacts on biological resources at the Thomas Shaft site since improvements would not be implemented at this site. This alternative would reduce impacts on biological resources since the artificial wetland at the Tesla Portal site would not be affected and would continue to provide a year-round source of water; less California annual grasslands and ruderal/disturbed habitat would be disturbed (due to the reduced building footprint at the Tesla Portal site); and less special-status wildlife foraging and/or breeding habitat would be converted (due to the reduced building footprint at the Tesla Portal site) compared to the project. However, if existing disinfection facilities were to be damaged during a seismic event, significant indirect impacts to special status species or their habitat would be expected, similar to the proposed project.

Cultural Resources

This alternative would not involve any direct impacts at the Thomas Shaft site since there would be no construction at this site. However, this alternative would reduce the project's building footprint at the Tesla Portal site and the amount of ground disturbance. Consequently, this alternative may reduce potential direct effects on cultural resources during construction relative to the proposed project. Regardless, if the existing disinfection facilities were to be damaged during a seismic event, construction of replacement facilities may result in similar cultural resources impacts compared to the proposed project.

Traffic, Transportation, and Circulation

This alternative would result in a slight decrease in traffic in the project area compared to the proposed project due to less construction activities at the Tesla Portal site and no construction work at the Thomas Shaft site. If existing disinfection facilities were to be damaged during a seismic event, indirect impacts from construction of replacement facilities would be expected to be less than significant, like the proposed project.

Air Quality

This alternative would not result in any direct impacts on air quality at the Thomas Shaft site since no additional emissions would occur above current conditions. During construction, the reduced building footprint at the Tesla Portal site associated with this alternative would require less grading. The decrease in grading would consequently result in fewer emissions of fugitive dust during construction. The severity of air quality impacts would be reduced for this alternative compared to the proposed project since less grading would be required and less fugitive dust would be generated. Air quality impacts from operations would be the same as the proposed project. However, if the existing disinfection facilities were damaged during a seismic event, indirect significant impacts could occur, and indirect impacts associated with emissions from construction of replacement facilities would be similar to the proposed project.

Noise and Vibration

This alternative would not result in any direct changes in the existing environment at the Thomas Shaft site. Thus, it would not result in any direct impacts at this site. Noise impacts would be somewhat reduced at the Tesla Portal site due to the shorter construction period but would otherwise include similar construction noise impacts as the proposed project. However, impacts could occur if the existing disinfection facilities were damaged during a seismic event and the facility needed to be replaced; noise impacts due to construction of replacement facilities would be similar to the proposed project.

Public Services and Utilities

This alternative would not have any direct environmental impacts at the Thomas Shaft site, as it would not implement any improvements at this site. The new UV building would be built within the SFPUC's existing property and would not affect offsite utility services. In addition, construction of the new UV building at the Tesla Portal site would not interrupt service to existing water supply customers. The system would be shutdown during a regularly scheduled maintenance shutdown, which would allow for the tie-in to the new facilities at the Tesla Portal site. However, no interruption to SFPUC water customers would result, as they would continue to be served by other system sources. At the Thomas Shaft site, no on or offsite utilities would be affected. Therefore, potential impacts to existing regional and local public utilities would be less than significant This alternative could have indirect impacts if a seismic event were to take place and damage existing facilities, which could affect the SFPUC's ability to deliver water to its customers and require the construction of replacement facilities. The construction of replacement facilities could generate construction debris and materials; however, similar to the proposed project, this impact would be less than significant.

Agricultural Resources

No construction would occur with this alternative at the Thomas Shaft site and it would not have direct impacts on agricultural resources at this site. The construction of only the 20,000 square foot UV building under this alternative would result in a somewhat decreased footprint relative to the project. Accordingly, a larger portion of the Tesla Portal site would continue to be available for cattle grazing. Thus, relative to the proposed project, this alternative would allow for greater potential for grazing on the site.

Should a seismic event damage existing disinfection facilities not up to current safety codes, and require construction of replacement facilities, this alternative would not have indirect impacts on agricultural resources. Construction of replacement facilities would not preclude agricultural activities from occurring on the undeveloped portion of either site, and indirect impacts of this alternative would be comparable to the proposed project.

Hazards

This alternative would not result in any direct hazard impacts at the Thomas Shaft site because it would not construct new facilities or implement other associated improvements at this site. Potential hazard impacts (both construction and operational) at the Tesla Portal site would be similar to the proposed project. However, if existing disinfection facilities were damaged during a seismic event, this alternative would be expected to have less-than-significant indirect impacts related to construction of replacement facilities, similar to the proposed project. Futhermore, depending on the strength of a seismic event, there is the possibility it could cause a release of disinfection material. The disinfection material, Sodium Hypochlorite 12.5%, is a hazardous material. It is stored within tanks located inside a secondary containment area, which should contain any leaks cause by a seismic event. However, the secondary containment could leak during a seismic event, depending on its severity and magnitude. Regardless, due to its nature, Sodium Hypochlorite 12.5%, would not persist in the environment or migrate into the groundwater. It is the type of chemical that would most likely dissipate naturally. Thus, while it could be released into the environment, the chances of it causing substantial damage are low. Nonetheless, it would be an increased indirect impact relative to the project.

Energy Resources

Given there would be no construction associated with this alternative at the Thomas Shaft site, it would not produce any direct impacts at this site. There would be somewhat reduced energy impacts since fewer facilities would be built and less energy would be needed (both for construction and operation) compared to the proposed project. Should existing disinfection facilities be damaged during a seismic event, construction of replacement facilities may result in temporary and operational increased energy consumption, and impacts would be similar to the proposed project.

Conclusions

- The No Project Alternative (Compliance with Safe Drinking Water Regulations) would reduce potentially significant but mitigable direct impacts associated with construction and operation of the proposed project since fewer facilities would be built. These reduced impacts include alteration of views as viewed from a

scenic route and nighttime light and glare at the Tesla Portal site, impacts on biological and cultural resources, and noise, and air quality impacts. This alternative would also avoid the project's contribution to the SFPUC's WSIP's potentially significant and unavoidable program-level impacts associated with growth inducement. However, under this alternative, if existing disinfection facilities at the Tesla Portal site were damaged during a seismic event, impacts similar to the proposed project, or potentially greater, since facility replacement would occur during emergency conditions, would be expected. Damage to existing disinfection facilities resulting from a seismic event could also affect the SFPUC's ability to deliver water to meet demands in the Sunol Valley, Bay Division, Peninsula, and San Francisco sub-regions of its regional water service area. This alternative would construct new water treatment facilities, and therefore, would meet the project objective related to compliance with LT2ESWTR. However, it would not meet contractual obligations to LLNL and it would not seismically upgrade existing facilities.

9.3.3 Alternative 3: Continue Water Source to Artificial Wetland at Tesla Portal Site

Description

Under this alternative, the SFPUC would continue to provide a year round water source to the artificial wetland at the Tesla Portal site. The source of water would change from existing analyzer equipment to the new analyzer equipment that would be located adjacent to the wetland area. The amount of water provided would be roughly the same amount that currently feeds the wetland area. During regularly scheduled shutdowns at the facility, which are up to 45 days at a time, water would not be provided, similar to existing conditions. Under this alternative, all other aspects of the proposed project at the Tesla Portal and Thomas Shaft sites would be implemented as described in Chapter 3. This alternative would meet all project objectives.

Impact Analysis

Biological Resources

This alternative would reduce impacts on biological resources since a permanent, year-round source of water would be provided to the artificial wetland at the Tesla Portal site. Although the artificial wetland is not considered a jurisdictional feature by state or federal agencies, implementation of the project would result in the loss of wetland functions and values (i.e., the only year-round source of water in the project area and surrounding valley bottom), and would substantially degrade or diminish habitat values for dependent plant and wildlife species. The proposed project would discontinue the water source for the artificial wetland area, when water from the analyzer equipment at Tesla Portal is no longer discharged to the artificial wetland area. The artificial wetland has little natural water source other than natural runoff and discharges from the Tesla Portal facility; therefore, the long-term effect of this action would be loss of most or all of the artificial wetland, resulting in a potentially significant impact that could be mitigated to less-than-significant levels. Thus, compared to the proposed project, this alternative would have reduced impacts.

Conclusion

- Alternative 3: Continue Water Source to Artificial Wetland at Tesla Portal Site would meet all of the project objectives and, therefore, would be expected to have similar growth inducement impacts compared to the proposed project. This alternative would contribute to the SFPUC's WSIP's potentially significant and unavoidable program-level impacts associated with growth inducement. This alternative would avoid impacts associated with permanent loss of 0.308 acre of artificial wetland at the Tesla Portal site and the associated loss of habitat value to dependent plant and wildlife species that are identified as potentially significant but mitigable under the proposed project. Other potentially significant but mitigable biological resources impacts during project construction would be the same as the proposed project under this alternative. This alternative would implement the Lawrence Livermore Water Quality Improvements at the Thomas Shaft site as described in Chapter 3. Therefore, the impact analysis and conclusions presented in Chapter 4 related to the Thomas Shaft site would be the same under this alternative, and are not discussed further in this section. Given that this alternative would implement all the same improvements as the project (excluding discontinuing the permanent, year round water supply to the artificial wetland at the Tesla Portal site), its potential impacts would be the same as the project's potential impacts for the following resource areas:

  - Land Use
  - Visual Quality
  - Geology, Soils, and Seismicity
  - Hydrology and Water Quality
  - Cultural Resources
  - Traffic, Transportation, and Circulation
  - Air Quality
  - Noise and Vibration
  - Public Services and Utilities
  - Agricultural Resources
  - Hazards
  - Energy Resources

9.3.4 Alternative 4: Combine Office/Control Building and UV Building at Tesla Portal Site

Description

This alternative proposes to combine the 3,500-square-foot Office/Control Building and the 20,000-square-foot UV Building in a single, two-story structure at the Tesla Portal site instead of housing each facility in two separate single-story buildings, as they would be under the proposed project. Under this alternative, the total building footprint would be smaller than the proposed project; however, the building would be taller than the proposed one-story structures under the project. In addition, the Chemical Process Building and other improvements at the Tesla Portal site as well as the Lawrence Livermore Water Quality Improvements at the Thomas Shaft site would be implemented as described in Chapter 3. This alternative would meet all project objectives.

Impact Analysis

Visual Quality

Construction activities under this alternative would be similar to the project and would have the same significant, but mitigable affects on the visual character and quality of the project sites as they would under the project.

I-580 is a state designated scenic route. The existing structures at the Tesla Portal site are somewhat visible from I-580, although much of the existing facility is shielded from view by trees. During the operational phase, this alternative would have a potentially greater visual impact than the project because the Office/Control Building and the UV Building would be combined into a single, two-story structure at the Tesla Portal site, which would be taller and more visible than the one-story structures proposed by the project.

Hydrology and Water Quality

The construction of a single multi-purpose building would reduce the building footprint at the Tesla Portal site as compared to the proposed project. Potential soil erosion to the artificial wetland and ephemeral drainage would be reduced under this alternative because less soil would be disturbed during construction. While the project was determined to have less-than-significant impacts associated with erosion and sedimentation during construction, comparatively this alternative would have less erosion and sediment potential than the proposed project during construction.

During operation, this alternative would have more pervious surface area than the proposed project. However, the increase in pervious surface area would minor, given that the majority of the site would remain pervious with its construction. Nonetheless, the increase of pervious surfaces would reduce peak flow runoff rates and velocities compared to the project, resulting in reduced onsite and offsite erosion, and an incremental decrease in runoff volume and related stormwater pollutants.

Biological Resources

Under this alternative, construction staging and other construction-related activities would be expected to be of a similar size and nature as the proposed project, as all the same features would be built, even though the Office/Control Building would be combined with the UV Building in a single, two-story structure rather than constructing two separate single-story buildings. Consequently, this alternative would be expected to result in similar construction disturbance of the ephemeral drainage, California annual grasslands, and ruderal/disturbed habitat, as well as similar temporary loss of foraging and/or breeding habitat for some or all of the special status species known to occur, or with potential habitat present at the project sites. Because the footprint of the permanent facilities would be 3,500 square feet less than they would be under the proposed project during operations, this alternative would convert less special-status wildlife foraging and/or breeding habitat than the proposed project, reducing impacts on special-status wildlife compared to the proposed project.

Cultural Resources

Under this alternative, the amount of ground disturbance would be slightly less (3,500 square feet) than for the proposed project and the potential effects during construction on cultural resources may be reduced accordingly relative to the proposed project. As with the project, after this alternative is built, its operation would not have the potential to affect historical, archaeological or paleontological resources.

Air Quality

During construction, the reduced building footprint at the Tesla Portal site associated with this alternative would require less grading. The decrease in grading would consequently result in fewer emissions of fugitive dust during construction. The severity of air quality impacts would be reduced for this alternative compared to the proposed project since less grading would be required and less fugitive dust would be generated. Air quality impacts from operations would be the same as the proposed project.

Agricultural Resources

Construction and operation of one less building would result in a decreased footprint relative to the project. Accordingly, 3,500 square feet of the Tesla Portal site would continue to be available for cattle grazing. Thus, this alternative would slightly increase the agricultural productivity potential of the site relative to the proposed project.

Conclusion

- Alternative 4: Combine Office/Control Building and UV Building at Tesla Portal site would meet all of the project objectives and, therefore, would be expected to have similar growth inducement impacts compared to the proposed project. This alternative would contribute to the SFPUC's WSIP's potentially significant and unavoidable program-level impacts associated with growth inducement. This alternative would reduce the severity of impacts associated with biological and cultural resources, and air quality in the proposed project area; these impacts would remain potentially significant, but mitigable as they are under the proposed project. Additionally, this alternative would reduce the severity of the project's erosion and sedimentation potential (a less than significant impact). It would also slightly increase the amount of land available for cattle grazing at the Tesla Portal site. However, this alternative could result in greater visual

impacts because of the increased building height. Because this alternative would implement all project features identified in the project description in Chapter 3 with the exception that it would reduce the development footprint of the project, it would be expected to result in similar impacts as the project for the following resource areas:

- Land Use
- Geology, Soils, and Seismicity
- Traffic, Transportation, and Circulation
- Noise and Vibration
- Public Services and Utilities
- Hazards
- Energy Resources

9.3.5 Alternative 5: Retrofit of Existing Tesla Portal Hypochlorite Station Building

Description

Under this alternative, the SFPUC would retrofit the existing building that contains the Tesla Portal Hypochlorite Station rather than construct a new Chemical Process Building. This alternative would reduce the building footprint at the Tesla Portal site by approximately 14,000 square feet. The Tesla Portal facility must be capable of providing disinfection to the Hetch Hetchy flows throughout the construction period. Consequently, a temporary chemical feed facility would be constructed to inject sodium hypochlorite into the Coast Range Tunnel at the same location as the existing injection system to maintain the disinfection function as well as the required monitoring, sampling, and reporting functions. The Thomas Shaft Chlorination Facility would continue to provide back up disinfection.

The temporary chemical feed facility would include an approximately 20-foot-wide by 20-foot-long by 12-foot-high building located approximately southeast of the existing feed building over the top or nearly over the top of the Coast Range Tunnel. The facility would have main and back-up power and communications to house and protect the pumps, pumping control equipment, feed lines, and monitoring equipment from weather, for security, and to allow for uninterrupted operation during construction. Temporary tanks and connections that provide for the required chemical storage and allow for chemical deliveries would also be provided. Since these temporary facilities must allow full access for operations and water quality personnel, the paved road would still be used for chemical deliveries and vehicle access. After the existing building containing the Tesla Portal Hypochlorite Station is retrofitted, demolition of the temporary chemical feed facility would generate approximately 200 cubic yards of building waste material.

Upgrades under this alternative that would meet (fully or partially) the project objective related to seismic reliability and safety consist of the following:

- Replace tanks, piping, and major process equipment
- Relocate the domestic/fire water pumps to allow full-time use
- Replace panels and uninterruptible power supply system to meet the applicable codes
- Repair damaged trusses
- Replace concrete slab, foundation, and containment area
- Install fire protection system (San Francisco Water Team, 2001).

The UV Building, Office/Control Building and other improvements at the Tesla Portal site as well as the Lawrence Livermore Water Quality Improvements at the Thomas Shaft site would be implemented as described in Chapter 3.

This alternative would not be able to accommodate the pH adjustment equipment and, therefore, that project objective would not be met, and a building for this equipment may be needed in the future. Furthermore, it should be noted that a previous structural and engineering evaluation of the current building and systems (San Francisco Water Team, 2001) concluded that upgrades to the current building and systems "cannot increase the reliability and performance comparable to a new facility." Thus, this alternative would not have the reliability and performance capability of a new facility.

Impact Analysis

Visual Quality

Construction activities under this alternative would be similar to the project and would have the same significant but mitigable affects on the visual character and quality of the project sites as they would under the project. During the operational stage, the visual quality impacts associated with this alternative would be reduced by constructing one less building than the proposed project.

Hydrology and Water Quality

The temporary disinfection facility would have a reduced footprint compared to the Chemical Process Building, as such, this alternative would require less grading relative to the project. Potential soil erosion to the artificial wetland would be reduced under this alternative because of the smaller area of disturbance during construction. Although the project was determined to have less-than-significant impacts associated with erosion and sedimentation during construction, comparatively, this alternative would have less erosion and sediment potential than the proposed project during construction.

During operation, this alternative would have more pervious surface area than the proposed project. However, the increase in pervious surface area would be minor, given that the majority of the site would remain pervious with its construction. Nonetheless, the increase of pervious surfaces would reduce peak

flow runoff rates and velocities compared to the project, resulting in reduced onsite and offsite erosion, and an incremental decrease in runoff volume and related stormwater pollutants. After the existing building containing the Tesla Portal Hypochlorite Station is retrofitted, demolition of the temporary chemical feed facility would generate approximately 200 cubic yards of building waste material. Demolition of the temporary chemical feed facility has the potential to impact water quality by increasing erosion and sedimentation. Construction activities would comply with SFPUC Construction Measure #3, minimizing erosion and sedimentation; therefore, demolition of the temporary facility would have less-than-significant impacts on water quality. While the project was determined to have less-than-significant impacts associated with erosion and sedimentation, comparatively, this alternative would have less erosion and sediment potential than the proposed project.

Biological Resources

With this alternative, construction staging and other construction-related activities would be relatively the same as the proposed project. However the building footprint would be reduced by about 14,000 square feet compared to the proposed project; therefore, this alternative would disturb less California annual grasslands and ruderal/disturbed habitat than the project, and would not convert as much special-status wildlife foraging and/or breeding habitat as the project would. Therefore this alternative would reduce impacts on special-status wildlife compared to the proposed project.

Cultural Resources

Implementation of this alternative would reduce the project's building footprint and the amount of ground disturbance. Consequently, this alternative may reduce potential effects on cultural resources during construction relative to the proposed project. As with the project, after this alternative is built, its operation would not have the potential to affect historical, archaeological, or paleontological resources.

Air Quality

The reduced building footprint at the Tesla Portal site associated with this alternative would require less grading. However, it would require demolition of the temporary facility. Fugitive dust emissions from demolition are expected to be minor. The net severity of air quality impacts would still be reduced for this alternative compared to the proposed project since less grading would be required and less fugitive dust would be generated during construction. Air quality impacts from operations would be the same as the proposed project.

Public Services and Utilities

This alternative would be expected to result in similar impacts as the project with the exception that it would generate a slightly greater amount of solid waste from demolition of the temporary feed facility.

Agricultural Resources

The construction of one less building under this alternative would result in a decreased footprint of approximately 14,000 square feet relative to the project. Accordingly, more of the Tesla Portal site would continue to be available for cattle grazing. Thus, this alternative could increase the potential for grazing on the site relative to the proposed project.

Conclusion

- Alternative 5: Retrofit of Existing Tesla Portal Hypochlorite Station Building would be expected to have similar growth inducement impacts compared to the proposed project, and would contribute to the SFPUC's WSIP's potentially significant and unavoidable program-level impacts associated with growth inducement. This alternative site configuration would reduce the severity of some of the impacts associated with the proposed project but would not reduce the need for mitigation or change the determinations of significant but mitigable impacts. It would reduce the amount of erosion, dust, and temporary California annual grassland and ruderal/disturbed habitat disturbance during construction. During operations, it would have reduced visual, erosion, and water quality impacts; would not convert as much special-status wildlife foraging and/or breeding habitat as the project; and would increase the agricultural productivity potential (grazing) of the site relative to the proposed project. This alternative would not be able to accommodate the pH adjustment equipment and, therefore, that project objective would not be met, and a building for this equipment may be needed in the future. Furthermore, this alternative would not have the reliability and performance capability of a new facility. Due to the minor changes associated with this alternative compared to the proposed project, it would be expected to result in similar impacts as the project for the following resource areas:

  - Land Use
  - Geology, Soils, and Seismicity
  - Traffic, Transportation, and Circulation
  - Noise and Vibration
  - Hazards
  - Energy Resources

TABLE 9-3

COMPARISON OF ALTERNATIVE PROJECT IMPACTS TO THE PROPOSED PROJECT

Category of Potential Significant Environmental Impact	Proposed Project	No Project Alternative (Status Quo)	No Project Alternative (Compliance with Safe Drinking Water Regulations)	Continue Water Source to Artificial Wetland at Tesla Portal Site Alternative	Combine Office/Control Building and UV Building at Tesla Portal Site Alternative	Retrofit of Existing Tesla Portal Hypochlorite Station Building Alternative
Land Use	Effects found to be less- than-significant.	No impacts since there would be no construction or change of use.	No impacts at the Thomas Shaft site since no construction or change of use would occur at this site. Reduction in the project's temporary land use disruption at the Tesla Portal site.	Same impacts as the project since only difference is that the water supply to the artificial wetland area at the Tesla Portal site would not be cut-off.	Same impacts as the project because the only difference is that the Office/Control Building and the UV Building would be combined in a single, two-story structure at the Tesla Portal site.	Same impacts as the project because of the minor differences associated with the building retrofit and construction of one less building at the Tesla Portal site.
Visual Quality	Permanent adverse impacts on scenic vistas or resources found to be significant, but mitigable to less-than-significant levels at the Tesla Portal site. Operational nighttime light and glare found to be significant, but mitigable to a less-than-significant level at the Tesla Portal site.	No impacts since there would be no construction. If the existing disinfection facilities were to be damaged during a seismic event, there could be direct mitigable impacts similar to the proposed project from the construction of replacement facilities.	No impacts at the Thomas Shaft site since no construction would occur at this site. Reduction in the amount construction activities and temporary affects to visual character and quality of the Tesla Portal site. Permanent visual impacts would be somewhat reduced because of the construction of fewer buildings and installation of less lighting at Tesla Portal.	Same impacts as the project because the only difference is that the water supply to the artificial wetland area at the Tesla Portal site would not be cut-off.	Potentially somewhat greater visual impact since the Office/Control Building and the UV Building would be combined in a single, two-story structure at the Tesla Portal site which would be taller and more visible than the one-story structures proposed by the project.	Visual impacts would be somewhat reduced because of the construction of one less building at Tesla Portal.

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Geology, Soils and Seismicity	Expansive or corrosive soils represent a potentially significant, but mitigable impact with investigation to a less-than-significant level.	Increased relative to the project because of possible failure of the existing disinfection facilities at the Tesla Portal site during a seismic event; failure could affect the ability of the SFPUC to provide treated water to its customers.	No impacts at Thomas Shaft since no construction would occur at this site. Increased relative to the project because of possible failure of the existing disinfection facilities at the Tesla Portal site during a seismic event; failure could affect the ability of the SFPUC to provide treated water to its customers.	Same impacts as the project because the only difference is that the water supply to the artificial wetland area at the Tesla Portal site would not be cut-off.	Similar impacts as the project, as construction activities would occur within the approximate footprint as the project.	Similar impacts as the project because construction activities would occur within the approximate footprint as the project.
Hydrology and Water Quality	Effects found to be less than significant.	No impacts since there would be no construction. If disinfection facilities were to be damaged during a seismic event, there could be less-than-significant indirect impacts similar to the proposed project.	No impacts at Thomas Shaft since no construction would occur at this site. Erosion sedimentation, and water quality impacts slightly reduced relative to the project due to somewhat smaller construction and operational footprint at the Tesla Portal site. If disinfection facilities were to be damaged during a seismic event, there could be less-than-significant	Same impacts as the project because the only difference is that the water supply to the artificial wetland area at the Tesla Portal site would not be cut-off.	Erosion sedimentation, and water quality impacts slightly reduced relative to the project due to somewhat smaller construction and operational footprint.	Erosion, sedimentation, and water quality impacts reduced slightly relative to the project due to somewhat smaller construction and operational footprint.

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			indirect impacts similar to the proposed project.			
Biological Resources	Effects on the artificial wetland habitat found to be significant but mitigable to a less-than-significant level. Temporary impacts on California annual grasslands during construction activities found to be significant but mitigable to less-than-significant levels. Effects on sensitive species found to be significant but mitigable to less-than-significant levels.	No impacts since there would be no construction. If the existing disinfection facilities were to be damaged during a seismic event, there could be indirect less than significant impacts similar to the proposed project from the construction of replacement facilities.	No impacts at the Thomas Shaft site since no construction would occur at this site. Decreased relative to the project at the Tesla Portal site because the habitat value of the artificial wetland area would not be permanently lost. Impacts on California annual grassland, species, and their habitats at the Tesla Portal site slightly reduced relative to the project due to somewhat smaller construction footprint. If the existing disinfection facilities were to be damaged during a seismic event, there could be indirect less than significant impacts similar to the proposed project from	Decreased relative to the proposed project; because habitat value of the artificial wetland area at the Tesla Portal site would not be permanently lost.	Impacts on California annual grassland, species, and their habitats slightly reduced relative to the project due to somewhat smaller construction footprint.	Impacts on California annual grassland, species, and their habitats slightly reduced relative to the project due to somewhat smaller construction footprint.

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			the construction of replacement facilities.			
Cultural Resources	Effects on cultural resources found to be significant but mitigable to less-than-significant levels.	No impacts since there would be no construction. If the existing disinfection facilities were to be damaged during a seismic event, there could be indirect impacts similar to the proposed project from the construction of replacement facilities.	No impacts at the Thomas Shaft site since no construction would occur at this site. Impacts on paleontological resources and unknown prehistoric archaeological resources, slightly reduced relative to the project due to somewhat smaller construction footprint. If the existing disinfection facilities were to be damaged during a seismic event, there could be indirect impacts similar to the proposed project from the construction of replacement facilities.	Same impacts as the project because the only difference is that the water supply to the artificial wetland area at the Tesla Portal site would not be cut-off.	Impacts on paleontological resources and unknown prehistoric archaeological resources, slightly reduced relative to the project due to somewhat smaller construction footprint.	Impacts on paleontological resources and unknown prehistoric archaeological resources, slightly reduced relative to the project due to somewhat smaller construction footprint.
Traffic, Transportation, and Circulation	Effects found to be less- than-significant.	No impacts since there would be no construction. If the existing disinfection facilities were to be	No impacts at the Thomas Shaft site since no construction would occur at this site.	Same impacts as the project because the only difference is that the water supply to the	Same impacts as the project because the only difference is that the Office/Control Building and the UV	Similar impacts as the project because of the minor differences associated with the

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		damaged during a seismic event, there could be less-than-significant indirect impacts similar to the project from the construction of replacement facilities.	Somewhat reduced impacts at the Tesla Portal site since there would be less construction compared to the project.. If the existing disinfection facilities were to be damaged during a seismic event, there could be less-than-significant indirect impacts similar to the project from the construction of replacement facilities.	artificial wetland area at the Tesla Portal site would not be cut-off.	Building would be combined in a single, two-story structure at the Tesla Portal site.	building retrofit and construction of one less building at the Tesla Portal site.
Air Quality	Construction emissions of criteria pollutants, including diesel particulates, found to be potentially significant but mitigable to less-than-significant levels. Other construction and operation effects less-than-significant.	No impacts since there would be no construction. If the existing disinfection facilities were to be damaged during a seismic event, there could be indirect impacts similar to the proposed project from the reconstruction of replacement.	No impacts at the Thomas Shaft site since no construction would occur at that site. Severity of fugitive dust during construction would be reduced slightly relative to the project due to somewhat smaller construction footprint. If the existing disinfection facilities were to be damaged	Same impacts as the project because the only difference is that the water supply to the artificial wetland area at the Tesla Portal site would not be cut-off.	Severity of fugitive dust during construction would be reduced slightly relative to the project due to somewhat smaller construction footprint.	Severity of fugitive dust during construction would be reduced slightly relative to the project due to somewhat smaller construction footprint.

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			during a seismic event, there could be indirect impacts similar to the project from the reconstruction of replacement facilities.			
Noise and Vibration	Disturbance from temporary construction-related noise and vibration increases at Tesla Portal potentially significant but mitigable to less-than-significant levels. Other construction and operation effects less-than-significant.	No impacts since there would be no construction. If the existing disinfection facilities were to be damaged during a seismic event, there could be indirect impacts similar to the proposed project from the construction of replacement facilities.	No impacts at the Thomas Shaft site since no construction would occur at this site. If the existing disinfection facilities were to be damaged during a seismic event, there could be indirect impacts similar to the proposed project from the construction of replacement facilities.	Same impacts as the project because the only difference is that the water supply to the artificial wetland area at the Tesla Portal site would not be cut-off.	Similar impacts as the project because the only difference is that the Office/Control Building and the UV Building would be combined in a single, two-story structure at the Tesla Portal site.	Similar impacts as the project because of the minor differences associated with the building retrofit and construction of one less building at the Tesla Portal site.
Public Services and Utilities	Effects found to be less- than-significant.	No impacts since there would be no construction. If the existing disinfection facilities were to be damaged during a seismic event, there could be less-than-significant indirect impacts similar to the	No impacts at the Thomas Shaft site since there no construction would occur at that site. If the existing disinfection facilities were to be damaged during a seismic event, there could be	Same impacts as the project because the only difference is that the water supply to the artificial wetland area at the Tesla Portal site would not be cut-off.	Similar impacts as the project because the only difference is that the Office/Control Building and the UV Building would be combined in a single, two-story structure at the Tesla Portal site.	Similar impacts as the project because of the minor differences associated with the building retrofit and construction of one less building at the Tesla Portal site except for slightly higher waste

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		project from the construction of replacement facilities.	less-than-significant indirect impacts similar to the project from the construction of replacement facilities.			generated from this alternative as a result of demolition of the temporary facilities.
Agricultural Resources	Effects found to be less- than-significant.	No impacts since there would be no construction. If disinfection facilities would be damaged during a seismic event, there could be less-than-significant indirect impacts similar to the project.	No impacts at the Thomas Shaft site since no construction would occur at that site. Slightly increased area for continued potential to allow cattle grazing at the Tesla Portal site. If disinfection facilities were damaged during a seismic event, there could be less-than-significant indirect impacts similar to the project.	Same impacts as the project because the only difference is that the water supply to the artificial wetland area at the Tesla Portal site would not be cut-off.	Increased area (~3,500 sf) for continued potential to allow cattle grazing at the Tesla Portal site.	Increased area (~14,000 sf) for continued potential to conduct allow cattle grazing at the Tesla Portal site.
Hazards	Effects found to be less- than-significant.	No impacts since there would be no construction. If disinfection facilities would be damaged during a seismic event, there could be less-than-significant indirect impacts	No impacts at the Thomas Shaft site since no construction would occur at this site. If disinfection facilities were damaged during a seismic event, there could be less-than-	Same impacts as the project because the only difference is that the water supply to the artificial wetland area at the Tesla Portal site would not be cut-	Similar impacts as the project because the only difference is that the Office/Control Building and the UV Building would be combined in a single, two-story structure at	Similar impacts as the project because of the minor differences associated with the building retrofit and construction of one less building at the Tesla Portal site.

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		similar to the project.	significant indirect impacts similar to the project.	off.	the Tesla Portal site.	
Energy Resources	Construction-related energy use found to be less-than-significant. Operational energy impacts found to be potentially significant but mitigable to less-than-significant.	No energy impacts associated with the use of fuels during construction or energy during operation. If the existing disinfection facilities were to be damaged during a seismic event, there could be indirect impacts similar to the project from the construction of replacement facilities.	Somewhat reduced impacts compared to the project due to construction and operation of only the UV building at the Tesla Portal site.	Same impacts as the project because the only difference is that the water supply to the artificial wetland area at the Tesla Portal site would not be cut-off.	Similar impacts as the project because the only difference is that the Office/Control Building and the UV Building would be combined in a single, two-story structure at the Tesla Portal site.	Similar impacts as the project because of the minor differences associated with the building retrofit and construction of one less building at the Tesla Portal site.

9.4 Possible Alternatives Considered, but Rejected

This section presents 11 alternatives that were considered as alternatives to the proposed project, but were not carried forward for further consideration because they would clearly result in environmental impacts greater than those of the proposed project and/or because they did not meet most of the project objectives, which are listed above in the introduction to this chapter and in Chapter 3. These are therefore not considered CEQA alternatives.

9.4.1 Locate UV Disinfection Facility at Moccasin Reservoir

Under this alternative, a UV system similar to the one that would be installed at the Tesla Portal site would be installed at Moccasin Reservoir, a Hetch Hetchy component located in Tuolumne County. Due to site topography and system hydraulics, the UV reactor building would have to be constructed below the existing ground surface to eliminate the need to pump water when Moccasin Reservoir is at its minimum operating water surface elevation. Implementation of this alternative would require draining the reservoir during construction or constructing the facility underwater. This alternative would install an effluent line to convey treated water back to the Hetch Hetchy system and an effluent weir to make sure that the UV lamps would stay submerged under all operating conditions.

This alternative would achieve the objectives of the project. However, this alternative would create greater construction-related impacts than the proposed project, as more excavation would be required for the UV building, the effluent line, and the effluent weir. Among other potential impacts, increased excavation would generate more noise, greater amounts of construction-related air pollutants, greater consumption of energy, greater total numbers of truck trips, and pose greater potential threats to biological resources. Greater operational impacts would also result from the pumping equipment that would be needed.

9.4.2 Locate UV Disinfection Facility at the Oakdale Portal

This alternative would install a UV system similar to one that would be installed at the Tesla Portal site at Oakdale Portal, where the San Joaquin Pipelines begin, in Tuolumne County. It would require new medium voltage power supply to power the facility. While this alternative would achieve the project objectives, it would create greater construction-related and long-term environmental impacts than the proposed project. New power lines would have to be erected along several miles of land currently used for cattle grazing. Extensive road improvements, much greater than those that would be undertaken with the proposed project, would be required to allow truck access to the facility. Lastly, there is no onsite staff at this facility, and a greater number of personnel would have to be hired than would be the case under the proposed project.

9.4.3 Use Ozone Disinfection in Place of UV Disinfection

Under this alternative, instead of UV disinfection, ozone would be used to sanitize drinking water at the Tesla Portal site by injecting the water with ozone. This would involve construction of an approximately 3,750-square-foot liquid oxygen storage building, an approximately 4,900-square-foot building for ozone generation, and an extensive serpentine piping system. This alternative would achieve the objectives of the project, but it would have greater environmental impacts. Energy consumption under this alternative

would be roughly four times the amount used by the UV facility (SFPUC, 2006). Increased hazards associated with liquid oxygen consist of over-pressurization due to expansion of small amounts of liquid into large volumes of gas in inadequately vented equipment; oxygen enrichment of the surrounding atmosphere; and the possibility of a combustion reaction if the oxygen is permitted to contact a non-compatible material.[2] Although this alternative would have a smaller building footprint at the Tesla Portal site than the project, its construction would result in a greater total ground disturbance at the Tesla Portal site due to the extensive piping system that would be required. In addition, this alternative would require more truck deliveries than the proposed project.

9.4.4 Use Ozone Preoxidation in Addition to UV Disinfection

This alternative would use ozone to oxidize water prior to the water undergoing UV disinfection. This would involve construction of an approximately 3,750-square-foot liquid oxygen storage building, an approximately 5,500-square-foot building for ozone generation, and degassing facilities. The UV system would remain the same as that of the proposed project. This alternative would achieve the objectives of the project. However, it would create greater construction-related impacts than the proposed project, as additional facilities would be constructed besides the ones already proposed under the project. This alternative would have increased hazards impacts due to the use of liquid oxygen, as described above. In addition, this alternative would require more truck deliveries than the proposed project.

9.4.5 New UV Building and Percolation Pond at Thomas Shaft

This alternative would install a UV system in a new approximately 300 square foot building within an existing fenced area near the Thomas Shaft and a concrete percolation pond. This alternative was originally the proposed project but was redesigned to minimize potential environmental impacts by eliminating new building construction for the UV system, and minimizing the construction footprint of the percolation pond by using a percolation tank instead. This alternative was rejected because it would disturb a larger area of the site, compared to the proposed project, and result in greater environmental impacts. Since this alternative was originally the proposed project, it accordingly would meet the project objectives.

9.4.6 UV Disinfection System Plus Booster Chlorine at Thomas Shaft

This alternative would install a UV system in a new approximately 300 square foot building within an existing fenced area near the Thomas Shaft and a new booster chlorination system and an offline monitoring system. The booster chlorination provides virus inactivation through free chlorine contact time (CT) from transmission lines during an emergency event when chlorination that occurs at the Tesla Portal site goes offline due to a system failure. It should be noted that the option of booster chlorination would not be needed if LLNL switches to an alternate water supply source when the supply of properly treated water is interrupted due to a chlorination system failure at the Tesla Portal site. This alternative would meet project objectives, but it was rejected because it would disturb a larger area of the Thomas Shaft site and result in greater environmental impacts.

[2] Harvard School of Engineering and Applied Sciences, Physics Department and Department of Earth and Planetary Sciences Safety Committee website, accessed May 23, 2008.

9.4.7 CT Tanks System at Thomas Shaft

Under this alternative, all project components proposed at the Tesla Portal site would be constructed and additional *Giardia* inactivation would occur at Thomas Shaft in two CT tanks. At the Thomas Shaft site, this alternative would construct a CT tanks system consisting of two identical tanks, a booster pump station, and tank inlet and outlet chlorine monitoring stations. With two tanks, an effective contact volume is provided assuming that each tank maintains an operating level at least half-full. The booster pump station would consist of two pumps that deliver water from either CT tank through the transmission line and to the LLNL Site 300. A booster chlorine system would be constructed to feed additional chlorine as needed. This alternative would meet project objectives, but it was rejected because it would disturb a larger area of the Thomas Shaft site and result in greater environmental impacts.

9.4.8 CT Tanks System plus Booster Chlorine at Thomas Shaft

This alternative is similar to the CT Tanks System alternative with the exception that a new booster chlorination system would also be constructed at Thomas Shaft to provide *Giardia* inactivation via the CT tanks during an emergency event when chlorination that occurs at the Tesla Portal site goes offline due to a system failure. The option of booster chlorination would not be needed if LLNL switches to an alternate water supply source when the supply of properly treated water is interrupted due to a chlorination system failure at the Tesla Portal site. This alternative would meet project objectives, but it was rejected because it would disturb a larger area of the Thomas Shaft site and result in greater environmental impacts.

9.4.9 LLNL Transmission Line Chlorination

Under this alternative, drinking water disinfection would occur at the Tesla Portal site as proposed by the project. Accordingly, all project components proposed at the Tesla Portal site would be constructed. At the Thomas Shaft site, *Giardia* and other viruses would be inactivated through free chlorine disinfection in the Coast Range Tunnel (from Tesla Portal to Thomas Shaft) and the 10-inch transmission line (from Thomas Shaft to LLNL Site 300). This alternative would construct an onsite chlorine monitoring station at Thomas Shaft and an offsite chlorine monitoring station. This alternative would meet project objectives, but it was rejected because it would disturb a larger area of the Thomas Shaft site, require the construction of offsite facilities, and result in greater environmental impacts.

9.4.10 LLNL Transmission Line Chlorination with Booster Chlorine

This alternative is similar to the LLNL Transmission Line Chlorination alternative with the exception that a new booster chlorination system would also be constructed at Thomas Shaft to provide *Giardia* inactivation during an emergency event when chlorination that occurs at the Tesla Portal site goes offline due to a system failure. The option of booster chlorination would not be needed if LLNL switches to an alternate water supply source when the supply of properly treated water is interrupted due to a chlorination system failure at the Tesla Portal site. This alternative would meet project objectives, but it was rejected because it would disturb a larger area of the Thomas Shaft site, require the construction of offsite facilities, and result in greater environmental impacts.

9.4.11 All Facilities Built at Thomas Shaft Site

This alternative would install all the facilities proposed at the Tesla Portal site at the Thomas Shaft site. This alternative was rejected because the new facilities would need to be connected to the Coast Range Tunnel which is very deep at the Thomas Shaft site (approximately 300 feet) and, therefore, water would have to be pumped to the surface for treatment requiring installation of a pump station, resulting in greater potential environmental impacts, associated with air quality; cultural resources; hydrology and water quality; geology, soils, and seismicity, noise and vibration; and, energy resources.

This alternative would not meet project objectives because the Hetch Hetchy water system would no longer have a backup chlorination facility to treat water, as is currently required, if all the facilities proposed were to be built at Thomas Shaft site. This would eliminate SFPUC's flexibility in making adjustments to disinfection requirement in time prior to distribution to the regional customers. This alternative would also affect current water distribution to LLNL Site 200 from the Mocho Shaft, making that water non-potable and, therefore, the SFPUC would not be able to meet contractual requirements for both Site 200 and Site 300.

9.5 Environmentally Superior Alternative

The CEQA Guidelines require the identification of an environmentally superior alternative to the proposed project (Section 15126.6[e]) if it is determined that the No Project Alternative would otherwise be the environmentally superior alternative. If so, then the EIR must also identify an environmentally superior alternative among the other project alternatives (Section 15126.6[e]).

Alternative 1, the No Project Alternative (Status Quo), would reduce all of the potentially significant, but mitigable impacts of the proposed project to a level of no impact. While this alternative would not result in any construction-related impacts, failure to take action would result in the continued seismic vulnerability of existing facilities at the Tesla Portal site. Moreover, earthquake damage could cause the release of Sodium Hypochlorite 12.5%, is a hazardous material. As described under the impact analysis for the Status Quo Alternative, such vulnerability makes the system susceptible to the damaging effects of earthquakes. Thus, it is reasonably foreseeable that the Status Quo Alternative would eventually lead to future environmental impacts associated with earthquake damage to the existing Tesla Portal Hypochlorite Station. Such earthquake damage could constitute a threat to human health and safety (e.g., disruption of water supply, and release of hazardous materials [Sodium Hypochlorite 12.5%]). Furthermore, the Status Quo Alternative would result in the failure of the SFPUC to comply with federal regulations regarding the reduction of *Cryptosporidium* and *Giardia* in drinking water, and also would prohibit the SFPUC from fulfilling a contractual agreement with Lawrence Livermore National Laboratory (LLNL) to supply LLNL Site 300 with drinking water.

Based on the comparison of alternatives in this section, Alternative 4 (Retrofit of Existing Tesla Portal Hypochlorite Station Building) would be the environmentally superior alternative because, in comparison to the other alternatives, it would have the potential to reduce the greatest amount of project impacts (visual quality, hydrology and water quality, biological resources, cultural resources, air quality, and agricultural resources), resulting in the fewest or least significant environmental effects. However, this alternative would not be able to accommodate the pH adjustment equipment and, therefore, that project objective would not be met, and a building for this equipment may be needed in the future. Furthermore,

it should be noted that a previous structural and engineering evaluation of the current building and systems (San Francisco Water Team, 2001) concluded that upgrades to the current building and systems "cannot increase the reliability and performance comparable to a new facility." Thus, this alternative would not have the reliability and performance capability of a new facility.

9.6 References

Harvard School of Engineering and Applied Sciences, Physics Department and Department of Earth and Planetary Sciences Safety Committee website, accessed May 23, 2008.

San Francisco Public Utilities Commissions (SFPUC), Technical Memorandum 3 Advanced Disinfection Workplan Agreement Number CS-751 Task 3 Hetch Hetchy Aqueduct Systems Preliminary Evaluation, May 2006.

SFPUC, Technical Memorandum 6 Advanced Disinfection Workplan Agreement Number CS-751 Task 6 Hetch Hetchy Aqueduct System Recommendations, August 2006e.

SFPUC, Final Alternative Analysis Report for Lawrence Livermore Supply Improvements Project CUW 36401, May 2007.

The San Francisco Water Team, Hetch Hetchy Water Treatment Project Tesla Portal Chlorination System Evaluation, September 2001.

U.S. Environmental Protection Agency (U.S. EPA Office of Water, Interim Enhanced Surface Water Treatment Rule, EPA 816-F-01-013, June 2001.

U.S. EPA Office of Water, LT2ESWTR Source Water Monitoring for Systems Serving At Least 10,000 People Factsheet, June 2006.

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Acronyms and Abbreviations

CCSF	City and County of San Francisco
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CVP	Central Valley Project
CWA	Clean Water Act
EIR	Environmental Impact Report
ESA	Federal Endangered Species Act
FERC	Federal Energy Regulatory Commission
GAMAQI	Guide to Assessing and Mitigating Air Quality Impacts
GWP	Great Western Power Company
hp	horsepower
ITMMs	Incidental Take Minimization Measures
JPA	Joint Powers Authority
kWh	Kilowatt-hours
LLNL	Lawrence Livermore National Laboratory
MBTA	Migratory Bird Treaty Act
MEA	Major Environmental Analysis Division, San Francisco Planning Department
mgd	million gallons per day
MID	Modesto Irrigation District
MMRP	Mitigation Monitoring and Reporting Program
NMFS	National Marine Fisheries Service
PEIR	Program Environmental Impact Report
PG&E	Pacific Gas and Electric Company
SFPUC	San Francisco Public Utilities Commission
SJCOG	San Joaquin Council of Governments
SJMSCP	San Joaquin Multi-Species Habitat Conservation Plan
SJRWQIP	San Joaquin Regional Water Quality Improvement Project
SJVAPCD	San Joaquin Valley Air Pollution Control District
SWP	State Water Project
TAC	Technical Advisory Committee
TID	Turlock Irrigation District
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
UV	Ultraviolet
VAMP	Vernalis Adaptive Management Program
WSIP	Water System Improvement Program

CHAPTER 1
Introduction

This Comments and Responses document has been prepared to respond to comments received on the Draft Environmental Impact Report (Draft EIR) for the San Francisco Public Utilities Commission's (SFPUC) San Joaquin Regional Water Quality Improvement Project (SJRWQIP) (State Clearinghouse No. 2007052109), which was published by the San Francisco Planning Department on August 25, 2008. The 45-day public review period for the document occurred between August 25 and October 8, 2008. The Draft EIR together with this Comments and Responses document constitute the Final EIR for the SJRWQIP.

The Draft EIR described the proposed SJRWQIP, identified the environmental impacts associated with the project, specified mitigation measures to reduce significant and potentially significant impacts, and analyzed and compared the environmental effects of four alternatives to the proposed project as required by the California Environmental Quality Act (CEQA).

This Comments and Responses document responds to the written and oral comments on the Draft EIR and revises the Draft EIR as necessary to provide additional clarity. This document has been distributed to the San Francisco Planning Commission, SFPUC, State Clearinghouse, agencies and persons who commented on the Draft EIR. The San Francisco Planning Commission will consider this document, along with the Draft EIR and any revisions to the Draft EIR based on the responses to comments, for certification as the Final EIR for the SJRWQIP. In the event of an appeal of the certification, the San Francisco Board of Supervisors will hear and decide on the appeal.

If the Planning Commission certifies the EIR, the SFPUC will consider the environmental evaluation in the Final EIR, and the associated Mitigation Monitoring and Reporting Program (MMRP), prior to its decision on the proposed project. The SFPUC will adopt CEQA findings and the MMRP at the project decision hearing.

This Comments and Responses document for the SJRWQIP includes:

- A list of all persons, organizations, and public agencies who submitted written comments on the Draft EIR and who testified at the public hearings on the Draft EIR held in San Joaquin County (City of Tracy) on September 16, 2008 and in San Francisco on September 18, 2008;

- Chapter 2 contains copies of the written comments received on the Draft EIR, along with a response to each comment, and copies of the transcripts from the public hearings on the Draft EIR, along with responses to oral comments made at the hearings; and

- Staff-initiated text changes to the Draft EIR are included in Chapter 3.

1.1 Comments on the Draft EIR and Responses to Comments

To facilitate the preparation of responses, each comment document (i.e., letter, email, or public hearing transcript) received on the Draft EIR was coded to identify the commenter and then divided into individual comments, which were numbered. Each comment document (i.e., letter or transcript) consists of a prefix indicating the commenter category (shown in Table 1-1) followed by the acronym of the agency/organization or the first five letters of the person's last name. For example, the comment letter received from the California Department of Fish and Game (a state agency) is coded S-CDFG. Within each comment document, the individual topics or issues raised are bracketed and numbered sequentially. Therefore in this example, the first comment in the letter received from the California Department of Fish and Game is coded S-CDFG-01 and is shown in the right margin of the letter.

TABLE 1-1
COMMENTER CATEGORIES

Category of Commenter	Coding Abbreviation
Federal Agency	F
State Agency	S
Local and Regional Agency	L
Citizen	C
Group	G

The Draft EIR was circulated for a 45-day public review period from August 25 to October 8, 2008. Agencies, organizations, and individuals who submitted written comments on the Draft EIR during the public review period are listed in Table 1-2. Individuals who spoke at the public hearing in Tracy on September 16 are also included in Table 1-2. Please note that no public comments were received at the Public Hearing held in San Francisco on September 18. The transcripts of both public hearings are provided in Chapter 2 for reference.

In cases where the response to the comment results in a change in the Draft EIR, the revised text, figures or tables are shown in the response to that comment. Additions are indicted by a double underline; deletions are indicated by "strike-out." For example: Edits to this text are ~~inserted~~ provided for clarity.

1.2 Staff-Initiated Text Changes to the Draft EIR

Additional edits to the Draft EIR are provided at the initiation of staff to clarify content, add additional information received after the release of the Draft EIR, or to correct content in the Draft EIR. These text changes are provided in Chapter 3 and indicate the page and paragraph to be revised and show the proposed change using double underline and strike-out, as described above. A description of the text changes is provided if necessary.

In addition, text changes that were made in response to a comment (and discussed in Chapter 2) are also reiterated in Chapter 3.

TABLE 1-2
PUBLIC AGENCIES, ORGANIZATIONS, AND MEMBERS OF THE PUBLIC – WRITTEN DRAFT EIR COMMENTS

Comment Format	Comment ID	Name, Title and Affiliation	Date of Comment Letter
Fax	S-Caltrans	Tom Dumas, Chief, Office of Metropolitan Planning, California Department of Transportation	8/28/2008
Mail	S-CDFG	Charles Armor, Regional Manager, California Department of Fish and Game	10/1/2008
Mail	S-OPR	Terry Roberts, Director, State Clearinghouse	10/10/2008
Mail	L-SFDPH	June Weintraub, Senior Epidemiologist, City and County of San Francisco, Department of Public Health, Environmental Health Section	9/17/2008
Mail	L-SFLPAB	M. Bridget Maley, President, City and County of San Francisco, Landmarks Preservation Advisory Board	10/3/2008
Mail	L-BAWSCA	Nicole Sandkulla, Senior Water Resources Engineer, Bay Area Water Supply & Conservation Agency	10/3/2008
Fax	L-SJVAPCD	Dave Warner, Director of Permit Services, San Joaquin Valley Air Pollution Control District	10/6/2008
Email	C-Lawre	Steve Lawrence	8/24/2008
Fax	G-OPCMIA	Lucille Palmer-Byrd, Business Agent, Operative Plasterers and Cement Masons International Association	9/15/2008
PH Tracy	G-SJBTC	Dave Thomas, San Joaquin Building Trades Association	9/16/2008
PH Tracy	G-CVCU	Augie Beltran, Central Valley Carpenters Union	9/16/2008

CHAPTER 2
Comments and Responses

This chapter includes a copy of each comment letter received on the Draft EIR followed by the corresponding response(s). The responses correspond to the numbers that appear in the margins of the comment letters and public hearing transcripts. As required by the California Environmental Quality Act (CEQA) Section 15132, the responses in this chapter are directed towards potentially significant environmental points raised by commenters during the review period.

The responses are intended to provide clarification and refinement of information presented in the Draft EIR, and in some cases, to correct or update information in the Draft EIR. Where the responses indicate additions or deletions to the text of the Draft EIR, additions are indicated in double underline and deletions are in ~~strike-out~~.

STATE OF CALIFORNIA—BUSINESS, TRANSPORTATION AND HOUSING AGENCY ARNOLD SCHWARZENEGGER, Governor

DEPARTMENT OF TRANSPORTATION
P.O. BOX 2048 STOCKTON, CA 95201
(1976 E. CHARTER WAY/1976 E. DR. MARTIN
LUTHER KING JR. BLVD. 95205)
TTY: California Relay Service (800) 735-2929
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Flex your power!
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August 28, 2008

10-SJ-Various
SCH#2007052109
San Joaquin Regional
Water Quality

Jamie Dean
San Francisco Planning Department
1650 Mission Street, Fourth Floor
San Francisco CA 94130

Dear Ms. Dean:

The California Department of Transportation (Department) appreciates the opportunity to have reviewed the Draft Environmental Impact Report (DEIR) for the proposed construction of the San Joaquin Regional Water Quality Improvement Project. This proposed project is to be located in the unincorporated San Joaquin County at two existing facility sites, the Tesla Portal site and the Thomas Shaft site along the SFPUC's regional water system. [01]

The Department has no comments at this time.

If you have any questions or would like to discuss our comments in more detail, please contact Kathy Selsor at (209) 948-7190 (e-mail: kathy_selsor@dot.ca.gov) or me at (209) 941-1921.

Sincerely,

Kathy Selsor for

TOM DUMAS, CHIEF
OFFICE OF METROPOLITIAN PLANNING

c: SMorgan CA Office of Planning and Research

10.1 Response to Comments from the California Department of Transportation (S-Caltrans)

[S-Caltrans-01]

Caltrans had no comments on the Draft EIR.

State of California – The Resources Agency
DEPARTMENT OF FISH AND GAME
http://www.dfg.ca.gov

POST OFFICE BOX 47
YOUNTVILLE, CALIFORNIA 94599
(707) 944-5500

ARNOLD SCHWARZENEGGER, Governor

RECEIVED

OCT 06 2008

CITY & COUNTY OF S.F.
PLANNING DEPARTMENT
M E A

October 1, 2008

Ms. Jamie Dean
City and County of San Francisco
Planning Department
1650 Mission Street, Fourth Floor
San Francisco, CA 94103

Dear Ms. Dean:

Subject: Comments on Draft Environmental Impact Report for San Joaquin Regional Water Quality Improvement Project, SCH #2007052109, San Joaquin County

Department of Fish and Game (DFG) staff has reviewed the draft Environmental Impact Report (EIR) for the San Joaquin Regional Water Quality Improvement Project (Project). The San Francisco Public Utilities Commission (SFPUC) proposes to construct the above referenced Project. The proposed Project is located in unincorporated San Joaquin County at two existing facility sites, the Tesla Portal site and the Thomas Shaft site, along the SFPUC's regional water system. The Tesla Portal site includes Assessor's Parcel No. 253-160-02, Township 3S and Range 5E. The Thomas Shaft site includes Assessor's Parcel No. 251-330-10, Township 4S and Range 4E. At the Tesla Portal site, the existing building that contains the Tesla Portal Hypochlorite Station would be replaced with a new Chemical Process Building and Office/Control Building. An ultraviolet (UV) facility would be constructed, which would disinfect water using a series of UV light arrays. At the Thomas Shaft site, the Lawrence Livermore Water Quality Improvements would upgrade existing water treatment with a UV facility to meet disinfection requirements of the Surface Water Treatment Rule and the Long Term 2 Enhanced Surface Water Treatment Rule.

DFG, a Trustee Agency under the California Environmental Quality Act (CEQA), is responsible for the conservation, protection, and management of the State's biological resources. Pursuant to Fish and Game Code Section 1801, it is the policy of the State to encourage preservation, conservation, and maintenance of wildlife resources, including perpetuation of all species of wildlife for their intrinsic and ecological values. In addition, pursuant to Fish and Game Code Section 1802, DFG has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and habitat necessary for biologically sustainable populations of those species. The purpose of DFG's comments is to provide guidance to the SFPUC to ensure that, if the Project under the Water System Improvement Program (WSIP) is implemented, biological resources are protected. Like the draft EIR, DFG has organized comments beginning with the WSIP and proceeding with comments by each respective section.

Project Description

The proposed Project would consist of the following components:

Tesla Treatment Facility (Tesla Portal Site)

- A 14,000-square-foot Chemical Process Building, 32 feet in height containing three 16,000-gallon sodium hypochlorite tanks, two 10,000-gallon fluoride tanks and two outdoor 12,500-gallon carbon dioxide (CO_2) tanks.

- A 3,500-square-foot Office/Control Building, 12 feet in height containing offices, control room, process room, laboratory, restrooms, lockers, shower, and a multipurpose room.

- A 20,000-square-foot UV Building, 32 feet in height containing 12 UV reactors (10 active and two standby) each with UV lamp arrays and various sensors on a floor recessed approximately 14 feet below-grade, below-grade piping vaults and two 3,000-gallon food-grade acid tanks.

- Other proposed improvements at the Tesla Portal site include a 90,000-gallon containment basin lined with rip rap to capture released water for grit removal and periodic maintenance (three times per month), two valve vaults to direct adequate flow, as required, two valve houses, and other infrastructure including a microwave tower up to 100 feet in height.

Lawrence Livermore Water Quality Improvements (Thomas Shaft Site)

- Two UV reactors (one active and one standby) installed within the existing Chlorination Facility building.

- A 360-square-foot prefabricated structure 10 feet in height within the fenced area atop Thomas Shaft.

- A 2,500-gallon percolation water tank for processed water.

The proposed project would improve already existing uses (i.e., water treatment) at the two sites. The Lawrence Livermore Water Quality Improvements are being designed for a 0.165 million gallons per day (mgd) capacity. The proposed project would allow Lawrence Livermore National Laboratory (LLNL) to take up to 0.165 mgd of their annual average demand of 0.8 mgd from Thomas Shaft, and continue to receive the remainder of the water from Mocho Shaft, an SFPUC facility located downstream of the Thomas Shaft site. The amount of water supplied to LLNL would be consistent with the preexisting contract between the two parties.

Project Objectives

The objectives of the proposed Project consist of the following:

Tesla Treatment Facility (Tesla Portal Site)

- Replace existing water treatment facilities that are not currently seismically safe with new facilities that are designed to meet current seismic, safety/fire, and building code standards.

- Construct new water treatment facilities to meet U. S. Environmental Protection Agency (U. S. EPA) requirements for *Cryptosporidium* reduction/inactivation in drinking water, as required under the U. S. EPA's Long Term-2 Enhanced Surface Water Treatment Rule (LT2ESWTR).

- Improve current water quality management capabilities such as pH control.

Lawrence Livermore Water Quality Improvements (Thomas Shaft Site)

- Construct new water treatment facilities to meet U.S. EPA requirements under the Surface Water Treatment Rule for the reduction/inactivation of *Giardia*, as well as assist in meeting LT2ESWTR *Cryptosporidium* requirements to enable delivery of potable water to LLNL from the Thomas Shaft of the Coast Range Tunnel.

- Continue to provide back-up chlorination capabilities.

Comments on Executive Summary

WSIP Water Supply Option, Pg. 1-6: Through the WSIP, the SFPUC proposes a water supply option to address the water supply level of service objective of meeting a projected 35 mgd increase in customer purchase requests by 2030, and to provide drought-year delivery with a maximum systemwide rationing of 20 percent. This strategy includes maximizing the use of local watershed supplies, increasing diversions from the Tuolumne River under existing water rights, and development of new local resources, including additional conservation, water recycling, and groundwater supply programs in San Francisco. This combination of water supply sources is expected to fully meet customer purchase requests during non-drought years through 2030. [01]

On October 7, 2007, DFG provided comments to the draft Program Environmental Impact Report (PEIR) for the WSIP proposed by the SFPUC which included comments to the proposed water supply option. DFG reiterates the following comments as well as others in the PEIR as previously stated and provides new comments with respect to current information.

Lower Tuolumne River (Below New Don Pedro)

The PEIR states that the implementation of WSIP would have no impact on the current minimum instream flow requirement set by the Federal Energy Regulatory Commission (FERC) in the 1996 Fishery Settlement Agreement. DFG is concerned that the current FERC required flow regime (i.e., PEIR's CEQA baseline conditions) may not be sufficient to prevent salmon populations in the Tuolumne River from declining. In fact, we have evidence demonstrating that adult Tuolumne River fall-run Chinook salmon *(Oncorhynchus tshawytscha)* produced at a given spring flow has declined by about 50% (mean of 6,805 [02]

recruits) since the FERC Settlement Agreement was implemented in 1996. The decline is statistically significant based on an F-test comparison of two flow recruitment regression models: one based on the period from 1980 to 1990 and the other based on the period from 1998 to 2003. We believe that, as proposed, WSIP would make these conditions worse for Tuolumne River salmonids, thus exacerbating the current decline of this population. To address this concern, DFG wrote a letter dated August 1, 2007 to Secretary Kathleen Bose of the FERC and requested them to direct the Modesto Irrigation District and Turlock Irrigation District to provide higher magnitude and greater duration instream flows during the spring period of each year in order to assure acceptable salmon smolt survival and assure that the now critically-impaired salmon populations will remain intact until a new license is considered for Project 2299 in 2014. In this letter, DFG presents evidence, which is summarized below, that demonstrates strong correlations between this observed population decline and the conditions of reduced spring flow and elevated spring water temperature, as directly caused by the operations of Project 2299.

The CEQA environmental baseline conditions in the Lower Tuolumne River are essentially driven by the operations of Project 2299 which, for reasons we identify below, are creating conditions that are not suitable for the anadromous fisheries in the Tuolumne River. Although we recognize that the City and County of San Francisco are not the licensees for Project 2299, it is irrefutable that the actions of the SFPUC on the Tuolumne River at Early Intake, Cherry Valley Dam, and Hetch Hetchy and Lake Eleanor reservoirs influence the timing, duration, and magnitude of water releases from the New Don Pedro Dam. Increased diversion of waters from a river system which currently lacks sufficient flow to support sustainable anadromous fisheries including Federally Threatened Central Valley steelhead (*Oncorhynchus mykiss iridieus*) should be considered a significant cumulative impact (see Zimmerman et al. 2008). Although the proposed increase in diversion in itself may (arguably) not be deemed significant, when viewed in conjunction with Project 2299, existing SFPUC diversions, and other diversions from the Tuolumne River, the effects are cumulatively considerable [see CCR Title 14, Section 15065(a)(3)]. In this context, *we believe the proposed project has the potential to cause anadromous fish populations to drop below self-sustaining levels and further reduce the number and restrict range of Federally Threatened Central Valley steelhead* – thereby requiring a finding of significant effect [CCR Title 14, Section 15065 (a)(1)]. Therefore, we respectfully request the SFPUC use alternative water sources other than the Tuolumne River system to meet purchase requests in 2030 and drought year demands, at least until Project 2299 can properly address the inadequacies in the current flow regime for the purpose of creating, enhancing and supporting a sustainable anadromous fishery in the Lower Tuolumne River. [02] cont.

Documented Tuolumne River Salmon Population Decline

Strong evidence exists that the Tuolumne River fall-run Chinook salmon population has declined severely. Historically, this fall run was documented (U. S. Fish and Wildlife Service 1940) to annually exceed 72,000 escaping (i.e., spawning) adults. This number became reduced severely, coincidentally with, and in part caused by, water diversions and dams which were developed and operated on the Tuolumne River. Immediately prior to the operation of the New Don Pedro Project, fall-run Chinook salmon numbers annually reached 20,000 to 25,000 escaping adults, but unfortunately the instream flow and other

fishery protection measures included in the original Project 2299 license were inadequate to stem the continuing decline of salmon. By the time of the 1996 Fisheries Settlement Agreement, salmon numbers had progressively declined to less than 1,000 adults annually. This decline, both overall and when dissected into various lifestage survival components, very strongly correlates with Tuolumne River flow inadequacy during critical salmon life-stages.

In 1997, a record high water year produced substantial project spill, essentially rendering moot the fishery effects of Project 2299 water operations, as well as the effects of some of the out-of-tributary influences on juvenile salmon survival during that year. Absent those controlling influences, the salmon experienced much greater juvenile survival and downstream migration success. Accordingly, in 2000, when most of these fish returned to the Tuolumne River as adults, we documented runs well in excess of 18,000 individuals. Unfortunately, that benefit was short-lived. Since 2000, and after normal Project 2299 operations resumed, the Tuolumne River salmon escapements have again sharply declined. As of 2006, the Tuolumne River escapement population had dwindled to about 600 returning adults. This represents an order-of-magnitude salmon population reduction during the time when the Fishery Settlement Agreement flows and other "protective conditions" under that agreement were in full effect.

Subsequently, since comments were made to the PEIR in October 2007, in a report titled "Lower Tuolumne River Spawning Report, Spawning Survey Summary Update, March 2008" (Ford & Kirihara 2008), run size estimate for Tuolumne River Chinook for 2007 was 211 fish. The current run size of 211 fish with the declines experienced over recent years clearly show the Tuolumne River Chinook to be at *high risk of extinction*, (Lindley 2007). Additionally, USFWS issued a preliminary analysis which indicates that the Tuolumne River fall-run Chinook salmon population of naturally produced fish "is at a high risk of extinction because the instream flow releases are too low" (Mesick 2008). The report finds that "the Tuolumne River fall-run Chinook salmon population is at a high risk of extinction because the population of naturally produced fish was probably less than 83 for three consecutive years (2005 to 2007), there was precipitous decline, and the fall 2007 escapement was a catastrophe considering the spring 2005 wet year conditions." It identifies the Project's control of instream flow to be a significant limiting factor affecting natural salmon production: "The number of naturally produced adult salmon that return to the Tuolumne River is primarily a response of the juvenile salmon to the flows released at La Grange Dam during the winter and spring…" [02] cont.

In a request for rehearing letter written by DFG on May 5, 2008 to FERC, DFG wrote that neither ocean harvest, ocean conditions, nor Delta exports, even though they are in fact minor sources of mortality, are strong controlling factors in the abundance, health and vitality of the Tuolumne River adult salmon population. Annual adult salmon escapement abundance in the Tuolumne River began its sharp decline well before the poor ocean condition phenomena experienced in summer of 2007 (Figure 9, Page 16, Marston 2008). Additionally, a new analysis of the relationship between Delta smolt survival and Delta exports, and San Joaquin River inflow [i.e. Tuolumne River contributions along with other tributary flows (Newman 2008)] suggest that the Tuolumne River adult salmon population is

primarily affected and controlled by in-tributary limiting factors, rather than oceanic or other downstream controlling features.

As further described in the DFG letter written on May 5, 2008 to FERC, the primary factors controlling the salmon population to the Tuolumne River are occurring within the reach of the River which is directly operated in association with Project 2299. Districts have asserted that other downstream factors within the San Joaquin River and Delta are principally responsible for the observed salmon population declines. However, since Tuolumne River flow contributions from the Project requirements are important in determining the fate of salmon and other species (e.g., Delta smelt, longfin smelt, steelhead), in the Delta this, too, is a direct effect of Project operations. We have observed a very dramatic decline in Tuolumne River salmon adult escapement between 2000 and 2007, while the Fishery Settlement Agreement flow regimes and other protective features have been in place. The strong relationship between this observed population decline and the conditions of reduced spring flow and elevated spring water temperature indicated needed changes in the operations of Project 2299. Our analysis, only a part of which is provided above, shows fairly comprehensively that out-of-tributary limiting factors are indeed in play, yet are not the most important determinants of Tuolumne River salmon production, by at least an order-of-magnitude. [02] cont.

Alternatives to the WSIP

Accordingly, the WSIP draft PEIR identified the Modified WSIP Alternative as the environmentally superior alternative. This alternative implements all of the proposed WSIP projects, but would modify proposed system operations to minimize environmental effects. Modified proposed system operations to be considered as environmentally minimal must not include increased diversions from the Tuolumne River. Since there is strong evidence the Tuolumne River as managed, for the reasons discussed above and others, lacks sufficient water flows to keep in good condition anadromous salmonids, DFG does not agree with increased diversions from the Tuolumne River. Diversions of even 3-mgd of water from the Tuolumne River would be cumulatively considerable [see CCR Title 14, Section 15065(a)(3)] and put Chinook salmon at *high risk of extinction* in that watershed. Consequently, we continue to respectfully request SFPUC to use alternative water sources other than the Tuolumne River system to meet purchase requests in 2030 and drought year demands, at least until Project 2299 can properly address the inadequacies in the current flow regime for the purpose of creating, enhancing and supporting a sustainable anadromous fishery in the lower Tuolumne River. [03]

DFG encourages SFPUC continue aggressive conservation and water recycling. Furthermore, year-round desalination at Oceanside to provide 25-mgd customer purchase requests through 2030 could be a good alternative for protecting salmonids of the Tuolumne River. With the implementation of alternative energy sources and proper brine disposal, such as dilute diffusion, the desalination alternative has the potential to be an environmentally superior alternative.

Comments on Biological Resources

California Annual Grassland, Pg. 4.6-1: California annual grassland is the predominant natural community at the Project sites. At the Tesla Portal site, there are approximately 42 acres of California annual grassland, and about 25.6 acres of annual grassland at the Thomas Shaft site. The proposed Project would result in the permanent loss of approximately 3.2 acres of California annual grassland at the Tesla Portal site. Permanent loss of California annual grasslands would contribute incrementally to the statewide loss of this type of habitat. As such, the impact of permanent loss of California annual grasslands from the proposed Project combined with the permanent loss of California annual grasslands of other projects identified in Table 4.15-a would be potentially significant (pgs. 4.15-13 and 4.15-14). Therefore, loss of California annual grassland at the Tesla site would contribute to a "cumulatively considerable" impact and substantially degrade the quality of the environment as stated in Section 15065 of the CEQA guidelines. Mitigation Measure 4.6-1a indicates participation in the San Joaquin Multi-Species Habitat Conservation and Open Space Plan (SJMSCP) which includes compensation for the permanent loss of 0.308-acre of habitat values of artificial wetland, the temporary loss of <0.001-acre of ephemeral drainage, the temporary loss and permanent conversion of natural lands and incidental take authorization for special-status species. Participation in the SJMSCP should include, but not be limited to, 3.2 acres of permanent conversion of California annual grassland. [04]

Special-Status Plant Species, Pg. 4.6-6: One special-status plant species, Mt. Diablo cottonweed, was observed along the access road leading to the Thomas Shaft site, but is not located within the Project footprint or construction staging area (Weiss Associates, 2003). During construction, the access road to the Thomas Shaft site should not be modified in any way which could impact Mt. Diablo cottonweed. [05]

According to the May and Associates technical report on page 55 in the table titled "Plants Observed," both the Thomas Shaft and Tesla sites have known occurrences of *Amsinckia* spp. It is important a distinction is made which *Amsinckia* spp. is present since *Amsinckia grandiflora* is Federally- and State-listed as endangered, and has CNPS status 1B. *Amsinckia lunaris* also has CNPS status 1B. Until this distinction has been made, construction activities should be restricted. [06]

Impacts on sensitive habitats, common habitats, and heritage trees (Tesla Portal: PSM; Thomas Shaft: LS, pg. 4.6-23): Temporary impacts resulting from construction staging and other construction-related activities at the Tesla Portal Project site would result in impacts to 11.716 acres of California annual grasslands, <0.001-acre of ephemeral drainage, and 0.846 acre of ruderal/disturbed habitat. Temporary impacts to California annual grasslands and aquatic habitat would contribute to the degradation of natural habitat in the region and could result in the potential permanent loss of habitat. Mitigation Measures 4.6-1a, 4.6-1b and 4.6-2 (participation in the SJMSCP, implement Best Management Practices and returning the site to pre-project conditions) would reduce potential temporary construction impacts to less than significant. [07]

Since prior to the commencement of construction activities, the SFPUC will coordinate with the Joint Powers Authority/Technical Advisory Committee and pay necessary fees to fund offsite compensation under the terms of the SJMSCP, any temporary impacts that could result in the potential permanent loss of habitat should be considered as a permanent impacts. [07] cont.

Comments on Special Status Wildlife Species [08]

Implement Incidental Take Minimization Measures for San Joaquin Kit Fox, Pg. 5-6: A qualified biologist shall conduct preconstruction surveys 14 to 30 calendar days prior to commencement of ground disturbance. These surveys should be conducted no later than two weeks prior to commencement of ground disturbance.

Preconstruction surveys for the San Joaquin kit fox should adhere to the U. S. Fish and Wildlife Service's (USFWS) San Joaquin Kit Fox Survey Protocol for the Northern Range. Accordingly, DFG recognizes properly qualified biologists conducting San Joaquin kit fox surveys as described by the USFWS must have demonstrable experience in kit fox biology, identification and survey techniques. [09]

Furthermore, DFG as described by the USFWS Standardized Recommendations for Protection of the San Joaquin Kit Fox Prior to or During Ground Disturbance (1999), does not consider water storage or conveyance facilities that promote urban growth or agriculture small projects. Recommendations for take minimization measures for San Joaquin kit fox should follow the above referenced document under the section "other projects."

Determine Burrowing Owl Presence

Breeding Season Surveys

The California Burrowing Owl Consortium (Consortium) survey protocol specifies a multi-phase approach, which is recommended in order to adequately evaluate burrowing owl use of an area and to inform the CEQA process. Phase 1 of the protocol begins with a habitat assessment that recognizes that burrows are the essential component of burrowing owl habitat and that burrowing owls may use man-made structures as burrows (see Page 1 of Consortium guidelines). If suitable habitat [appropriate vegetation and burrow(s) or burrow surrogate(s)] is present, then a Phase 2 intensive burrow survey is necessary even if owl sign is not present during the habitat assessment phase. Owl signs include molted feathers, cast pellets, prey remains, egg shell fragments, or excrement at or near burrow entrance or perch site. During the intensive burrow survey phase, burrow concentration areas should be mapped. Phase 3 of the protocol requires four survey visits whether or not owl sign is observed during Phase 2. DFG recommends that the Consortium survey protocol for breeding season surveys be adhered to [4 survey visits spread evenly (roughly every three weeks) during the peak of the breeding season, from April 15 to July 15] until enough information is available to warrant their revision or until new detailed protocols are developed as part the Conservation Strategy. The habitat assessment, intensive burrow surveys and burrowing owl surveys should include the area within 150 meters of the Project boundaries (approximately 500 feet). [10]

Non-Breeding Season Surveys (Including Winter)

Surveys during the non-breeding season (September 1 to January 31) are recommended by DFG but are not generally required because burrowing owls are much more difficult to detect during the non-breeding season, and the number or type of surveys that would be needed to detect presence then has not been studied or quantified. Owls detected during non-breeding season surveys may be year-round residents or their young from the previous nesting season, pre-breeding territorial adults, winter residents, dispersing juveniles, migrants, or new colonizers. Negative results during any non-breeding season surveys are not conclusive proof that owls do not use the site. Because of this complication, DFG recommends breeding season surveys as the first step, but project applicants should consult with DFG if burrowing owls have been documented on the Project site during the non-breeding season.

Avoid Impacts (destruction, disturbance) to Individual Owls

Pre-Construction Surveys for Owl Presence

Pre-construction surveys (usually initiated during the non-breeding season) are necessary for assessing owl presence at a site within a short time period before site modification is scheduled to begin. Pre-construction surveys are supplemental to the existing breeding season survey protocol (four survey visits spread evenly during the peak of the breeding season, from April 15 to July 15), and should not be used in place of it without consulting with DFG in advance. The pre-construction surveys are intended to document if colonizing owls have recently moved onto the site, or if burrow locations of resident owls have changed, or if young of the year are still present and have not yet fledged or dispersed. Because any one or all of these events may have occurred on site since the breeding season (protocol) surveys were completed, it is important to also complete the pre-construction surveys in order to avoid direct take of owls or their nests and to design proper minimization and mitigation measures (e.g., document number and reproductive status of resident owls and location of satellite burrows, establish buffer zones and equipment/personnel travel routes and work/storage areas, unequivocally evict owls and ground squirrels from burrows). [10] cont.

Initial pre-construction surveys should be conducted outside of the owl breeding season (from February 1 to August 31) but as close as possible to the date that ground-disturbing activities will begin, to avoid the problem of waiting until March or April when the Project would be delayed if owls are detected. Generally, initial pre-construction surveys should be conducted no more than 30 days prior to ground-disturbing activities (i.e., disking, clearing, grubbing, grading). The time lapse between surveys and site disturbance should be as short as possible and will be determined by DFG based on specific project conditions but generally should not exceed seven days. Additional surveys are necessary when the initial disturbance is followed by periods of inactivity or the development is phased spatially and/or temporally over the Project area.

The number of pre-construction surveys necessary to accurately detect current owl presence and owl locations will be driven by a number of interacting criteria such as: 1) the time period that has elapsed since the last breeding survey was completed; 2) height and density of vegetation that may obscure owl presence; 3) topographical conditions that may

obscure owl presence; 4) time of year (e.g., in the winter owls are more cryptic and spend more time in their burrows); 5) time of day and weather conditions when surveys are conducted; 6) long-term history of owl use at the site; 7) size of the parcel and degree of coverage by walking or by intensive observations via spotting scope, and 8) tolerance of owls to human presence. Generally, at a minimum, four survey visits on at least four separate days will be necessary, especially given the cryptic nature of this species during the non-breeding season.

Biologists conducting pre-construction surveys should expend enough effort, based on the above criteria, to assure with a high degree of certainty that take of owls will not occur once site modification and grading activities begin. The full extent of pre-construction survey effort must be described and mapped in detail (e.g., dates, time periods, area(s) covered, and methods employed) in a biological report. Current vegetation and topographical conditions and their corresponding effect on visibility should also be described. The report should be submitted to DFG for review.

DFG's concurrence with the pre-construction survey results will depend on the level of detail that is provided in the Consultant's biological report that summarizes the methods, results, and level of survey effort. DFG has a responsibility to give input regarding measures that would result in avoiding take and minimizing unavoidable impacts to owls.

[10] cont.

Take Avoidance

Avoidance of take of individual burrowing owls and their nests is currently mandated under Fish and Game Code sections 86, 3503, 3503.5 and 3513.

Burrows are an essential ecological requisite for burrowing owls throughout the year. Loss of nest burrows, satellite burrows, breeding concentrations, foraging habitat, dispersal and migration habitat, wintering habitat, habitat linkages and stepping stones, including habitat supporting host burrowers, and other essential habitat attributes, can individually or collectively have significant impacts on burrowing owls. DFG will work with Project proponents and lead agencies to develop compensatory mitigation for impacts to burrowing owls.

Conduct Pre-Construction Surveys for Swainson's Hawk, Pg. 5-8: A distance of two times the dripline of the tree is arbitrary and in the event any occupied nests are found, DFG will help determine appropriate actions based on scientific recommendations for construction activities. These measures may include waiting for the birds to fledge and forage on their own prior to construction or having a biological monitor on site to determine an appropriate buffer by monitoring any changes in behavior. If any Swainson's hawks are found nesting in the area, DFG should be notified to determine appropriate actions.

[11]

Implement Incidental Take Minimization Measures for White-Tailed Kite, Pg. 5-8: The white-tailed kite is a Fully-Protected species under Fish and Game Code Section 3511. Fully-Protected species may not be taken or possessed at any time and no licenses or permits may be issued for their take except for collecting these species for necessary scientific research. Therefore, the avoidance measures must prevent the take of these

[12]

species. If the species is found nesting, a setback from nesting areas shall be established far enough away to prevent any impacts. The buffer shall be maintained during the nesting season for the period encompassing nest building and continue until fledglings leave nests. If any white-tailed kites are found nesting, DFG should be notified to determine or confirm an appropriate buffer zone. [12] cont.

Implement Incidental Take Minimization Measures for California Horned Lark and Northern Harrier, Pg. 5-9: If species are found, a setback of 500 feet from nesting areas shall be established and maintained for the period encompassing nest building and continuing until fledglings leave nests, unless other measures are agreed to by DFG, or offsite compensation shall be provided. If any bird nests are found, DFG should be notified to determine or confirm the appropriate buffer zone for the species. [13]

Conduct Pre-Construction Surveys for Golden Eagle, Pg. 5-9: Golden eagles are Fully-Protected under Fish and Game Code Section 3511. Fully-Protected species may not be taken or possessed at any time and no licenses or permits may be issued for their take except for collecting these species for necessary scientific research. Therefore, the avoidance measures must prevent the take of these species. If the species is found nesting, a setback from nesting areas shall be established far enough away to prevent any impacts. The buffer shall be maintained during the nesting season for the period encompassing nest building and continuing until fledglings leave nests. If any nests are discovered, DFG should be notified to determine appropriate actions. [14]

Conduct Pre-Construction Surveys for Ferruginous Hawk and Prairie Falcon, Pg. 5-10: If species are found, a setback of 500 feet from nesting areas shall be established and maintained for the period encompassing nest building and continuing until fledglings leave nests, unless other measures are agreed to by DFG. If any bird nests are found, DFG should be notified to determine or confirm the appropriate buffer zone for the species. [15]

We appreciate your consideration of our comments. If you have any questions, please contact Mr. Wes Stokes, Environmental Scientist, at (707) 944-5571 or wstokes@dfg.ca.gov; or Mr. Greg Martinelli, Water Conservation Supervisor, at (707) 944-5570.

Sincerely,

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10.2 Response to Comments from the California Department of Fish and Game (S-CDFG)

[S-CDFG-01]

The commenter provides comments on the Water System Improvement Program (WSIP), which were reviewed and considered as part of the certification process for the Program EIR (PEIR) on the WSIP. The commenter focuses on the impacts of the originally proposed WSIP. On October 30, 2008, the San Francisco Planning Commission certified the Final PEIR in its Motion No. 17734 and the SFPUC adopted the WSIP (known as the "Phased WSIP") in its Resolution No. 08-0200. The Phased WSIP is a variant on the originally proposed WSIP, and defers the decision to deliver more water to the SFPUC's customers until 2018. The Phased WSIP involves *full implementation of all proposed WSIP facility improvement projects* to ensure that the public health, seismic safety and delivery reliability goals are achieved as soon as possible *and phased implementation of a water supply program to meet projected water purchases through 2030*. Under the Phased WSIP, the SFPUC established an interim mid-term planning horizon – 2018. The SFPUC made a decision about providing water supply to the water customers through 2018 only, and deferred a decision regarding long-term water supply after 2018 and through 2030 until it undertakes further water supply planning and demand analysis. All non-water supply–related goals and system performance objectives identified for the original WSIP would be achieved under the Phased WSIP and all individual WSIP facility improvement projects proposed in the original WSIP would be constructed. PEIR Chapter 13 provides a description and analysis of the Phased WSIP and is included in this EIR as Appendix B.

Description of the Phased WSIP

The Phased WSIP includes the following key program elements:

- Full implementation of all of the 17 proposed WSIP facility improvement projects described in the PEIR, including the Tesla Treatment Facility and the Lawrence Livermore Water Quality Improvements analyzed in this EIR.[1]

- Water supply delivery to regional water system customers through 2018 only of 265 million gallons per day (mgd) average annual target delivery originating from the Tuolumne, Alameda and Peninsula watersheds. This includes 184 mgd for the wholesale customers (including 9 mgd for the cities of San Jose and Santa Clara), and 81 mgd for the retail customers.

- Development of 20 mgd of conservation, recycled water and groundwater within the service area (10 mgd retail; 10 mgd wholesale).

- Dry year transfer from Modesto Irrigation District (MID) and/or Turlock Irrigation District (TID) of about 2 mgd coupled with the Westside Groundwater Basin conjunctive

[1] The Tesla Treatment Facility and the Lawrence Livermore Water Quality Improvements are listed as three separate projects in the WSIP PEIR: the Tesla Portal Disinfection Facility, Advanced Disinfection, and the Lawrence Livermore Supply Improvements.

use project to meet the drought year goal of limiting rationing to no more than 20 percent on a systemwide basis.

- Re-evaluation of 2030 demand projections, potential regional water system purchase requests, and water supply options by 2018 and a separate SFPUC decision in 2018 regarding regional water system water deliveries after 2018.

- Financial incentives to limit water sales to an annual average of 265 mgd from the watersheds.

The Phased WSIP would not provide water supply to meet 300 mgd average annual water sales in 2030 as proposed under the original WSIP. Rather, the SFPUC would limit deliveries to no more than an annual average of 265 mgd from the watersheds through 2018, and the SFPUC and wholesale customers would collectively develop 20 mgd in conservation, recycled water, and groundwater to meet or offset the projected regional water system purchase request of 285 mgd in 2018. This 20 mgd of conservation, recycled water, and groundwater includes development of 10 mgd of conservation, recycled water, and groundwater in San Francisco as proposed under the WSIP and 10 mgd of conservation, recycled water, and groundwater developed by the wholesale customers, which is in addition to 15 mgd of conservation, recycled water, and groundwater already assumed by the wholesale customers in preparing their regional water system purchase requests.

There is no change between the WSIP and the Phased WSIP in the average annual water delivery proposed for the SFPUC's retail customers; the current average annual retail customer demand is approximately 91 mgd and this same amount would be provided to the retail customers through 2018, although 10 mgd of this amount would be provided through conservation, recycled water, and groundwater developed in San Francisco. While the WSIP proposed to provide the full 2030 projected wholesale customer average annual purchase requests of 209 mgd, the Phased WSIP instead is designed to meet a projected 2018 wholesale customer average annual purchase request of 194 mgd in 2018, although 10 mgd of this amount would be provided through conservation, recycled water, and groundwater projects.

Under the Phased WSIP, the SFPUC also would implement the delivery and drought reliability elements of the WSIP, including the Westside Basin Conjunctive Use Project and proposed dry-year transfers from the MID and the TID, which would increase average annual diversions from the Tuolumne River by about 2 mgd over existing conditions.

Before 2018, the SFPUC would engage in a new planning process to re-evaluate water system demands and water supply options. As part of the process, San Francisco would conduct additional environmental studies and CEQA review as appropriate to address the SFPUC's recommendation regarding water supply and proposed water system deliveries after 2018. The SFPUC would review and consider approval of the terms of any new master Water Sales Agreement that would take effect after 2018.

The SFPUC will deliver to customers up to 265 mgd from the SFPUC watersheds on an average annual basis. While average annual deliveries from the SFPUC watersheds would be limited to 265 mgd such that there would be no increase in diversions from the Tuolumne River to serve additional demand, there would be a small increase in average annual Tuolumne River diversions of about 2 mgd over existing conditions to meet the delivery and drought reliability elements through 2018. As part of adoption of the Phased WSIP, the SFPUC will implement the mitigation measures identified for the Phased WSIP in the Final PEIR, including measures addressing interim impacts from potential increases in deliveries from the SFPUC watersheds over the total average annual of 265 mgd in the event that conservation, recycled water, and groundwater projects are not completed prior to the increase in customers' demand.

The SFPUC must maintain water deliveries to all its customers for the protection of public health and safety. Therefore, the SFPUC will work with its customers to develop financial incentives to limit water sales to an average annual amount of 265 mgd from the watersheds through 2018. With the projected 20 mgd of conservation, recycled water, and groundwater projects, the system would meet average daily demand of 285 mgd in 2018.

Environmental Analysis of the Phased WSIP

The Phased WSIP would have the same potential impacts associated with proposed facility construction and operation as the WSIP. The 17 facility improvement projects proposed under the WSIP and analyzed in the PEIR would also be implemented under the Phased WSIP to meet the intent of the water quality, seismic reliability, delivery reliability, and water supply goals of the WSIP.

The Phased WSIP would have potential impacts associated with its proposed water supply program similar to those described in the PEIR for the alternatives where the wholesale customer purchase requests for 2030 would not be provided by the regional water system. Under those alternatives, the PEIR assumed that the wholesale customers might pursue other types of projects to either reduce demand and/or to supplement the surface water supplies delivered by the regional water system from the SFPUC watersheds. The potential facility and operations impacts associated with such projects are discussed in the analysis for the alternatives, including the No Program Alternative, the No Purchase Request Increase Alternative, and the Aggressive Conservation/Water Recycling and Local Groundwater Alternative.

Similar to the Modified WSIP Alternative and the Aggressive Conservation/Water Recycling and Local Groundwater Alternative, the Phased WSIP, which envisions developing additional local conservation, recycled water, and groundwater projects, could result in construction and operation of additional recycled water and groundwater facilities in the wholesale customer service areas; thus, collective impacts in the Bay Division and Peninsula Regions and associated cumulative effects would occur. The types of potential impacts associated with implementation of the local recycled water and groundwater projects are summarized in PEIR Table 13.9 and Section 13.4 (see Appendix B of this EIR) and generally relate to construction

of new infrastructure, water quality, and groundwater resources, and operational uses of energy and long-term air quality emissions.

The water supply impacts of the Phased WSIP would be similar to those analyzed in Chapter 9 of the WSIP PEIR for the No Purchase Request Increase Alternative, and overall the impacts of the Phased WSIP Variant through 2018 would be less than the water supply impacts of the WSIP (see Appendix B of this EIR). With a few exceptions, the water supply impacts identified as potentially significant and mitigable for the proposed WSIP remain potentially significant and mitigable for the Phased WSIP. Two potential impacts on the lower Tuolumne River were determined to be less than significant as long as the SFPUC does not increase deliveries to customers above 265 mgd from the watersheds: WSIP Impact 5.3.6-4, potential effects on fishery resources along the Tuolumne River below La Grange Dam; and WSIP Impact 5.3.7-6, potential impacts on terrestrial biological resources along the Tuolumne River below La Grange Dam (see Appendix B of this EIR). Although the Phased WSIP is designed to keep deliveries from exceeding an annual average level of about 265 mgd, in the event the SFPUC must deliver more than 265 mgd to its customers from the watersheds, the SFPUC shall implement the mitigation measures associated with these potential impacts in proportion to the extent of the exceedance. In implementing the Phased WSIP, the need could arise to temporarily increase deliveries from the Tuolumne River and local watersheds over the 265 mgd average annual target levels to meet customer water delivery needs in the near term, because of public health and safety considerations and because it might not be possible to implement all of the local conservation, recycling, and groundwater projects and actions in time to meet increasing customer demands. Although avoidance of these potential impacts on the lower Tuolumne River is not ensured, the magnitude, frequency, and duration of the impacts are likely to be less than the originally proposed WSIP. The impact analysis for the Phased WSIP recognized that, between now and 2018, deliveries from the Tuolumne River and local watersheds might increase above the 265 mgd average annual level (to a possible 275 mgd average annual) for up to a few years. By 2018, and perhaps well before, it is expected that local projects would provide sufficient local supply and conservation to bring SFPUC watershed deliveries back down to current levels, an annual average of 265 mgd.

Under the Phased WSIP, the SFPUC would monitor sales to ensure that sales delivered from the SFPUC watersheds are limited to an average annual of 265 mgd through 2018. The SFPUC would measure and review average annual sales at the close of each fiscal year. WSIP Mitigation Measures 5.3.6-4a or 5.3.6-4b, as well as WSIP Mitigation Measure 5.3.7-6 (see Appendix B of this EIR), will be implemented when the average annual sales from the watersheds exceed 265 mgd. The SFPUC would continue to implement the necessary measure(s) until the average annual SFPUC watershed deliveries are 265 mgd or less. Implementation of WSIP Measure 5.3.6-4a is the preferred mitigation approach, and for the Phased WSIP, the amount of conserved water required to reduce the potential impact to a less-than-significant level would be proportional to the amount of increased diversions from the Tuolumne River contributing to exceeding the 265 mgd deliveries restriction.

Four potential impacts in the Pilarcitos watershed were determined to be potentially significant and mitigable for the originally proposed WSIP, but are considered less than significant for the Phased WSIP through 2018: Surface Water Quality Impact 5.5.3-2, effects on water quality in Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam; Fisheries Impacts 5.5.5-4, effects on fishery resources in Pilarcitos Reservoir, and 5.5.5-5, potential effects on fishery resources along Pilarcitos Creek below Pilarcitos Reservoir and below Stone Dam; and, Terrestrial Biology Impact 5.5.6-4, potential impacts on biological resources in Pilarcitos Reservoir. With the Phased WSIP, operations for Pilarcitos Reservoir and releases to Pilarcitos Creek will be similar to existing conditions, resulting in a less-than-significant impact. Thus no mitigation is required. (WSIP Draft PEIR pp. 5.5.3-5 through 5.5.3-7, 5.5.6-17 through 5.5.6-22, 5.5.5-7, 13-39, 13-44, and 16-80 to 16-82. See Appendix B of this EIR.)

Please refer to Chapter 3, Staff-Initiated Text Changes, of this Comments and Responses for revisions to Chapters 1, 2, 3, 4.1, 6, 7, 9, and Appendix B of the SJRWQIP Draft EIR related to the Phased WSIP.

[S-CDFG-02]

The commenter states that the WSIP could cause anadromous fish populations of the Tuolumne River to drop below self-sustaining levels and that evidence supports an existing decline in Chinook salmon populations. As discussed below, the WSIP PEIR concluded that long-term WSIP-induced flow changes in the Tuolumne River below La Grange Dam could have a potential significant adverse effect on anadromous fish in that reach of river if left unmitigated. The analysis in the WSIP PEIR indicates that implementation of WSIP Mitigation Measures 5.3.6-4a and 5.3.6-4b would reduce these potential impacts to a less-than-significant level (WSIP PEIR pp. 6-48 and 6-49; see Appendix B of this EIR).

The commenter expressed the preference that the SFPUC's WSIP obtain additional water from sources other than the Tuolumne River. It should be noted that the WSIP PEIR analyzed potential impacts based on increased Tuolumne River diversions under 2030 purchase request conditions. Under the Phased WSIP, the SFPUC established an interim mid-term planning horizon – 2018. The SFPUC made a decision about providing water supply to the water customers through 2018 only, and deferred a decision regarding long-term water supply after 2018 and through 2030 until it undertakes further water supply planning and demand analysis. Thus, the Phased WSIP would include lower purchase requests (i.e., water demand), smaller increases in diversions, and therefore less severe impacts would be expected under the Phased WSIP. Please refer to the discussion above under the response to comment S-CDFG-01 for a description of the Phased WSIP and the anticipated environmental impacts.

The WSIP PEIR provides information on Chinook salmon populations in the Tuolumne River (WSIP PEIR pp. 5.3.6-13 to 5.3.6-17; see Appendix B of this EIR). Table 5.3.6-2 of the WSIP PEIR shows the results of spawning surveys for the period 1971 to 2004, which show a declining trend in Chinook salmon production.

The information on Chinook salmon provided in the WSIP PEIR was sufficient to reach the conclusion that the WSIP could have a potentially significant adverse impact on salmonids in the Tuolumne River below La Grange Dam. As stated in the WSIP PEIR (pp. 5.3.6-28 to 5.3.6-32; see Appendix B of this EIR), overall flow reductions coupled with the projected infrequent water temperature increases that could result from the WSIP would have a potentially adverse impact on habitat conditions for juvenile salmonids. *The Habitat Restoration Plan for the Lower Tuolumne River Corridor* (McBain and Trush, 2000) establishes goals for fishery habitat restoration, and the National Marine Fisheries Service (NMFS) and others have identified goals for fishery enhancement in this reach of the river. The WSIP's small but incremental contribution to adverse effects on the lower river would make planned restoration of habitat and fishery resources more difficult. Thus, the WSIP PEIR reflects the view that the WSIP has the potential to cause a significant adverse effect on anadromous fish in the Tuolumne River below La Grange Dam.

The following supplemental information was provided as part of the Final WSIP PEIR.

The San Joaquin River and its major tributaries historically supported large populations of both spring-run and fall-run Chinook salmon. During the late 1800s and early 1900s, construction of a number of dams and impoundments within the watershed to provide hydroelectric power generation as well as water supplies for agricultural and municipal usage substantially altered the hydrologic regime of the rivers in terms of the seasonal timing and magnitude of instream flows. The dams also created completely impassable barriers to the upstream migration of adult salmonids, thereby precluding access to otherwise suitable spawning and juvenile rearing habitat located farther upstream within the watershed. The construction of various dams and impoundments coupled with land use changes within the watershed cumulatively contributed to the declining abundance of Chinook salmon, ultimately leading to the extirpation of both spring-run and fall-run Chinook salmon on the mainstem San Joaquin River downstream of Friant Dam. Fall-run Chinook salmon continued to persist within the three major tributaries to the San Joaquin River, the Stanislaus, Merced, and Tuolumne Rivers, within habitat reaches downstream of major dams on each of these three tributaries. In addition to naturally spawning, self-sustaining populations of Chinook salmon within the three tributaries, a mitigation hatchery was constructed on the Merced River for the production of Chinook salmon, which has also contributed to the population abundance and dynamics of Chinook salmon within the lower watershed.

Since completion of the major dams in the San Joaquin River watershed during the late 1940s, the Chinook salmon population inhabiting the Tuolumne, Merced, and Stanislaus Rivers has been characterized by highly variable and fluctuating numbers of adult salmon returning to the tributaries each year to spawn. Adult Chinook salmon population abundance within the three tributaries over the past six decades has fluctuated from a low of several hundred fish to a high of over 40,000 adult salmon. Recent fall-run Chinook salmon escapement averages from 1992 through 2006 were 3,700 adults for the Stanislaus River, 4,600 for the Tuolumne River, and 3,800 for the Merced River. Maximum fall-run escapement over the period from 1967 to 2006 was between 10,000 and 14,000 adults for the Stanislaus River, between 10,000 and 20,000 for the Tuolumne River, and between

10,000 and 15,000 for the Merced River. The fluctuations in adult abundance appear to follow a long-term cyclical pattern, which has been hypothesized to be related to a variety of environmental factors. During the two most recent years, 2006 and 2007, adult Chinook salmon returns to the three tributaries have declined substantially to near-record lows.

There is a high degree of uncertainty and disagreement about the causal mechanisms that have contributed to the high fluctuations in adult returns to the Tuolumne River and other San Joaquin River tributaries. Research on the Tuolumne River suggests that numerous in-river mortality factors may be affecting the abundance and survival of Chinook salmon within the Tuolumne River and other tributaries, including the following: predation by piscivorous fish such as largemouth and smallmouth bass, striped bass, and Sacramento pikeminnow, both within the river and associated with gravel pits; exposure to seasonally elevated water temperatures, particularly during drier water years; low water velocities; habitat degradation within the tributaries; reduced instream flows supporting spawning, egg incubation, juvenile rearing, and adult and juvenile migration; redd superimposition; lack of turbidity during smolt outmigration; and limitations on available juvenile rearing habitat.

It appears that much of the fry and smolt mortality takes place after the juvenile Chinook salmon emigrate from the tributary rivers to the mainstem San Joaquin River, the Delta, or the ocean where there are a number of adverse conditions. Potential sources of mortality within the mainstem San Joaquin River and Delta include exposure to seasonally elevated water temperatures; exposure to potential entrainment risk at unscreened water diversions; entrainment and salvage risk as a result of operation of the State Water Project (SWP) and Central Valley Project (CVP) water export facilities; exposure to contaminants and toxics; vulnerability to predation mortality by striped bass, largemouth bass, Sacramento pikeminnow, and other predatory fish and birds; and delays in adult and juvenile migration as a result of changes in Delta hydrologic conditions associated with water export operations. In addition, the availability of suitable food supplies may be reduced for emigrating juvenile salmon within the lower San Joaquin River and the Delta. Furthermore, the results of correlation analyses between hydrologic conditions within the San Joaquin River basin during the spring period of juvenile emigration and the subsequent number of adult Chinook salmon returning to the tributaries two and one-half years later suggest the importance of river flow as a factor affecting the survival of juvenile Chinook salmon as they migrate downstream from the San Joaquin River tributaries through the lower mainstem and Delta.

There is growing scientific evidence that coastal oceanographic conditions, such as changes in water currents, changes in ocean water temperatures, and changes in ocean upwelling, are important influences on coastal productivity. They affect the species composition and abundance of zooplankton, macroinvertebrates, and fish inhabiting coastal marine waters. Changes in oceanographic conditions and coastal productivity have been related to salmon survival and ultimately the population abundance of adults. Within Pacific coastal waters, changes in oceanographic conditions associated with the Pacific decadal oscillation have been used to predict the abundance of returning adult Chinook salmon to inland tributaries to spawn. Ocean commercial and recreational harvesting of adult Chinook salmon has also

been identified as a factor affecting the population dynamics and abundance of Central Valley Chinook salmon stocks.

Concern has been expressed that the hatchery production of Chinook salmon in the Merced River and other Central Valley hatcheries could affect the genetic integrity and population dynamics of Chinook salmon stocks within the San Joaquin River watershed and throughout the Central Valley. The NMFS and CDFG are working cooperatively to identify hatchery management practices that will reduce the potential effects of hatchery production on the genetic integrity of Central Valley Chinook salmon populations, as well as the potential effects of hatchery planting practices and the ocean harvesting of hatchery-produced salmon on the health and abundance of wild in-river Chinook salmon produced within the Central Valley tributaries.

A variety of scientific investigations and management programs have been implemented recently in an effort to better understand the factors affecting the survival and population dynamics of Chinook salmon within San Joaquin River tributaries, including the Tuolumne River, as well as programs designed to protect and enhance habitat conditions for Chinook salmon spawning, egg incubation, juvenile rearing, and adult and juvenile migration. For example, the Vernalis Adaptive Management Program (VAMP, described in WSIP PEIR pp. 5.2-17 and 5.2-18; see Appendix B of this EIR) was specifically designed to: (1) provide improved protection and survival of juvenile Chinook salmon emigrating from the San Joaquin River tributaries through the Delta during the spring months, and (2) provide a scientific framework for testing and evaluating the potential relationship between changes in stream flows within the San Joaquin River at Vernalis, installation of the Head of Old River barrier, and reductions in SWP and CVP export rates during the spring months on juvenile Chinook salmon survival. The VAMP investigations are ongoing.

Investigations have also been conducted to monitor the seasonal loading and concentrations of various toxics and potential pollutants within the mainstem San Joaquin River and its tributaries. Land use within the San Joaquin River watershed includes both urban populations and extensive agricultural production. Runoff within the watershed may include a variety of water quality contaminants, including pesticides and herbicides, petroleum products, selenium, and salts. Scientific investigations in combination with various regulatory programs have been designed to characterize the potential effects of these water quality constituents on the health and survival of aquatic resources, including San Joaquin River basin Chinook salmon, as well as to identify management actions to reduce or avoid the potential risk of exposure to these water quality constituents.

Large-scale management and habitat restoration programs, such as the CALFED Bay-Delta Program, have invested substantial staff and financial resources in conducting scientific investigations and in supporting habitat enhancement and improvement projects designed to benefit Chinook salmon and other aquatic resources in the lower Tuolumne River and other Central Valley rivers. In addition, the Anadromous Fish Restoration Program under the Central Valley Project Improvement Act has invested substantial time and financial resources to improve the scientific understanding of various factors affecting Chinook salmon in the

San Joaquin River tributaries as well as to implement various management actions and habitat restoration and enhancement programs designed to improve the quality and availability of suitable habitat for Chinook salmon and other fish species.

One of the potentially significant environmental factors that affects habitat quality and availability within the Tuolumne River and other San Joaquin River tributaries for Chinook salmon spawning, egg incubation, juvenile rearing, and adult and juvenile migration is exposure to seasonally elevated water temperatures. A variety of scientific programs designed to develop simulation and predictive models have been implemented in recent years; these models can be used to assess the effects of various reservoir operating strategies, stream flow schedules, coldwater pool management strategies, and other factors influencing the seasonal and longitudinal gradients of water temperatures within the tributaries that potentially affect the health and survival of Chinook salmon in the watershed.

As part of previous State Water Resources Control Board Bay-Delta water quality and water-right proceedings as well as the Federal Energy Regulatory Commission (FERC) hydroelectric project relicensing, considerable emphasis has been placed on evaluating and potentially modifying instream flow schedules for the Tuolumne River and other San Joaquin River tributaries. These management changes to instream flows were intended to improve the physical habitat for various life-history stages of Chinook salmon and other fishery resources as well as to provide more suitable seasonal water temperature conditions in an effort to improve the overall health and survival of Chinook salmon. Investigations into the relationship between instream flows and the hatching success, abundance of fry, abundance of smolts, juvenile emigration survival, and ultimately the abundance of adult Chinook salmon returning to the tributaries to spawn are continuing.

Ongoing investigations are also being performed by the CDFG, NMFS, and the Pacific Fishery Management Council to better identify the effects of recreational and commercial harvesting of Chinook salmon from various river systems, including the Tuolumne River, on population dynamics and adult escapement. Since the Central Valley Chinook salmon populations are comprised of both naturally spawning, in-river-produced salmon and fish produced within the Central Valley hatcheries, including the Merced River Fish Hatchery, regulation of commercial and recreational harvesting is an important factor in protecting weaker stocks, such as the wild, inriver Chinook salmon produced in the Tuolumne River. Since 2007, a large-scale constant fractional marking program has been implemented at Central Valley hatcheries to provide additional information on the contribution of various hatcheries to adult salmon populations in the ocean, the effects of harvest on various salmon stocks, adult straying among Central Valley rivers, and the relationship between various environmental factors within the rivers, the Delta, and ocean environments that ultimately affect the health and survival of Central Valley populations.

In recent years, a settlement was reached in federal court that is intended to restore instream flows and self-sustaining populations of spring-run and fall-run Chinook salmon to the mainstem San Joaquin River downstream of Friant Dam. The San Joaquin River Restoration Program is in its early stages, but has identified a number of physical features within the

mainstem of the San Joaquin River that need to be modified or altered in order to reestablish Chinook salmon populations. The restoration program is seeking funding to implement the various restoration elements of the program, which are ultimately expected to support long-term fishery restoration within the river. There are, however, a number of uncertainties regarding the performance and effectiveness of the proposed restoration actions as well as the relationship between Chinook salmon populations and physical habitat within the mainstem and the survival of fall-run Chinook salmon inhabiting the lower tributaries. Full implementation of the San Joaquin River Restoration Program is expected to take a decade or longer.

Currently, the California Department of Water Resources and U.S. Bureau of Reclamation are engaged in a formal Section 7 consultation with the U.S. Fish and Wildlife Service regarding the potential effects of SWP and CVP export operations on the health and survival of delta smelt. The NMFS is responsible for issuing biological opinions under the Federal Endangered Species Act regarding the coordinated operations of the SWP and CVP for the protection of listed stocks of Chinook salmon, steelhead, and green sturgeon. The current Section 7 re-consultation process is expected to result in modifications to SWP and CVP export operations and other facilities within the Delta estuary, such as installation of the Head of Old River barrier and the south Delta barrier project, which may also have direct and indirect effects on the survival of juvenile Chinook salmon emigrating from the San Joaquin River tributaries downstream through the Delta.

The environmental and biological factors affecting the abundance of adult Chinook salmon returning to spawn in the Tuolumne River and other San Joaquin tributaries are dynamic and vary within and among years. An understanding of these various factors and their associated level of uncertainty provides, in part, the framework used in the PEIR to assess potential impacts of the WSIP operations on habitat quality and availability for various life-history stages of Chinook salmon inhabiting the lower Tuolumne River.

The commenter also addresses impacts to steelhead due to diversion of water from the Tuolumne River and that the WSIP could further reduce the range of the federal threatened Central Valley steelhead. Additional discussion from the WSIP PEIR on the potential impacts to steelhead has been included below. Section 5.3.6.1 of the WSIP PEIR (pp. 5.3.6-1 to 5.3.6-24; see Appendix B of this EIR) provides setting information and discussion on the presence of steelhead trout in the Tuolumne River. The data presented in the WSIP PEIR on habitat conditions in the lower Tuolumne River indicate that this reach of the river is unsuitable for significant populations of steelhead trout due to high temperatures over summer months. The studies by FERC (1996) concluded that no significant populations of steelhead or rainbow trout are present within the lower Tuolumne River system.

The McEwan study (2001) includes a discussion on the historical distribution of steelhead and documents historical evidence of steelhead in the lower Tuolumne River. The study also estimates the present range of likely steelhead occurrence, including in the Tuolumne River. Consistent with the WSIP PEIR, the McEwan study states that high water temperatures are a primary stressor for juvenile steelhead through the summer months. Dam construction over

the last century has made coldwater spawning and rearing habitat at mid-range and high elevations in the Tuolumne River watershed inaccessible to steelhead. Steelhead are now confined to the lower elevation reaches, where high summer water temperatures are a major stressor (McEwan, 2001).

Additionally, consistent with the WSIP PEIR, McEwan found that no significant populations of steelhead/rainbow trout are present in the lower Tuolumne River system. Section 5.3.6.1 of the WSIP PEIR presents the findings of rainbow trout surveys conducted between 1982 and 2004. These findings concluded that, while rainbow trout are present and their range has been moderately extended downstream as a result of FERC Settlement Agreement flows, large anadromous steelhead occur in the system very infrequently. Also consistent with the WSIP PEIR, McEwan presents data from surveys on the Tuolumne River that established the presence of rainbow trout. However, the surveys (conducted by a CDFG biologist in 2001) documented only a single rainbow trout of 28 inches and a single steelhead smolt of 11 inches, captured in the same location within a few days of each other. These findings by McEwan (2001) on steelhead presence in the lower Tuolumne River are consistent with those provided in the WSIP PEIR in showing that no significant populations of steelhead are present within the lower Tuolumne River system.

Table 5.3.1-3 in the WSIP PEIR shows current minimum stream flow requirements for the Tuolumne River below La Grange Dam (WSIP PEIR p. 5.3.1-12; see Appendix B of this EIR). The minimum flows are a condition of the license issued by the FERC in 1996 for the Don Pedro Project. Various other conditions are contained in the settlement agreement that led to issuance of the license, including a requirement that water quality and fish populations be monitored and certain fish habitat restoration projects completed. The Don Pedro Project is scheduled for relicensing in 2016, at which time the FERC will review the results of the monitoring program and the minimum instream flow requirements. Several commenters to the WSIP Draft PEIR indicated that because fall-run Chinook salmon populations in the Tuolumne River below La Grange Dam have declined in the last 10 years, it is likely that the FERC will increase the minimum instream flow requirements. Therefore, these commenters stated that the analysis of the WSIP in the Draft PEIR should have allowed for an increase in minimum flows. The WSIP PEIR did not incorporate a possible increase in the future minimum flow requirement in its primary analysis of the WSIP (WSIP PEIR Section 5.3.6; see Appendix B of this EIR), although it did consider the possibility of an increase in the future minimum flow requirement in the cumulative impact analysis (WSIP PEIR Section 5.7; see Appendix B of this EIR). The PEIR did not include an increase in the future minimum instream flow in its primary analysis of the WSIP for two reasons. First, it is impossible to predict what the future minimum instream flow requirements might be, and to assume flow requirements other than the current minimum flows would be speculative. Secondly, an increase in the minimum instream flows would likely have both beneficial and adverse effects on salmonids. Increased stream flow would likely benefit salmonids at times, such as providing increased quality and quantity of spawning and rearing habitat, but would also cause Don Pedro Reservoir to be drawn down farther than it is under the current minimum flow regime. This would reduce the magnitude of pulse flows in excess of the minimum required during the winter months and delay the typical large spring release during

the snowmelt period. The changes in pulse flows and the delay in spring release could harm salmonids. The delay in spring release due to an increase in the minimum flow requirement would be additive to the delay in spring release caused by the WSIP, producing a longer delay than the WSIP alone. The combined delay would have a more severe adverse effect on salmonids in the river below La Grange Dam than the WSIP alone. Therefore, while the Draft PEIR acknowledges that the FERC relicensing process will likely result in minimum flow requirements remaining the same or increasing, the San Francisco Planning Department determined that, in the absence of any information, the most reliable (and least speculative) assumption to use in the impact analysis was the existing, known minimum instream flow requirements.

[S-CDFG-03]

The commenter requests that SFPUC use alternative water sources other than the Tuolumne River system and uses the Modified WSIP as an example.

The commenter raises the Modified WSIP Alternative as an environmentally superior alternative to the WSIP. As discussed in SFPUC Resolution No. 08-0200, water supply sources in both the Modified WSIP Alternative and the Phased WSIP are similar, but differ in a few respects. First, the Modified WSIP Alternative proposes to divert an additional annual average of 15 mgd from the upper Tuolumne River compared to existing conditions through 2030 and thus would result in diverting more water from the upper Tuolumne River than would occur under the Phased WSIP through 2018. Under the Modified WSIP Alternative, water would be diverted at Hetch Hetchy Reservoir to meet 2030 demand. That diversion would result in reduced inflow to Don Pedro Reservoir, which, under the Modified WSIP Alternative, would be offset by reduced outflow from Don Pedro because of conservation measures undertaken by MID or TID (and/or in the service area of another nearby water agency). Water releases from Don Pedro Reservoir to the lower Tuolumne River thus would be similar to existing conditions under the Modified WSIP Alternative. The Phased WSIP proposes long-term increases in diversions of about 2 mgd, average annual, from the Tuolumne River to meet the WSIP reliability and drought rationing objectives and would maintain total deliveries to customers from the watersheds at an annual average of 265 mgd. In the short term, the Phased WSIP may result in the need to deliver more than a total of 265 mgd, average annual, to customers for a limited period while local conservation, recycling, and groundwater programs are being implemented. In the event the Phased WSIP delivers more than an average annual of 265 mgd from the watersheds, WSIP PEIR Mitigation Measure 5.3.6-4a will be implemented for the Lower Tuolumne River. If Mitigation Measure 5.5.6-4a proves infeasible, Mitigation Measures 5.3.6-4b and 5.3.7-6 will be implemented.

Second, the approach to the dry-year transfer is slightly different for the Modified WSIP Alternative and the Phased WSIP. The Westside Groundwater Basin conjunctive use program would provide a supplemental dry-year water supply source for both the Phased WSIP and the Modified WSIP Alternative. The dry-year water transfer from TID and MID under the Modified WSIP Alternative would be a transfer made only from conserved water (approximately 17.5 mgd average over the design drought). The Phased WSIP does not rule out the possibility of using conserved water only, and includes preferred Mitigation Measure

5.3.6-4a to be implemented if average annual deliveries of water from the watersheds exceeds 265 mgd, but it does not require that dry-year transfers be conserved water only (approximately 2 mgd average over the design drought). Thus, the substantially reduced size of the dry-year transfer under the Phased WSIP compared to the Modified WSIP Alternative combined with the urgency of undertaking the improvements and increasing reliability through implementation of the dry-year supply measures make it difficult to require that no transfer occur without equal and balancing conservation measures in MID/TID service area at this time.

Third, the Phased WSIP proposes more conservation, recycling and groundwater programs than the Modified WSIP Alternative. Both the Modified WSIP Alternative and the Phased WSIP assume 10 mgd of conservation, recycling, and groundwater programs in San Francisco. While the Modified WSIP Alternative commits to 5 to 10 mgd of additional conservation, recycling, and groundwater programs in the wholesale customer area through 2030, the Phased WSIP requires that a minimum of 10 mgd of additional conservation, recycling, and groundwater programs be implemented in the wholesale customer area by 2018.

The Modified WSIP Alternative would result in more impacts on the upper Tuolumne River watershed than the Phased WSIP, but possibly fewer impacts on the lower Tuolumne River watershed if under the Phased WSIP, average annual deliveries from the watersheds were to exceed 265 mgd in the short term.

The Modified WSIP Alternative would lessen but not entirely eliminate potential impacts on the lower Tuolumne River, but the impacts would be considered less than significant. As long as average annual deliveries from the watersheds do not exceed 265 mgd under the Phased WSIP, impacts on the lower Tuolumne River would be considered less than significant; mitigation measures will be implemented any time the SFPUC's average annual deliveries from the watersheds exceed an average annual total of 265 mgd. The SFPUC recognized that WSIP Mitigation Measure 5.3.6-4a is the preferred mitigation measure and should be undertaken as part of the Phased WSIP. The SFPUC did not close the door on the possibility of a dry-year "conserved water" transfer from TID and MID.

[S-CDFG-04]

The commenter states that participation in the San Joaquin Multi-Species Habitat Conservation and Open Space Plan (SJMSCP) should include, but not be limited to, 3.2 acres of permanent conversion of California annual grassland.

Implementation of the project would be expected to result in temporary and permanent impacts to California grassland at both the Tesla Portal and Thomas Shaft sites as described on pp. 4.6-23 and 4.6-27 of the Draft EIR. However, the analysis in the Draft EIR (Impact 4.6-2) concludes that temporary impacts to California annual grassland habitat from construction disturbance would be less than significant with the implementation of Mitigation Measures 4.6-1a, 4.6-1b and 4.6-2, which require participation in the SJMSCP, implementation of best management practices during construction, and returning site to pre-

construction condition. SFPUC's SJMSCP Agreement includes compensation for the total acres of disturbed habitat anticipated for the project including both temporary and permanent impacts. As a participant in the SJMSCP, the SFPUC would remit a fee for compensatory mitigation related to the total acres of expected habitat disturbance (15.89 acres for both the Tesla Portal and Thomas Shaft sites). This area of disturbance was calculated as follows:

Permanent Impacts:

- 3.2 acres California annual grasslands
- 0.01 acre ruderal/disturbed land

Temporary Impacts:

- 11.72 acres California annual grassland
- 0.96 acre ruderal/disturbed land

TOTAL 15.89 acres

In SFPUC's SJMSCP Agreement, the San Joaquin Council of Governments (SJCOG) assigns this acreage to the two sites as follows: 15.77 acres at the Tesla Portal site and 0.12 acre at the Thomas Shaft site.

In addition, Mitigation Measure 4.6-2 requires that soils and/or vegetation disturbed or removed on the project site during construction be restored to the pre-construction conditions. This requires the restoration of original grade where possible, light compaction of loose soils or aeration of compacted soils, and reseeding with native grasses as necessary. Therefore construction-related impacts to California annual grassland are expected to be temporary and not contribute to a permanent loss of habitat on site, and would be considered less than significant. The project would result in permanent impacts that would be mitigated via SFPUC's SJMSCP Agreement (Mitigation Measure 4.6-1a). The cumulative analysis in the Draft EIR assumes that these measures would be effective, and while the loss of California annual grassland could be considered a potentially significant cumulative impact, the project's contribution (3.2 acres of permanent impact with compensatory mitigation) would not be considered cumulatively considerable.

The Mitigation Measure 4.6-1a presented on pp. 5-4 and 5-5 of the Draft EIR is revised for clarity as follows:

Participate in the SJMSCP

Mitigation Measure 4.6-1a: Prior to the commencement of construction activities, SFPUC shall coordinate with the Joint Powers Authority (JPA)/Technical Advisory Committee (TAC), implement relevant ITMMs for applicable species (as identified in Mitigation Measures 4.6-3b through 4.6-3l, below) and pay any necessary fees to fund offsite compensation under the terms

of the SJMSCP to provide replacement values that are equal to that of the permanent loss of ~~0.308~~ 3.2 acres of California annual grasslands and 0.01 acre of ruderal/disturbed land, and temporary impacts to 11.72 acres of California annual grassland and 0.96 acre of ruderal/disturbed land ~~habitat values of the artificial wetland, the temporary loss of <0.001 acre of ephemeral drainage, the temporary loss and permanent conversion of natural lands~~, and incidental take authorization for special-status species.

[S-CDFG-05]

The commenter states that during construction, the access road to the Thomas Shaft site should not be modified in any way that could impact Mt. Diablo cottonweed. The comment is noted; there will be no road improvements to the access road to the Thomas Shaft site under this project. No change to the Draft EIR is required.

[S-CDFG-06]

The commenter refers to data presented in a technical report cited in the EIR. This report, titled "San Joaquin Regional Water Quality Improvement Project Biological Resources Report" was prepared by May & Associates in May 2008 in support of the EIR. Table 7 of Appendix A (on page 55) of this technical report included a list of species identified on site during a survey conducted in the summer of 2007. At that time specific *Amisinckia* species could not be identified because the plants were not flowering. Subsequent surveys conducted in February 2008 confirmed that the fiddleneck species present were: *Amsinckia menziesii* var. *intermedia*, *Amsinckia eastwoodiae*, and *Amsinckia menziesii*. None of these species are state or federal special-status species.

Tables 3 and 6 of the May & Associates report correctly state that no rare fiddleneck species (*Amsinckia lunaris* or *Amsinckia grandiflora*) were identified on the Tesla Portal or Thomas Shaft sites. This is also the information presented in the Draft EIR in Table 4.6-1 on pages 4.6-7 and 4.6-8 and in Appendix C of the Draft EIR.

Therefore the information presented in the Draft EIR is accurate and no changes to the Draft EIR are required.

[S-CDFG-07]

The commenter notes that any temporary impacts that could result in the potential permanent loss of habitat should be considered as permanent impacts. As discussed in response to comment S-CDFG-04 above, implementation of Mitigation Measures 4.6-1a, 4.6-1b, and 4.6-2, which require participation in the SJMSCP, implementation of best management practices during construction and returning site to pre-construction condition, would be expected to mitigate temporary impacts to California annual grassland on both sites and therefore, temporary impacts are not expected to contribute to a permanent loss of habitat on site. The SFPUC's SJMSCP Agreement includes compensatory mitigation (in the form of in lieu fees) for 15.89 total acres of disturbance (both permanent and temporary), including California grassland habitat and ruderal habitat at the Tesla Portal and Thomas Shaft sites. In the agreement, the SJCOG assigns the mitigation breakdown of the acreage to the two sites as follows: 15.77 acres at Tesla Portal and 0.12 acre at Thomas Shaft.

Please see the response to S-CDFG-04 for changes made to Mitigation Measure 4.6-1a that provide additional clarification to the mitigation measure.

[S-CDFG-08]

The commenter addresses mitigation for impacts to special-status wildlife species. The SFPUC will participate in the SJMSCP and as such, the mitigation measures in the Draft EIR for the SJRWQIP were developed to be consistent with the Incidental Take Minimization Measures (ITMMs) as outlined in the SJMSCP (SJCOG, 2000). On October 10, 1994, SJCOG, Caltrans, USFWS, CDFG, and the cities of Escalon, Lathrop, Lodi, Manteca, Ripon, Stockton, and Tracy signed a memorandum of understanding that established the objectives of the SJMSCP. The SJMSCP identifies USFWS and CDFG as permitting agencies as defined in Section 1.19 Permitting Agencies and Section 8.1.1 Permitting Agencies.

As stated in Section 1.1.7 on page 1-12 of the SJMSCP:

> "The SJMSCP intends to provide comprehensive compensation for impacts to threatened, endangered, rare and unlisted SJMSCP Covered Species and other wildlife and compensation for some non-wildlife related impacts to recreation, agriculture, scenic values and other beneficial Open Space uses. At the state and federal levels, the SJMSCP is expected to provide adequate compensation for impacts to plants, fish and wildlife for SJMSCP pursuant to the California Endangered Species Act (CESA), the California Native Plant Protection Act, the Federal Endangered Species Act (ESA), Section 404 of the Federal Clean Water Act (CWA), Section 10 of the Rivers and Harbors Act of 1899, and the Migratory Bird Treaty Act (MBTA) for ESA-listed SJMSCP Covered Bird Species also protected under this Act as these laws relate to the California Department of Fish and Game's (CDFG), United States Fish and Wildlife Service's (USFWS), and the U.S. Army Corps of Engineers' (USACE) responsibilities for Covered Species with respect to SJMSCP Permitted Activities located within the boundaries of San Joaquin County."

The proposed project is considered a "permitted activity" under the SJMSCP, and therefore the mitigation identified by the SJMSCP Joint Powers Authority (JPA) and included in the SFPUC's SJMSCP Agreement for this project is sufficient to address potential impacts under CEQA to species covered by the SJMSCP.

[S-CDFG-09]

The commenter requests that preconstruction surveys for San Joaquin kit fox be conducted within 14 days of the start of construction. Mitigation Measure 4.6-3c, Implement Incidental Take Minimization Measures for the San Joaquin Kit Fox, states that preconstruction surveys will be conducted 14 to 30 days prior to the commencement of ground disturbance. The survey timing stated in the mitigation measure is consistent with the SJMSCP ITMMs, SFPUC's SJMSCP Agreement, and the USFWS Standardized Recommendations for Protection of the San Joaquin Kit Fox Prior to or during Ground Disturbance. Therefore, no changes to the Draft EIR are necessary.

Mitigation Measure 4.6-3c outlines the San Joaquin kit fox protection measures that will be implemented prior to and during project construction to reduce potential impacts to San Joaquin kit fox, consistent with the SJMSCP ITMMs and SFPUC's SJMSCP Agreement. The mitigation measure outlines preconstruction survey methods. The mitigation measure does not include the protocol level surveys as described in the USFWS San Joaquin Kit Fox Survey Protocol for the Northern Range, which are typically implemented to determine whether kit fox are actively present in the project area. However for this project, it is assumed that kit fox may be present in the project area and therefore the mitigation measure adheres to kit fox protection measures. Mitigation Measure 4.6-3c outlines what measures would be undertaken should dens be identified during preconstruction surveys (differentiating between unoccupied dens, dens occupied by adults only and natal dens). The mitigation measure also outlines that the provisions of the USFWS Standardized Recommendations for Protection of the San Joaquin Kit Fox Prior to or During Ground Disturbance, will be followed should a den be identified during construction, based on the outcome of the preconstruction surveys. These measures are sufficient to reduce potential impacts to San Joaquin kit fox at both the Tesla Portal and Thomas Shaft sites to a less-than-significant level.

In addition, the commenter requests that biologists with specialized experience with San Joaquin kit fox conduct the required surveys. In response, Mitigation Measure 4.6-3c has been revised to explicitly identify that the qualified biologist would have experience with kit fox biology, identification, and survey techniques. Mitigation Measure 4.6-3c of the Draft EIR is revised as follows:

Implement Incidental Take Minimization Measures for San Joaquin Kit Fox

Mitigation Measure 4.6-3c: SFPUC shall implement the ITMMs identified for the San Joaquin kit fox under the SJMSCP to reduce the level of impact on the San Joaquin kit fox. Mitigation measures defined by the SJMSCP and the USFWS to protect the San Joaquin kit fox include the following:

- A qualified biologist with demonstrated experience in kit fox biology, identification, and survey techniques shall conduct preconstruction surveys two calendar weeks to 30 calendar days prior to commencement of ground disturbance. Surveys shall be conducted by qualified biologists. When surveys identify potential dens (potential dens are defined as burrows at least four inches in diameter which open up within two feet), potential den entrances shall be dusted for three calendar days to register track of any San Joaquin kit fox present. If no San Joaquin kit fox activity is identified, potential dens may be destroyed.

Mitigation Measure 4.6-3c as described in the Draft EIR is consistent with the measures as described by the USFWS Standardized Recommendations for Protection of the San Joaquin Kit Fox Prior to or During Ground Disturbance (USFWS, 1999) that apply to "Other Projects" as the commenter requests.

[S-CDFG-10]

The commenter addresses mitigation for potential impacts to burrowing owls. In response, Mitigation Measures 4.6-3e, 4.6-3f, and 4.6-3g, Conduct Pre-Construction Surveys for Burrowing Owls, have been revised for clarity and consistency and to be consistent, as applicable, with the SJMSCP and the California Burrowing Owl Consortium's Burrowing Owl Survey Protocol and Mitigation Guidelines (California Burrowing Owl Consortium, 1993), as follows:

Conduct Pre-Construction Surveys for Burrowing Owls

Mitigation Measure 4.6-3e: Breeding Season Surveys. ~~In January, and again no more than two weeks before construction, a survey for burrows and burrowing owls shall be conducted by a qualified biologist within 500 feet of the project (access permitting). The survey will conform to the protocol described by the California Burrowing Owl Consortium in the Burrowing Owl Survey Protocol and Mitigation Guidelines (California Burrowing Owl Consortium, 1993), which includes up to four surveys on different dates if there are suitable burrows present.~~

~~If occupied owl burrows are found within the survey area, a determination will be made by a qualified biologist, in consultation with the California Department of Fish and Game (CDFG), as to whether or not work will affect the occupied burrows or disrupt reproductive behavior.~~

~~If it is determined that construction will not affect occupied burrows or disrupt breeding behavior, construction will proceed without any restriction or mitigation measures.~~

~~If it is determined that construction will affect occupied burrows during August through February, the subject owls will be passively relocated from the occupied burrow(s) using one-way doors. There will be at least two unoccupied burrows suitable for burrowing owls within 300 feet of the occupied burrow before one-way doors are installed. Artificial burrows will be in place at least one week before one-way doors are installed on occupied burrows. One-way doors will be in place for a minimum of 48 hours before burrows are excavated.~~

~~If it is determined that construction will physically affect occupied burrows or disrupt reproductive behavior during the breeding season (February 1 through August 31), then avoidance is the only mitigation available. Construction will be stopped within 250 feet of occupied burrows until it is determined that the subject owls are not nesting or until a qualified biologist determines that juvenile owls are self-sufficient or are no longer using the natal burrow as their primary source of shelter.~~ Measures to avoid and minimize impacts on the western burrowing owl will be implemented as described below:

- If project schedule permits, a qualified biologist will survey for burrows and burrowing owls during the breeding season (February 1 to August 31), immediately preceding construction. Surveys will be conducted within 500 feet of the project boundary (access permitting) in accordance with the California Burrowing Owl Consortium (1993) guidelines or as otherwise determined by CDFG. Burrows would be inspected for signs of owl activity (tracks, pellets, feathers, etc.). The locations of burrowing owl sightings, occupied burrows, and burrows with signs of owl activity will be marked on a map of the project area at a scale sufficient to accurately show the distance of active burrows to the limits of construction. Surveys will be conducted on at least four separate dates during the breeding season in areas where suitable burrows are present. If possible, surveys will be conducted during the peak of the burrowing owl breeding season, generally between April 15 and July 15.

- If occupied owl burrows are found within the survey area, a determination will be made by a qualified biologist, in consultation with CDFG, as to whether work will affect the occupied burrows or disrupt reproductive behavior.

- If it is determined that construction will not affect occupied burrows or disrupt breeding behavior, construction will proceed without any restrictions or mitigation measures.

Mitigation Measure 4.6-3f: Winter Surveys. ~~During the non-breeding season (September 1 through January 31) burrowing owls occupying the project site should be evicted from the project site by passive relocation as described in the CDFG's Staff Report on Burrowing Owls (CDFG, 1995).~~ Measures to avoid and minimize impacts on the western burrowing owl will be implemented as described below:

- If birds are not observed during breeding season surveys, or if breeding season surveys are infeasible due to project scheduling, or if construction will occur during the wintering season, a winter survey will be conducted to identify non-breeding residents of the project site. Winter surveys will be conducted within 500 feet of the project site (access permitting) or as otherwise determined by CDFG during the period when wintering owls are most likely to be present (December 1 to January 31). The locations of burrowing owl sightings, occupied burrows, and burrows with signs of owl activity will be marked on a map of the project area at a scale sufficient to accurately show the distance of active burrows to the limits of construction.

- If occupied owl burrows are found within the survey area, a determination will be made by a qualified biologist, in consultation with CDFG, as to whether or not work will affect the occupied burrows.

- If it is determined that construction will not affect occupied burrows, construction will proceed without any restrictions or mitigation measures.

- If it is determined that construction will affect occupied burrows, the subject owls will be passively relocated from the occupied burrow(s) using one-way doors prior to the onset of breeding season. Owls will be encouraged to relocate to alternate burrows that are at least 160 feet from the construction limits. One alternate natural or artificial burrow for each burrow excavated will be in place at least one week before one-way doors are installed on occupied burrows. One-way doors will be in place for a minimum of 48 hours before burrows are excavated.

Mitigation Measure 4.6-3g: Fall Surveys.~~During the breeding season (February 1 through August 31) occupied burrows shall not be disturbed and shall be provided with a 100-foot protective buffer until and unless the TAC, with the concurrence of the Permitting Agencies' representatives on the TAC; or unless a qualified biologist approved by the Permitting Agencies verifies through noninvasive means that either: 1) the birds have not begun egg laying, or 2) juveniles from the occupied burrows are foraging independently and are capable of independent survival. Once the fledglings are capable of independent survival, the burrow can be destroyed.~~ Measures to avoid and minimize impacts on the western burrowing owl will be implemented as described below:

- If surveys must be conducted between September 1 and November 30 (which is outside of the time windows specified above), a qualified biologist will conduct a survey for burrows and burrowing owls no more than thirty (30) days prior to ground-disturbing activity. If necessary, resident owls will be passively relocated from occupied burrows, as described above. If construction activities are still ongoing beyond November 30, then winter surveys will be conducted during December and January.

[S-CDFG-11]

The commenter addresses mitigation related to Swainson's hawk and states that during construction a buffer of two times the dripline of a tree with an occupied Swainson's hawk nest is an arbitrary buffer distance. Mitigation Measure 4.6-3h, Conduct Pre-Construction Surveys for Swainson's Hawk, of the Draft EIR addresses the measures that will be implemented during project construction to mitigate potential impacts to Swainson's hawk. Mitigation Measure 4.6-3h is consistent with the SJMSCP ITMMs for Swainson's hawk and the SFPUC's SJMSCP Agreement, both of which state that if a nest tree becomes occupied during construction then a buffer of two times the dripline of the tree will be established. Also, per the SJMSCP, the mitigation measure states that if a nest is found during preconstruction surveys, then all construction activities shall remain at a distance of 1,320 feet, unless equally effective measures are agreed to by CDFG.

The commenter also requests that CDFG be notified to determine appropriate actions should Swainson's hawk be found nesting in the project area. Mitigation Measure 4.6-3h has been revised as follows:

Conduct Pre-Construction Surveys for Swainson's Hawk

Mitigation Measure 4.6-3h: A qualified biologist shall conduct a preconstruction survey for Swainson's hawk, prior to the commencement of any ground disturbing construction activities (e.g., grass/vegetation/brush/tree removal, soil excavation, grading, vehicle access, staging of materials or vehicles, large scale materials off-haul or delivery, construction of temporary or permanent access roads).

In the case that Swainson's hawks are found nesting in the area, the SFPUC will notify CDFG. At a minimum~~In addition,~~ the following mitigations regarding Swainson's hawk, as listed from the SJMSCP, will be implemented:

- If a nest tree becomes occupied during construction activities, then all construction activities shall remain a distance of two times the dripline of the tree, measured from the nest.

- If any nest trees need to be removed, they may be removed between September 1 and February 15, when the nests are unoccupied.

The following two measures will also be implemented:

- If any unoccupied nests are found during preconstruction surveys, these nests may be removed when the nests are unoccupied.

- If any occupied nests are found during preconstruction surveys, then all construction activities shall remain at a distance of ¼ mile (1,320 feet), unless CDFG agrees to other equally effective measures~~ are agreed to by CDFG~~ (e.g., monitor occupied nest during construction in the buffer zone, limit hours of construction, restrict construction activities, etc).

[S-CDFG-12]

The commenter addresses mitigation for potential impacts to white-tailed kite. Mitigation Measure 4.6-3j, Implement Incidental Take Minimization Measures for White-Tailed Kite, in the Draft EIR is consistent with the SJMSCP ITMM with respect to establishing a setback of 100 feet from white-tailed kite nesting areas as mitigation for the SJRWQIP. The commenter requests that CDFG be notified of the proposed buffer zone. Mitigation Measure 4.6-3i in the Draft EIR has been revised as follows:

Implement Incidental Take Minimization Measures for White-Tailed Kite

Mitigation Measure 4.6-3i: SFPUC shall implement the ITMM identified for the white-tailed kite under the SJMSCP, which consists of the following:

- A qualified biologist shall conduct preconstruction surveys and investigate all potential nesting trees on the project site (e.g., especially tree tops 15-59 feet above the ground in oak, willow, eucalyptus, cottonwood, or other deciduous trees), during the nesting season (February 15 to September 15) whenever white-tailed kites are noted on site or within the vicinity of the project site during the nesting season.

- If the species is found nesting, a setback of 100 feet from nesting areas shall be established and maintained during the nesting season for the period encompassing nest building and continuing until fledglings leave nests, unless CDFG agrees to other equally effective measures ~~are agreed to by CDFG~~ (e.g., monitor occupied nest during construction in the buffer zone, limit hours of construction, restrict construction activities, etc.) and CDFG shall be notified of the proposed buffer zone. This setback applies whenever construction or other ground-disturbing activities must begin during the nesting season in the presence of nests which are known to be occupied. Setbacks shall be marked by brightly colored temporary fencing.

[S-CDFG-13]

The commenter requests that CDFG be notified of the proposed buffer zone for the California horned lark. Mitigation Measure 4.6-3j, Implement Incidental Take Minimization Measures for California Horned Lark and Northern Harrier, in the Draft EIR incorporates a 500-foot setback from nesting areas and is consistent with the SJMSCP ITMMs and SFPUC's SJMSCP Agreement. Mitigation Measure 4.6-3j in the Draft EIR has been revised as follows:

Implement Incidental Take Minimization Measures for California Horned Lark and Northern Harrier

Mitigation Measure 4.6-3j: SFPUC shall implement the ITMM identified for the California horned lark and northern harrier under the SJMSCP, which consists of the following:

- A qualified biologist shall conduct a preconstruction survey and investigate all potential nesting trees to determine the presence or absence of the species on the project site.

- If species are found, a setback of 500 feet from nesting areas shall be established and maintained during the nesting season (February 16 – August 31) for the period encompassing nest building and continuing until

fledglings leave nests, unless CDFG agrees to other equally effective measures ~~are agreed to by CDFG~~ (e.g., monitor occupied nest during construction in the buffer zone, limit hours of construction, restrict construction activities, etc.), or offsite compensation shall be provided, and CDFG shall be notified of the proposed buffer zone. If a setback is used, this setback would apply whenever construction or other ground-disturbing activities must begin during the nesting season in the presence of nests which are known to be occupied. Setbacks shall be marked by brightly colored temporary fencing.

[S-CDFG-14]

The commenter requests that CDFG be notified to determine the appropriate actions should any golden eagle nest be discovered on site. Mitigation Measure 4.6-3k, Conduct Pre-Construction Surveys for Golden Eagle, in the Draft EIR incorporates a 500-foot setback from golden eagle nesting areas and is consistent with the SJMSCP ITMMs. Mitigation Measure 4.6-3k in the Draft EIR has been revised as follows:

Conduct Pre-Construction Surveys for Golden Eagle

Mitigation Measure 4.6-3k: Prior to the start of construction, a qualified biologist shall conduct golden eagle surveys as required by the SJMSCP. Additionally, SFPUC shall implement the ITMM identified for the golden eagle under the SJMSCP, which consists of the following:

- When a site inspection indicates the presence of a nesting golden eagle, CDFG will be notified and a setback of 500 feet from the nesting area shall be established and maintained during the nesting season (normally approximately February 1 – June 30) for the period encompassing nest building and continuing until fledglings leave nests, unless CDFG agrees to other equally effective measures ~~are agreed to by CDFG~~ (e.g., monitor occupied nest during construction in the buffer zone, limit hours of construction, restrict construction activities, etc). This setback applies whenever construction or other ground-disturbing activities must begin during the nesting season in the presence of nests which are known to be occupied. Setbacks shall be marked by brightly colored temporary fencing.

[S-CDFG-15]

The commenter requests that should species be found, a setback of 500 feet from nesting areas be established and CDFG should be notified of the proposed buffer zone. Mitigation Measure 4.6-3l, Conduct Pre-Construction Surveys for Ferruginous Hawk and Prairie Falcon, in the Draft EIR identifies that in the highly unlikely event that the species are found nesting on a project site, ITMMs shall be formulated prior to ground disturbance by the TAC and approved by the JPA with the concurrence of the Permitting Agencies' representatives on the TAC in accordance with the SJMSCP's Adaptive Management Plan. The SJMSCP identifies CDFG as permitting agency of the plan and whose representative on the TAC would need to

concur with ITMMs developed by the TAC and approved by the JPA. This mitigation is consistent with the SJMSCP ITMMs. Mitigation Measure 4.6-3l has been revised as follows:

Conduct Pre-Construction Surveys for Ferruginous Hawk and Prairie Falcon

Mitigation 4.6-3l: Prior to the start of construction, a qualified biologist shall conduct surveys for ferruginous hawk and prairie falcon as required by the SJMSCP. These species currently do not nest in San Joaquin County and are not expected to nest in the County over the life of the SJMSCP. Therefore, in the highly unlikely event that one of these species is found nesting on a project site, SFPUC shall notify CDFG of the proposed buffer zone and a setback of 500 feet from the nesting area shall be established and maintained for the period encompassing nest building and continuing until fledglings leave the nests, unless CDFG agrees to other equally effective measures. ITMMs shall be formulated prior to ground disturbance by the TAC and approved by the JPA with the concurrence of the Permitting Agencies' representatives on the TAC in accordance with the SJMSCP's Adaptive Management Plan. ITMMs may consist of preconstruction surveys, avoidance techniques, and buffer areas.

S-OPR

STATE OF CALIFORNIA

GOVERNOR'S OFFICE *of* PLANNING AND RESEARCH

STATE CLEARINGHOUSE AND PLANNING UNIT

ARNOLD SCHWARZENEGGER
GOVERNOR

CYNTHIA BRYANT
DIRECTOR

October 10, 2008

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CITY & COUNTY OF S.F.
PLANNING DEPARTMENT
MEA

Jamie Dean
San Francisco Planning Department
1650 Mission Street, Fourth Floor
San Francisco, CA 94103

Subject: San Joaquin Regional Water Quality Improvement Project
SCH#: 2007052109

Dear Jamie Dean:

The State Clearinghouse submitted the above named Draft EIR to selected state agencies for review. On the enclosed Document Details Report please note that the Clearinghouse has listed the state agencies that reviewed your document. The review period closed on October 8, 2008, and the comments from the responding agency (ies) is (are) enclosed. If this comment package is not in order, please notify the State Clearinghouse immediately. Please refer to the project's ten-digit State Clearinghouse number in future correspondence so that we may respond promptly.

Please note that Section 21104(c) of the California Public Resources Code states that:

> "A responsible or other public agency shall only make substantive comments regarding those activities involved in a project which are within an area of expertise of the agency or which are required to be carried out or approved by the agency. Those comments shall be supported by specific documentation."

[01]

These comments are forwarded for use in preparing your final environmental document. Should you need more information or clarification of the enclosed comments, we recommend that you contact the commenting agency directly.

This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act. Please contact the State Clearinghouse at (916) 445-0613 if you have any questions regarding the environmental review process.

Sincerely,

Terry Roberts

Terry Roberts
Director, State Clearinghouse

Enclosures
cc: Resources Agency

Document Details Report
State Clearinghouse Data Base

SCH# 2007052109
Project Title San Joaquin Regional Water Quality Improvement Project
Lead Agency San Francisco, City and County of

Type EIR Draft EIR

Description The San Francisco Public Utilities Commission (SFPUC) proposes to improve the disinfection capabilities of the Tesla Portal site and the Thomas Shaft site. The proposed Tesla Portal Disinfection Station would be located at the Tesla Portal site and includes closing the existing Tesla Portal Hypochlorite Station and the construction and operation of replacement facilities. Also at the Tesla Portal site, the project would include the construction and operation of a new Advanced Disinfection Facility that would pass water by a series of ultraviolet light arrays. At the Thomas Shaft site, the Lawrence Livermore Water Quality Improvements would upgrade water treatment facilities.

Lead Agency Contact

Name Jamie Dean
Agency San Francisco Planning Department
Phone (415) 575-9028 **Fax**
email
Address 1650 Mission Street, Fourth Floor
City San Francisco **State** CA **Zip** 94103

Project Location

County San Joaquin
City Tracy
Region
Lat / Long 37° 38' 6" N / 121° 25' 7" W
Cross Streets W. Vernalis Road(Tesla Portal Site), Thomas Shaft Road,and Corral Hollow Road(Thomas Shaft Site)
Parcel No. 253-160-02; 251-330-10
Township 3S; 4S **Range** 5E; 4E **Section** 33; 2 **Base** MDB&M

Proximity to:

Highways I-580, SR 132
Airports No
Railways No
Waterways California Aqueduct, Delta-Mendota Canal, Deep Gulch, Corral Hollow Creek
Schools No
Land Use Existing water supply treatment facility sites. The existing zoning is General Agriculture (AG-160) and General Plan designation is General Agriculture (A/G) for both the Tesla Portal site and the Thomas Shaft site.

Project Issues Aesthetic/Visual; Agricultural Land; Archaeologic-Historic; Air Quality; Biological Resources; Drainage/Absorption; Cumulative Effects; Geologic/Seismic; Growth Inducing; Landuse; Noise; Wildlife; Wetland/Riparian; Water Supply; Water Quality; Vegetation; Traffic/Circulation; Toxic/Hazardous; Solid Waste; Soil Erosion/Compaction/Grading; Septic System; Public Services; Other Issues

Reviewing Agencies Resources Agency; Department of Fish and Game, Region 3; Office of Historic Preservation; Department of Parks and Recreation; Department of Water Resources; California Highway Patrol; Caltrans, District 10; Department of Health Services; State Water Resources Control Board, Clean Water Program; State Water Resources Control Board, Division of Water Quality; Department of Toxic Substances Control; Native American Heritage Commission; Public Utilities Commission

Date Received 08/25/2008 **Start of Review** 08/25/2008 **End of Review** 10/08/2008

Note: Blanks in data fields result from insufficient information provided by lead agency.

S-OPR

STATE OF CALIFORNIA—BUSINESS, TRANSPORTATION AND HOUSING AGENCY ARNOLD SCHWARZENEGGER, Governor

DEPARTMENT OF TRANSPORTATION
P.O. BOX 2048 STOCKTON, CA 95201
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TTY: California Relay Service (800) 735-2929
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SCH#2007052109
San Joaquin Regional Water Quality

Attachment to Letter S-OPR. Refer to Letter S-Caltrans.

Jamie Dean
San Francisco Planning Department
1650 Mission Street, Fourth Floor
San Francisco CA 94130

Dear Ms. Dean:

The California Department of Transportation (Department) appreciates the opportunity to have reviewed the Draft Environmental Impact Report (DEIR) for the proposed construction of the San Joaquin Regional Water Quality Improvement Project. This proposed project is to be located in the unincorporated San Joaquin County at two existing facility sites, the Tesla Portal site and the Thomas Shaft site along the SFPUC's regional water system.

The Department has no comments at this time.

If you have any questions or would like to discuss our comments in more detail, please contact Kathy Selsor at (209) 948-7190 (e-mail: kathy_selsor@dot.ca.gov) or me at (209) 941-1921.

Sincerely,

Kathy Selsor for

TOM DUMAS, CHIEF
OFFICE OF METROPOLITIAN PLANNING

c: SMorgan CA Office of Planning and Research

State of California – The Resources Agency
DEPARTMENT OF FISH AND GAME
http://www.dfg.ca.gov
ARNOLD SCHWARZENEGGER, Governor

POST OFFICE BOX 47
YOUNTVILLE, CALIFORNIA 94599
(707) 944-5500

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October 1, 2008

Ms. Jamie Dean
City and County of San Francisco
Planning Department
1650 Mission Street, Fourth Floor
San Francisco, CA 94103

**Attachment
to Letter S-OPR.
Refer to Letter S-CDFG**

Dear Ms. Dean:

Subject: Comments on Draft Environmental Impact Report for San Joaquin Regional Water Quality Improvement Project, SCH #2007052109, San Joaquin County

Department of Fish and Game (DFG) staff has reviewed the draft Environmental Impact Report (EIR) for the San Joaquin Regional Water Quality Improvement Project (Project). The San Francisco Public Utilities Commission (SFPUC) proposes to construct the above referenced Project. The proposed Project is located in unincorporated San Joaquin County at two existing facility sites, the Tesla Portal site and the Thomas Shaft site, along the SFPUC's regional water system. The Tesla Portal site includes Assessor's Parcel No. 253-160-02, Township 3S and Range 5E. The Thomas Shaft site includes Assessor's Parcel No. 251-330-10, Township 4S and Range 4E. At the Tesla Portal site, the existing building that contains the Tesla Portal Hypochlorite Station would be replaced with a new Chemical Process Building and Office/Control Building. An ultraviolet (UV) facility would be constructed, which would disinfect water using a series of UV light arrays. At the Thomas Shaft site, the Lawrence Livermore Water Quality Improvements would upgrade existing water treatment with a UV facility to meet disinfection requirements of the Surface Water Treatment Rule and the Long Term 2 Enhanced Surface Water Treatment Rule.

DFG, a Trustee Agency under the California Environmental Quality Act (CEQA), is responsible for the conservation, protection, and management of the State's biological resources. Pursuant to Fish and Game Code Section 1801, it is the policy of the State to encourage preservation, conservation, and maintenance of wildlife resources, including perpetuation of all species of wildlife for their intrinsic and ecological values. In addition, pursuant to Fish and Game Code Section 1802, DFG has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and habitat necessary for biologically sustainable populations of those species. The purpose of DFG's comments is to provide guidance to the SFPUC to ensure that, if the Project under the Water System Improvement Program (WSIP) is implemented, biological resources are protected. Like the draft EIR, DFG has organized comments beginning with the WSIP and proceeding with comments by each respective section.

Project Description

The proposed Project would consist of the following components:

Tesla Treatment Facility (Tesla Portal Site)

- A 14,000-square-foot Chemical Process Building, 32 feet in height containing three 16,000-gallon sodium hypochlorite tanks, two 10,000-gallon fluoride tanks and two outdoor 12,500-gallon carbon dioxide (CO_2) tanks.

- A 3,500-square-foot Office/Control Building, 12 feet in height containing offices, control room, process room, laboratory, restrooms, lockers, shower, and a multipurpose room.

- A 20,000-square-foot UV Building, 32 feet in height containing 12 UV reactors (10 active and two standby) each with UV lamp arrays and various sensors on a floor recessed approximately 14 feet below-grade, below-grade piping vaults and two 3,000-gallon food-grade acid tanks.

- Other proposed improvements at the Tesla Portal site include a 90,000-gallon containment basin lined with rip rap to capture released water for grit removal and periodic maintenance (three times per month), two valve vaults to direct adequate flow, as required, two valve houses, and other infrastructure including a microwave tower up to 100 feet in height.

Lawrence Livermore Water Quality Improvements (Thomas Shaft Site)

- Two UV reactors (one active and one standby) installed within the existing Chlorination Facility building.

- A 360-square-foot prefabricated structure 10 feet in height within the fenced area atop Thomas Shaft.

- A 2,500-gallon percolation water tank for processed water.

The proposed project would improve already existing uses (i.e., water treatment) at the two sites. The Lawrence Livermore Water Quality Improvements are being designed for a 0.165 million gallons per day (mgd) capacity. The proposed project would allow Lawrence Livermore National Laboratory (LLNL) to take up to 0.165 mgd of their annual average demand of 0.8 mgd from Thomas Shaft, and continue to receive the remainder of the water from Mocho Shaft, an SFPUC facility located downstream of the Thomas Shaft site. The amount of water supplied to LLNL would be consistent with the preexisting contract between the two parties.

Project Objectives

The objectives of the proposed Project consist of the following:

Tesla Treatment Facility (Tesla Portal Site)

- Replace existing water treatment facilities that are not currently seismically safe with new facilities that are designed to meet current seismic, safety/fire, and building code standards.

- Construct new water treatment facilities to meet U. S. Environmental Protection Agency (U. S. EPA) requirements for *Cryptosporidium* reduction/inactivation in drinking water, as required under the U. S. EPA's Long Term-2 Enhanced Surface Water Treatment Rule (LT2ESWTR).

- Improve current water quality management capabilities such as pH control.

Lawrence Livermore Water Quality Improvements (Thomas Shaft Site)

- Construct new water treatment facilities to meet U.S. EPA requirements under the Surface Water Treatment Rule for the reduction/inactivation of *Giardia*, as well as assist in meeting LT2ESWTR *Cryptosporidium* requirements to enable delivery of potable water to LLNL from the Thomas Shaft of the Coast Range Tunnel.

- Continue to provide back-up chlorination capabilities.

Comments on Executive Summary

WSIP Water Supply Option, Pg. 1-6: Through the WSIP, the SFPUC proposes a water supply option to address the water supply level of service objective of meeting a projected 35 mgd increase in customer purchase requests by 2030, and to provide drought-year delivery with a maximum systemwide rationing of 20 percent. This strategy includes maximizing the use of local watershed supplies, increasing diversions from the Tuolumne River under existing water rights, and development of new local resources, including additional conservation, water recycling, and groundwater supply programs in San Francisco. This combination of water supply sources is expected to fully meet customer purchase requests during non-drought years through 2030.

On October 7, 2007, DFG provided comments to the draft Program Environmental Impact Report (PEIR) for the WSIP proposed by the SFPUC which included comments to the proposed water supply option. DFG reiterates the following comments as well as others in the PEIR as previously stated and provides new comments with respect to current information.

Lower Tuolumne River (Below New Don Pedro)

The PEIR states that the implementation of WSIP would have no impact on the current minimum instream flow requirement set by the Federal Energy Regulatory Commission (FERC) in the 1996 Fishery Settlement Agreement. DFG is concerned that the current FERC required flow regime (i.e., PEIR's CEQA baseline conditions) may not be sufficient to prevent salmon populations in the Tuolumne River from declining. In fact, we have evidence demonstrating that adult Tuolumne River fall-run Chinook salmon *(Oncorhynchus tshawytscha)* produced at a given spring flow has declined by about 50% (mean of 6,805

recruits) since the FERC Settlement Agreement was implemented in 1996. The decline is statistically significant based on an F-test comparison of two flow recruitment regression models: one based on the period from 1980 to 1990 and the other based on the period from 1998 to 2003. We believe that, as proposed, WSIP would make these conditions worse for Tuolumne River salmonids, thus exacerbating the current decline of this population. To address this concern, DFG wrote a letter dated August 1, 2007 to Secretary Kathleen Bose of the FERC and requested them to direct the Modesto Irrigation District and Turlock Irrigation District to provide higher magnitude and greater duration instream flows during the spring period of each year in order to assure acceptable salmon smolt survival and assure that the now critically-impaired salmon populations will remain intact until a new license is considered for Project 2299 in 2014. In this letter, DFG presents evidence, which is summarized below, that demonstrates strong correlations between this observed population decline and the conditions of reduced spring flow and elevated spring water temperature, as directly caused by the operations of Project 2299.

The CEQA environmental baseline conditions in the Lower Tuolumne River are essentially driven by the operations of Project 2299 which, for reasons we identify below, are creating conditions that are not suitable for the anadromous fisheries in the Tuolumne River. Although we recognize that the City and County of San Francisco are not the licensees for Project 2299, it is irrefutable that the actions of the SFPUC on the Tuolumne River at Early Intake, Cherry Valley Dam, and Hetch Hetchy and Lake Eleanor reservoirs influence the timing, duration, and magnitude of water releases from the New Don Pedro Dam. Increased diversion of waters from a river system which currently lacks sufficient flow to support sustainable anadromous fisheries including Federally Threatened Central Valley steelhead (*Oncorhynchus mykiss iridieus*) should be considered a significant cumulative impact (see Zimmerman et al. 2008). Although the proposed increase in diversion in itself may (arguably) not be deemed significant, when viewed in conjunction with Project 2299, existing SFPUC diversions, and other diversions from the Tuolumne River, the effects are cumulatively considerable [see CCR Title 14, Section 15065(a)(3)]. In this context, *we believe the proposed project has the potential to cause anadromous fish populations to drop below self-sustaining levels and further reduce the number and restrict range of Federally Threatened Central Valley steelhead* – thereby requiring a finding of significant effect [CCR Title 14, Section 15065 (a)(1)]. Therefore, we respectfully request the SFPUC use alternative water sources other than the Tuolumne River system to meet purchase requests in 2030 and drought year demands, at least until Project 2299 can properly address the inadequacies in the current flow regime for the purpose of creating, enhancing and supporting a sustainable anadromous fishery in the Lower Tuolumne River.

Documented Tuolumne River Salmon Population Decline

Strong evidence exists that the Tuolumne River fall-run Chinook salmon population has declined severely. Historically, this fall run was documented (U. S. Fish and Wildlife Service 1940) to annually exceed 72,000 escaping (i.e., spawning) adults. This number became reduced severely, coincidentally with, and in part caused by, water diversions and dams which were developed and operated on the Tuolumne River. Immediately prior to the operation of the New Don Pedro Project, fall-run Chinook salmon numbers annually reached 20,000 to 25,000 escaping adults, but unfortunately the instream flow and other

fishery protection measures included in the original Project 2299 license were inadequate to stem the continuing decline of salmon. By the time of the 1996 Fisheries Settlement Agreement, salmon numbers had progressively declined to less than 1,000 adults annually. This decline, both overall and when dissected into various lifestage survival components, very strongly correlates with Tuolumne River flow inadequacy during critical salmon life-stages.

In 1997, a record high water year produced substantial project spill, essentially rendering moot the fishery effects of Project 2299 water operations, as well as the effects of some of the out-of-tributary influences on juvenile salmon survival during that year. Absent those controlling influences, the salmon experienced much greater juvenile survival and downstream migration success. Accordingly, in 2000, when most of these fish returned to the Tuolumne River as adults, we documented runs well in excess of 18,000 individuals. Unfortunately, that benefit was short-lived. Since 2000, and after normal Project 2299 operations resumed, the Tuolumne River salmon escapements have again sharply declined. As of 2006, the Tuolumne River escapement population had dwindled to about 600 returning adults. This represents an order-of-magnitude salmon population reduction during the time when the Fishery Settlement Agreement flows and other "protective conditions" under that agreement were in full effect.

Subsequently, since comments were made to the PEIR in October 2007, in a report titled "Lower Tuolumne River Spawning Report, Spawning Survey Summary Update, March 2008" (Ford & Kirihara 2008), run size estimate for Tuolumne River Chinook for 2007 was 211 fish. The current run size of 211 fish with the declines experienced over recent years clearly show the Tuolumne River Chinook to be at *high risk of extinction*, (Lindley 2007). Additionally, USFWS issued a preliminary analysis which indicates that the Tuolumne River fall-run Chinook salmon population of naturally produced fish "is at a high risk of extinction because the instream flow releases are too low" (Mesick 2008). The report finds that "the Tuolumne River fall-run Chinook salmon population is at a high risk of extinction because the population of naturally produced fish was probably less than 83 for three consecutive years (2005 to 2007), there was precipitous decline, and the fall 2007 escapement was a catastrophe considering the spring 2005 wet year conditions." It identifies the Project's control of instream flow to be a significant limiting factor affecting natural salmon production: "The number of naturally produced adult salmon that return to the Tuolumne River is primarily a response of the juvenile salmon to the flows released at La Grange Dam during the winter and spring..."

In a request for rehearing letter written by DFG on May 5, 2008 to FERC, DFG wrote that neither ocean harvest, ocean conditions, nor Delta exports, even though they are in fact minor sources of mortality, are strong controlling factors in the abundance, health and vitality of the Tuolumne River adult salmon population. Annual adult salmon escapement abundance in the Tuolumne River began its sharp decline well before the poor ocean condition phenomena experienced in summer of 2007 (Figure 9, Page 16, Marston 2008). Additionally, a new analysis of the relationship between Delta smolt survival and Delta exports, and San Joaquin River inflow [i.e. Tuolumne River contributions along with other tributary flows (Newman 2008)] suggest that the Tuolumne River adult salmon population is

primarily affected and controlled by in-tributary limiting factors, rather than oceanic or other downstream controlling features.

As further described in the DFG letter written on May 5, 2008 to FERC, the primary factors controlling the salmon population to the Tuolumne River are occurring within the reach of the River which is directly operated in association with Project 2299. Districts have asserted that other downstream factors within the San Joaquin River and Delta are principally responsible for the observed salmon population declines. However, since Tuolumne River flow contributions from the Project requirements are important in determining the fate of salmon and other species (e.g., Delta smelt, longfin smelt, steelhead), in the Delta this, too, is a direct effect of Project operations. We have observed a very dramatic decline in Tuolumne River salmon adult escapement between 2000 and 2007, while the Fishery Settlement Agreement flow regimes and other protective features have been in place. The strong relationship between this observed population decline and the conditions of reduced spring flow and elevated spring water temperature indicated needed changes in the operations of Project 2299. Our analysis, only a part of which is provided above, shows fairly comprehensively that out-of-tributary limiting factors are indeed in play, yet are not the most important determinants of Tuolumne River salmon production, by at least an order-of-magnitude.

Alternatives to the WSIP

Accordingly, the WSIP draft PEIR identified the Modified WSIP Alternative as the environmentally superior alternative. This alternative implements all of the proposed WSIP projects, but would modify proposed system operations to minimize environmental effects. Modified proposed system operations to be considered as environmentally minimal must not include increased diversions from the Tuolumne River. Since there is strong evidence the Tuolumne River as managed, for the reasons discussed above and others, lacks sufficient water flows to keep in good condition anadromous salmonids, DFG does not agree with increased diversions from the Tuolumne River. Diversions of even 3-mgd of water from the Tuolumne River would be cumulatively considerable [see CCR Title 14, Section 15065(a)(3)] and put Chinook salmon at *high risk of extinction* in that watershed. Consequently, we continue to respectfully request SFPUC to use alternative water sources other than the Tuolumne River system to meet purchase requests in 2030 and drought year demands, at least until Project 2299 can properly address the inadequacies in the current flow regime for the purpose of creating, enhancing and supporting a sustainable anadromous fishery in the lower Tuolumne River.

DFG encourages SFPUC continue aggressive conservation and water recycling. Furthermore, year-round desalination at Oceanside to provide 25-mgd customer purchase requests through 2030 could be a good alternative for protecting salmonids of the Tuolumne River. With the implementation of alternative energy sources and proper brine disposal, such as dilute diffusion, the desalination alternative has the potential to be an environmentally superior alternative.

Comments on Biological Resources

California Annual Grassland, Pg. 4.6-1: California annual grassland is the predominant natural community at the Project sites. At the Tesla Portal site, there are approximately 42 acres of California annual grassland, and about 25.6 acres of annual grassland at the Thomas Shaft site. The proposed Project would result in the permanent loss of approximately 3.2 acres of California annual grassland at the Tesla Portal site. Permanent loss of California annual grasslands would contribute incrementally to the statewide loss of this type of habitat. As such, the impact of permanent loss of California annual grasslands from the proposed Project combined with the permanent loss of California annual grasslands of other projects identified in Table 4.15-a would be potentially significant (pgs. 4.15-13 and 4.15-14). Therefore, loss of California annual grassland at the Tesla site would contribute to a "cumulatively considerable" impact and substantially degrade the quality of the environment as stated in Section 15065 of the CEQA guidelines. Mitigation Measure 4.6-1a indicates participation in the San Joaquin Multi-Species Habitat Conservation and Open Space Plan (SJMSCP) which includes compensation for the permanent loss of 0.308-acre of habitat values of artificial wetland, the temporary loss of <0.001-acre of ephemeral drainage, the temporary loss and permanent conversion of natural lands and incidental take authorization for special-status species. Participation in the SJMSCP should include, but not be limited to, 3.2 acres of permanent conversion of California annual grassland.

Special-Status Plant Species, Pg. 4.6-6: One special-status plant species, Mt. Diablo cottonweed, was observed along the access road leading to the Thomas Shaft site, but is not located within the Project footprint or construction staging area (Weiss Associates, 2003). During construction, the access road to the Thomas Shaft site should not be modified in any way which could impact Mt. Diablo cottonweed.

According to the May and Associates technical report on page 55 in the table titled "Plants Observed," both the Thomas Shaft and Tesla sites have known occurrences of *Amsinckia* spp. It is important a distinction is made which *Amsinckia* spp. is present since *Amsinckia grandiflora* is Federally- and State-listed as endangered, and has CNPS status 1B. *Amsinckia lunaris* also has CNPS status 1B. Until this distinction has been made, construction activities should be restricted.

Impacts on sensitive habitats, common habitats, and heritage trees (Tesla Portal: PSM; Thomas Shaft: LS, pg. 4.6-23): Temporary impacts resulting from construction staging and other construction-related activities at the Tesla Portal Project site would result in impacts to 11.716 acres of California annual grasslands, <0.001-acre of ephemeral drainage, and 0.846 acre of ruderal/disturbed habitat. Temporary impacts to California annual grasslands and aquatic habitat would contribute to the degradation of natural habitat in the region and could result in the potential permanent loss of habitat. Mitigation Measures 4.6-1a, 4.6-1b and 4.6-2 (participation in the SJMSCP, implement Best Management Practices and returning the site to pre-project conditions) would reduce potential temporary construction impacts to less than significant.

Since prior to the commencement of construction activities, the SFPUC will coordinate with the Joint Powers Authority/Technical Advisory Committee and pay necessary fees to fund offsite compensation under the terms of the SJMSCP, any temporary impacts that could result in the potential permanent loss of habitat should be considered as a permanent impacts.

Comments on Special Status Wildlife Species

Implement Incidental Take Minimization Measures for San Joaquin Kit Fox, Pg. 5-6:
A qualified biologist shall conduct preconstruction surveys 14 to 30 calendar days prior to commencement of ground disturbance. These surveys should be conducted no later than two weeks prior to commencement of ground disturbance.

Preconstruction surveys for the San Joaquin kit fox should adhere to the U. S. Fish and Wildlife Service's (USFWS) San Joaquin Kit Fox Survey Protocol for the Northern Range. Accordingly, DFG recognizes properly qualified biologists conducting San Joaquin kit fox surveys as described by the USFWS must have demonstrable experience in kit fox biology, identification and survey techniques.

Furthermore, DFG as described by the USFWS Standardized Recommendations for Protection of the San Joaquin Kit Fox Prior to or During Ground Disturbance (1999), does not consider water storage or conveyance facilities that promote urban growth or agriculture small projects. Recommendations for take minimization measures for San Joaquin kit fox should follow the above referenced document under the section "other projects."

Determine Burrowing Owl Presence

Breeding Season Surveys

The California Burrowing Owl Consortium (Consortium) survey protocol specifies a multi-phase approach, which is recommended in order to adequately evaluate burrowing owl use of an area and to inform the CEQA process. Phase 1 of the protocol begins with a habitat assessment that recognizes that burrows are the essential component of burrowing owl habitat and that burrowing owls may use man-made structures as burrows (see Page 1 of Consortium guidelines). If suitable habitat [appropriate vegetation and burrow(s) or burrow surrogate(s)] is present, then a Phase 2 intensive burrow survey is necessary even if owl sign is not present during the habitat assessment phase. Owl signs include molted feathers, cast pellets, prey remains, egg shell fragments, or excrement at or near burrow entrance or perch site. During the intensive burrow survey phase, burrow concentration areas should be mapped. Phase 3 of the protocol requires four survey visits whether or not owl sign is observed during Phase 2. DFG recommends that the Consortium survey protocol for breeding season surveys be adhered to [4 survey visits spread evenly (roughly every three weeks) during the peak of the breeding season, from April 15 to July 15] until enough information is available to warrant their revision or until new detailed protocols are developed as part the Conservation Strategy. The habitat assessment, intensive burrow surveys and burrowing owl surveys should include the area within 150 meters of the Project boundaries (approximately 500 feet).

Non-Breeding Season Surveys (Including Winter)

Surveys during the non-breeding season (September 1 to January 31) are recommended by DFG but are not generally required because burrowing owls are much more difficult to detect during the non-breeding season, and the number or type of surveys that would be needed to detect presence then has not been studied or quantified. Owls detected during non-breeding season surveys may be year-round residents or their young from the previous nesting season, pre-breeding territorial adults, winter residents, dispersing juveniles, migrants, or new colonizers. Negative results during any non-breeding season surveys are not conclusive proof that owls do not use the site. Because of this complication, DFG recommends breeding season surveys as the first step, but project applicants should consult with DFG if burrowing owls have been documented on the Project site during the non-breeding season.

Avoid Impacts (destruction, disturbance) to Individual Owls

Pre-Construction Surveys for Owl Presence

Pre-construction surveys (usually initiated during the non-breeding season) are necessary for assessing owl presence at a site within a short time period before site modification is scheduled to begin. Pre-construction surveys are supplemental to the existing breeding season survey protocol (four survey visits spread evenly during the peak of the breeding season, from April 15 to July 15), and should not be used in place of it without consulting with DFG in advance. The pre-construction surveys are intended to document if colonizing owls have recently moved onto the site, or if burrow locations of resident owls have changed, or if young of the year are still present and have not yet fledged or dispersed. Because any one or all of these events may have occurred on site since the breeding season (protocol) surveys were completed, it is important to also complete the pre-construction surveys in order to avoid direct take of owls or their nests and to design proper minimization and mitigation measures (e.g., document number and reproductive status of resident owls and location of satellite burrows, establish buffer zones and equipment/personnel travel routes and work/storage areas, unequivocally evict owls and ground squirrels from burrows).

Initial pre-construction surveys should be conducted outside of the owl breeding season (from February 1 to August 31) but as close as possible to the date that ground-disturbing activities will begin, to avoid the problem of waiting until March or April when the Project would be delayed if owls are detected. Generally, initial pre-construction surveys should be conducted no more than 30 days prior to ground-disturbing activities (i.e., disking, clearing, grubbing, grading). The time lapse between surveys and site disturbance should be as short as possible and will be determined by DFG based on specific project conditions but generally should not exceed seven days. Additional surveys are necessary when the initial disturbance is followed by periods of inactivity or the development is phased spatially and/or temporally over the Project area.

The number of pre-construction surveys necessary to accurately detect current owl presence and owl locations will be driven by a number of interacting criteria such as: 1) the time period that has elapsed since the last breeding survey was completed; 2) height and density of vegetation that may obscure owl presence; 3) topographical conditions that may

obscure owl presence; 4) time of year (e.g., in the winter owls are more cryptic and spend more time in their burrows); 5) time of day and weather conditions when surveys are conducted; 6) long-term history of owl use at the site; 7) size of the parcel and degree of coverage by walking or by intensive observations via spotting scope, and 8) tolerance of owls to human presence. Generally, at a minimum, four survey visits on at least four separate days will be necessary, especially given the cryptic nature of this species during the non-breeding season.

Biologists conducting pre-construction surveys should expend enough effort, based on the above criteria, to assure with a high degree of certainty that take of owls will not occur once site modification and grading activities begin. The full extent of pre-construction survey effort must be described and mapped in detail (e.g., dates, time periods, area(s) covered, and methods employed) in a biological report. Current vegetation and topographical conditions and their corresponding effect on visibility should also be described. The report should be submitted to DFG for review.

DFG's concurrence with the pre-construction survey results will depend on the level of detail that is provided in the Consultant's biological report that summarizes the methods, results, and level of survey effort. DFG has a responsibility to give input regarding measures that would result in avoiding take and minimizing unavoidable impacts to owls.

Take Avoidance

Avoidance of take of individual burrowing owls and their nests is currently mandated under Fish and Game Code sections 86, 3503, 3503.5 and 3513.

Burrows are an essential ecological requisite for burrowing owls throughout the year. Loss of nest burrows, satellite burrows, breeding concentrations, foraging habitat, dispersal and migration habitat, wintering habitat, habitat linkages and stepping stones, including habitat supporting host burrowers, and other essential habitat attributes, can individually or collectively have significant impacts on burrowing owls. DFG will work with Project proponents and lead agencies to develop compensatory mitigation for impacts to burrowing owls.

Conduct Pre-Construction Surveys for Swainson's Hawk, Pg. 5-8: A distance of two times the dripline of the tree is arbitrary and in the event any occupied nests are found, DFG will help determine appropriate actions based on scientific recommendations for construction activities. These measures may include waiting for the birds to fledge and forage on their own prior to construction or having a biological monitor on site to determine an appropriate buffer by monitoring any changes in behavior. If any Swainson's hawks are found nesting in the area, DFG should be notified to determine appropriate actions.

Implement Incidental Take Minimization Measures for White-Tailed Kite, Pg. 5-8: The white-tailed kite is a Fully-Protected species under Fish and Game Code Section 3511. Fully-Protected species may not be taken or possessed at any time and no licenses or permits may be issued for their take except for collecting these species for necessary scientific research. Therefore, the avoidance measures must prevent the take of these

species. If the species is found nesting, a setback from nesting areas shall be established far enough away to prevent any impacts. The buffer shall be maintained during the nesting season for the period encompassing nest building and continue until fledglings leave nests. If any white-tailed kites are found nesting, DFG should be notified to determine or confirm an appropriate buffer zone.

Implement Incidental Take Minimization Measures for California Horned Lark and Northern Harrier, Pg. 5-9: If species are found, a setback of 500 feet from nesting areas shall be established and maintained for the period encompassing nest building and continuing until fledglings leave nests, unless other measures are agreed to by DFG, or offsite compensation shall be provided. If any bird nests are found, DFG should be notified to determine or confirm the appropriate buffer zone for the species.

Conduct Pre-Construction Surveys for Golden Eagle, Pg. 5-9: Golden eagles are Fully-Protected under Fish and Game Code Section 3511. Fully-Protected species may not be taken or possessed at any time and no licenses or permits may be issued for their take except for collecting these species for necessary scientific research. Therefore, the avoidance measures must prevent the take of these species. If the species is found nesting, a setback from nesting areas shall be established far enough away to prevent any impacts. The buffer shall be maintained during the nesting season for the period encompassing nest building and continuing until fledglings leave nests. If any nests are discovered, DFG should be notified to determine appropriate actions.

Conduct Pre-Construction Surveys for Ferruginous Hawk and Prairie Falcon, Pg. 5-10: If species are found, a setback of 500 feet from nesting areas shall be established and maintained for the period encompassing nest building and continuing until fledglings leave nests, unless other measures are agreed to by DFG. If any bird nests are found, DFG should be notified to determine or confirm the appropriate buffer zone for the species.

We appreciate your consideration of our comments. If you have any questions, please contact Mr. Wes Stokes, Environmental Scientist, at (707) 944-5571 or wstokes@dfg.ca.gov; or Mr. Greg Martinelli, Water Conservation Supervisor, at (707) 944-5570.

Sincerely,

Charles Armor
Regional Manager
Bay Delta Region

cc: See Next Page

cc: State Clearinghouse

Mr. Tim Ramirez
Ms. Jill Blanchard
San Francisco Public Utilities Commission
1145 Market Street, Suite 500
San Francisco, CA 94103

Mr. Gary Stern
NOAA Fisheries
777 Sonoma Avenue, Room 325
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Mr. Mike Monroe
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Mr. Ryan Olah
Mr. Carl Mesick, Ph.D.
Mr. Michael Hoover
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Mr. Xavier Fernandez
San Francisco Regional Water Quality Control Board
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Mr. Robert Smith
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333 Market Street, 8th floor
San Francisco, CA 94105-2197

Mr. Eric Wesselman
Tuolumne River Trust
Fort Mason Building C
San Francisco, CA 94123

10.3 Response to Comments from the Governor's Office of Planning and Research (S-OPR)

[S-OPR-01]

This letter acknowledges that the comment period for the Draft EIR closed on October 8, 2008. It also lists the reviewing agencies. Two agencies responded with comments: California Department of Transportation and California Department of Fish and Game. Responses to comments from these state agencies are addressed under responses to S-Caltrans and S-CDFG. The comment states that the San Francisco Planning Department has complied with the State Clearinghouse review requirements for draft environmental impact reports pursuant to the California Environmental Quality Act. No response is required.

The comment is noted for the record. No change to the Draft EIR is required.

City and County of San Francisco
DEPARTMENT OF PUBLIC HEALTH
ENVIRONMENTAL HEALTH SECTION

Gavin Newsom, Mayor
Mitchell H. Katz, MD, Director of Health
Rajiv Bhatia, MD, MPH, Director of EH

September 17, 2008

Ed Harrington, General Manager
San Francisco Public Utilities Commission
1155 Market Street
San Francisco, CA 94103

Re: SFPUC San Joaquin Regional Water Quality Improvement Project

Dear Mr. Harrington:

The San Francisco Department of Public Health Environmental Health Section supports the water quality goals of the SFPUC San Joaquin Regional Water Quality Improvement Project as being consistent with public health protection.

Disinfection of drinking water is one of the most successful public health interventions; ultraviolet (UV) treatment is an advanced type of disinfection which can inactivate viruses, bacteria and protozoans that may be a source of illness. In particular, UV treatment will disinfect *Cryptosporidium*, a protozoan parasite that is resistant to the disinfection techniques currently in use in the SFPUC water system.

The project is imperative to SFPUC's ability to comply with regulations of the U.S. Environmental Protection Agency (EPA) under the Long Term 2 Enhanced Surface Water Treatment Rule. EPA promulgated these rules specifically to enhance protection of public health; they require improvements to drinking water disinfection and other treatment practices to ensure the public is best protected from risks posed by potentially waterborne infectious agents. Timely compliance with their requirements is crucial to realize these public health benefits. UV is an extremely effective strategy for SFPUC to comply with these regulations. [01]

The SFPUC San Joaquin Regional Water Quality Improvement Project will also have other public health benefits, including improved safety of chemical storage facilities, and improved seismic reliability.

Very truly yours,

June M. Weintraub, Sc.D.
Senior Epidemiologist

cc: Bill Wycko, Environmental Review Officer
San Joaquin Regional Water Quality Improvement Project
San Francisco Planning Department

10.4 Response to Comments from the San Francisco Department of Public Health (L-SFDPH)

[L-SFDPH-01]

The commenter identifies some of the public health benefits of the project. The comments are noted for the record. No changes to the Draft EIR are required.

LANDMARKS PRESERVATION ADVISORY BOARD

1650 Mission Street, Suite 400 | San Francisco, CA 94103-2479 TEL: 415.575.6916 | FAX: 415.558.6409

October 3, 2008

Mr. Bill Wycko
Acting Environmental Review Officer
San Francisco Planning Department
1650 Mission Street, Suite 400
San Francisco, CA 94103

Dear Mr. Wycko,

On Wednesday, September 17, 2008, the Landmarks Preservation Advisory Board (Board) held a public hearing and took public comment on the Draft Environmental Impact Report (DEIR) for the San Joaquin Regional Water Quality Improvement Project dated August 25, 2008. After discussion the Board arrived at the following comments listed below:

- The Board suggested that it would be helpful to have copies of the context statement for the water system to be use as a guide and/or tool for future projects. [01]
- On page 57, the Board supports and recommends the following comment regarding the steam engine foundations and bucket assembly: "*since they are closed to the staging area, it is recommended that they be properly fenced off to avoid potential inadvertent physical impacts or damage to the resource that could occur during project construction*". [02]
- On page 4.7.6 (DEIR), and on pages 27 and 28, a brief summary about the political controversy surrounding hydro-electric power should be included. The Board suggested strengthening that statement by providing recognition of the opposition by electrical power companies for constructing this facility, especially PG & E. [03]
- The Board appreciates the opportunity to provide their comments but does not feel comfortable commenting on the archeological components of the project because there is not an archeologist member of the Board. [04]

The Landmarks Preservation Advisory Board appreciates the opportunity to participate in the review of this environmental document.

Sincerely,

M. Bridget Maley, President
Landmarks Preservation Advisory Board

10.5 Response to Comments from the San Francisco Landmarks Preservation Advisory Board (L-SFLPAB)

[L-SFLPAB-01]

The commenter suggests that it would be helpful to have copies of the water system context statement for use as a guide/tool for future projects. The comment is noted for the record. No changes to the Draft EIR are required.

[L-SFLPAB-02]

The commenter requests that at the Thomas Shaft site, the steam engine foundations and bucket assembly areas be fenced during construction to avoid inadvertent impacts to the resource. The text on page 3-11 of the Draft EIR project description is revised to include fencing of the steam engine foundation and bucket assembly as follows:

> Other improvements proposed at the Thomas Shaft site include installation of a 360-square-foot prefabricated structure 10 feet in height within the fenced area atop Thomas Shaft and replacing two existing 100 horse power (hp) pumps with two 30 hp pumps (one active and one standby). A trench, approximately 150 foot by 3 foot by 3 foot would be excavated from the existing Chlorination Facility building to the Thomas Shaft and to the percolation tank (as shown on Figure 3-2). Prior to commencement of this project, fencing will be installed as part of another project (Thomas Shaft Roadway Improvement Project, SFPUC Resolution No. 08-0061) and will remain installed around the steam engine foundation and bucket assembly; this fence will avoid potential inadvertent physical impacts or damage to the resource that could occur during project construction.

[L-SFLPAB-03]

The commenter requests that additional information be provided in the Draft EIR regarding the historic political controversy surrounding hydroelectric power related to the Hetch Hetchy System. The text on page 4.7-6 of the Draft EIR is revised to include the following description of the history of hydroelectric power in the region as follows:

> The Sierra Club, along with San Joaquin Valley farmers and the Spring Valley Water Company, contested the damming of the Tuolumne River. Opposition to construction of the Hetch Hetchy project came from a variety of interests. Understandably, the Spring Valley Water Company opposed this project, which effectively ended its role as the utility company supplying San Francisco with its municipal and domestic water (SFPUC, 1949). The Hetch Hetchy project was designed to transmit electrical power to San Francisco from a power plant at Moccasin. A politically charged conflict over this electric power and associated revenue pitted public power advocates against the privately financed electric power industry. Opposition came from electrical power generating companies like Pacific Gas and Electric Company (PG&E) and Great Western Power

Company (GWP), two utilities that served San Francisco and the Bay Area at the time. These private power companies opposed the competing generation and sale of electricity by public agencies, which was a provision of the Raker Act. The City and County of San Francisco (CCSF) planned to acquire PG&E and GWP's distribution systems within its service area, but between 1927 and 1941 the public consistently rejected bond issues required to fund their acquisition; allegedly, this opposition to the bond measures was largely funded by PG&E (Hundley, 1992; Sayles, 1985). The CCSF's agreements to have PG&E (which had acquired GWP in the 1930s) wheel its power through the company's existing transmission and distribution systems for delivery to San Francisco agencies, and its purchase of city power for resale, caused a longstanding controversy between the federal government, public power advocates, and the CCSF.

The text on page 4.7-29 of the Draft EIR is also revised to include the following additional references:

Hundley, Norris, *The Great Thirst: Californians and Water*, 1770s–1990s. University of California Press, pp. 187–189, 1992.

SFPUC, *San Francisco Water and Power*, pp. 57–61, June 1949.

The text on page 4.7-30 of the Draft EIR is also revised to include the following reference:

SFPUC, Thomas Shaft Roadway Improvement Project, SFPUC Resolution No. 08-0061, April 8, 2008.

Sayles, Stephen P., Hetch Hetchy Reversed: A Rural Urban Struggle for Power. *California History*, 64:4, pp. 256, Fall 1985.

[L-SFLPAB-04]

The commenter states that the board appreciated the opportunity to issue comments about the project but does not have an archeologist on the board to comment on the archaeological components. The comment is noted for the record. No changes to the Draft EIR are required.

BAWSCA
Bay Area Water Supply & Conservation Agency

October 3, 2008

RECEIVED
OCT 06 2008
CITY & COUNTY OF S.F
PLANNING DEPARTMENT
M E A

Mr. Bill Wycko
Acting Environmental Review Officer
San Joaquin Regional Water Quality Improvement Project Draft EIR
San Francisco Planning Department
1650 Mission Street, Suite 400
San Francisco, CA 94103

Subject: **Case No. 2007.0427E – San Joaquin Regional Water Quality Improvement Project Draft Environmental Impact Report**

Dear Mr. Wycko,

Thank you for the opportunity to provide the following comments from the Bay Area Water Supply & Conservation Agency (BAWSCA). BAWSCA represents the interests of 25 cities and water districts, an investor-owned utility, and a university, that purchase water wholesale from the San Francisco Regional Water System. These agencies, in turn, provide water to 1.7 million people, businesses and community organizations in Alameda, Santa Clara and San Mateo counties. These comments are in response to the Draft Environmental Impact Report (EIR) published August 25, 2008 for the San Joaquin Regional Water Quality Improvement project.

The comments below follow the report organization and do not reflect the level or priority.

1. **Section 2.12 – SFPUC Water System Improvement Program**
The footnote for Table 2-1 cites the January 2006 statement of level of service goals as presented in "San Francisco Public Utilities Commission, Water System Improvement Program" as the source for this table. The January 2006 document was clarified in a subsequent document which should also be referenced in the footnote and added to Section 2.5 – References. The source is "Parsons, WSIP System Assessment for Levels of Service Objectives; Prepared for San Francisco Public Utilities Commission, Final Report, November 22, 2006." [01]

2. **Section 3.3 – Proposed Project Components**
The new facility will significantly increase the power requirement for this site, however there appears no mention of what improvements may be required by PG&E to provide this power demand. UV systems are also sensitive to power interruptions. Please discuss the reliability of the power source to meet the new higher demand. [02]

3. **Section 3.7 – Approvals and Permits Required**
Please add the California Department of Public Health as one of the permitting agencies for this project. [03]

4. **Section 4.14 Energy Resources**
The energy consumption at the Tesla site is stated as increasing from 175,000 kWh per year to a new total of 6,000,000 kWh per year of which 3,550,000 kWh are for the UV generators. The power numbers quoted on page 4.14-6 appear to not add up since it is also stated that the UV reactors will require 1,800,000 kWh per year. Please verify the numbers and be sure they are consistent. Also, since the power use will go up nearly 10 times the current usages, what improvements will PG&E provide on their end? Are new transmission lines required? In the past, the Tesla Site appeared to have unstable power since it was near the end of the power grid. Since the power source is important given the sensitivity of UV reactors to stable power source, what is the large picture plan to ensure this reliability? [04]

Thank you for the opportunity to provide these comments on the Draft EIR for the San Joaquin Regional Water Quality Improvement Project dated August 25, 2008. If you have any questions, please contact me at (650) 349-3000.

Sincerely,

Nicole M. Sandkulla

Nicole M. Sandkulla, P.E.
Senior Water Resources Engineer

cc: A. Jensen, BAWSCA
R. McDevitt, Hanson Bridgett
D. Newkirk, Newkirk Environmental
T. Roberts, Terry Roberts Consulting
File

10.6 Response to Comments from the Bay Area Water Supply & Conservation Agency (L-BAWSCA)

[L-BAWSCA-01]

The commenter requests that the reference to Table 2-1, WSIP Goals and Objectives, be updated to include an additional reference. Per SFPUC Resolution No. 08-0200, the WSIP was adopted on October 30, 2008 and as a result the Goals and Objectives were further refined. Therefore, the most current source for Table 2-1 is SFPUC Resolution No. 08-0200 and Table 2-1 has been modified accordingly. Please refer to Chapter 3 of this document, Staff-Initiated Text Changes, for the updates to Table 2-1.

[L-BAWSCA-02]

The commenter has requested a discussion of the reliability of the power source that would be used to meet the new electrical demand. SFPUC has consulted with PG&E regarding historic outages at the facility. The data provided by PG&E shows that some outages occurred prior to 1998. However, reliability has improved and the outages within the last 10 years have not been significant. Between 1995 and 2006, the average number of the sustained outages was three per year, averaging 95.6 minutes per outage (SFPUC, 2008). Momentary outages also averaged three per year during that period. The onsite power backup system is automatically activated for all power interruptions and momentary outages.

In addition, to ensure uninterrupted service, the Tesla Treatment Facility is designed to address reliability. As described on page 3-7 of the Draft EIR, the facility is designed for "zero failure," providing both backup ultraviolet (UV) reactors and backup power generators. In addition, power supply at the site is being upgraded to improve reliability and to minimize the potential for power outages. As further described on page 3-9 of the Draft EIR, a new electrical transformer will be provided on site as a part of the project and a new electrical transmission line will be extended from the existing power pole to the new transformer and then undergrounded to the new buildings. All of these measures are included to improve the capacity and reliability of electrical supply to the Tesla Treatment Facility. The SFPUC has submitted a Service Application to PG&E for their review, and PG&E does not expect the need for any major improvements.

[L-BAWSCA-03]

The commenter requests that the California Department of Public Health be added as one of the permitting agencies for the project. In response to this comment, the following text on page 3-21 of the Draft EIR has been added as follows:

- Modification to Regional Operational Permit will be issued by the California Department of Public Health for changes in disinfection equipment used (Tesla Portal and Thomas Shaft sites).

[L-BAWSCA-04]

The commenter requested clarification of the anticipated energy consumption for the project facility. The estimated energy consumption described on page 4.14-6 of the Draft EIR for the new facilities at the Tesla Treatment Facility is accurate. The total energy consumption at the

Tesla Portal site would increase to a total estimated usage of 6,000,000 kilowatt-hours (kWh) per year. The existing Tesla Portal Hypochlorite Station, which uses most of the existing power at the Tesla Portal site (175,000 kWh), would be replaced by new facilities. Therefore, the energy consumption estimate for operation of the new facilities at the Tesla Portal site includes 1,800,000 kWh for the three buildings, 3,550,000 kWh for the UV reactors and approximately 650,000 kWh for the pumps, for a total of 6,000,000 kWh per year. Although no changes to the Draft EIR are required, page 4.14-6 of the Draft EIR has been revised to provide further clarification:

> SFPUC Power Enterprise provides power to the SFPUC's regional water system facilities, which use an estimated total energy usage of approximately 44 million kWh per year. This annual estimate includes the Tesla Portal facilities, which has a current demand of approximately 175,000 kWh per year. Operation of the new facilities at the Tesla Portal site could substantially increase overall on-site energy consumption. The SFPUC estimates that, in total, operation of the proposed improvements at the Tesla Portal facility would require approximately six million kWh per year. This estimate includes approximately 1,800,000 kWh for operation of the three new buildings (UV building, Chemical Process building and Office/Control building), approximately 3,550,000 kWh for the UV reactors, and approximately 650,000 kWh for the proposed pumps). Accounting for current energy use ~~This additional energy demand~~ at the Tesla Portal site ~~would~~, the project would result in a net increase of approximately 5,825,000 kWh, which represents roughly 13 percent of the regional water system's current annual energy use. ~~Under the significance criterion for energy, this additional energy demand represents the use of a large amount of energy, which is considered a potentially significant impact.~~ As described in the setting, the energy use by the regional water system is a fraction (less than three percent) of the long-term annual average energy production of the Hetch Hetchy system, and would remain at approximately three percent including the project's increased operational energy use.

Please see response to comment L-BAWSCA-02 for a discussion of power delivery and reliability.

San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

October 6, 2008

Bill Wycko
San Joaquin Regional Water Quality Improvement Project EIR
San Francisco Planning Department
1650 Mission Street, Suite 400
San Francisco, CA 94103

Project: Case No. 2007.0427E San Joaquin Regional Water Quality Improvement Project

District Reference No: 20080582

Dear Mr. Wycko,

The San Joaquin Valley Unified Air Pollution Control District (District) has reviewed the project referenced above and is providing the following comments:

1. As indicated in the draft Environmental Impact Report (EIR), the proposed project would be subject to District Rule 9510 (Indirect Source Review) because upon full build-out the project would include or exceed 9,000 square feet of space.

   District Rule 9510 is intended to mitigate a project's impact on air quality through project design elements or by payment of applicable off-site mitigation fees. Any applicant subject to District Rule 9510 is required to submit an Air Impact Assessment (AIA) application to the District no later than seeking final discretionary approval, and to pay any applicable off-site mitigation fees before issuance of the first building permit. If approval of the subject project constitutes the last discretionary approval by your agency, the District recommends that demonstration of compliance with District Rule 9510, including payment of all applicable fees, be made a condition of the project's approval. [01]

   Information about how to comply with District Rule 9510 can be found online at: http://www.valleyair.org/ISR/ISRHome.htm.

2. As previously stated in our comment letter dated June 19, 2007, the EIR should include estimates of projected pollutant emissions related to the project, and the methodology, model assumptions, inputs and results. The EIR should identify the components and phases of the project. The EIR should provide emissions projections for the project at the build out of each phase (including ongoing [02]

Seyed Sadredin
Executive Director/Air Pollution Control Officer

Northern Region
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Central Region (Main Office)
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Tel: (559) 230-6000 FAX: (559) 230-6061
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Southern Region
2700 M Street, Suite 275
Bakersfield, CA 93301-2373
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Printed on recycled paper.

emissions from each previous phase). The District recommends using the most current URBEMIS program to quantify these emissions. URBEMIS can be downloaded from http://www.urbemis.com/. [02] cont.

If you have any questions or require further information, please call Patia Siong at (559) 230-5930.

Sincerely,

Dave Warner
Director of Permit Services

Arnaud Marjollet
Permit Services Manager

DW:ps

cc: File

10.7 Response to Comments from the San Joaquin Valley Air Pollution Control District (L-SJVAPCD)

[L-SJVAPCD-01]

The commenter is reiterating that the proposed project would be subject to San Joaquin Valley Air Pollution Control District (SJVAPCD or District) Rule 9510 (Indirect Source Review). As described under Impact 4.9-1, Construction Emissions of Criteria Pollutants, on p. 4.9-22 of the Draft EIR, the project would be subject to the requirements of Rule 9510. Accordingly, NO_x and PM_{10} reduction measures will be implemented for the SJRWQIP through Mitigation Measure 4.9-1a, SJVAPCD Dust Control Measures and Mitigation Measure 4.9-1b, SJVAPCD Exhaust Control Measures. As described further in response to comment L-SJVAPCD-02, below, implementation of these measures will achieve onsite reductions required by District Rule 9510. Prior to commencement of construction of the SJRWQIP, the SFPUC will submit an Air Impact Assessment application to the SJVAPCD in accordance with Rule 9510. The proposed facility improvements at the Thomas Shaft would not be subject to Rule 9510 because the proposed project's square footage is well-below the SJVAPCD's applicability threshold and construction emissions are considered minor.

[L-SJVAPCD-02]

The commenter requests that the Draft EIR include estimates of projected pollutant emissions for the various phases of the project.

CONSTRUCTION

Construction emissions have been estimated for the facility improvements at the Tesla Portal site and include construction of the chemical process building (14,000 square feet), the office/control building (3,500 square feet), and the UV building (20,000 square feet). Buildout at the Thomas Shaft site would result in a 360-square-foot prefab structure. The square footage of this structure is significantly below the SJVAPCD's 9,000-square-foot threshold for Rule 9510 (Indirect Source Review) applicability. For this reason construction emissions were only calculated for construction associated with the Tesla Portal site. Per the SJVAPCD's suggestion, URBEMIS was used to estimate unmitigated emissions. Table 4.9-5 below presents the results of these calculations.

URBEMIS was also used to calculate specific emission reductions to demonstrate compliance with District Rule 9510. Only the fugitive dust control measures specified in Mitigation Measure 4.9-1a of the Draft EIR were applied to the URBEMIS model as these were the only proposed mitigation measures that could be quantified in URBEMIS. Therefore, the application of all mitigation described in Mitigation Measures 4.9-1a and 4.9-1b would be expected to achieve even greater reductions. Unmitigated construction emissions of PM_{10} are below the District's Rule 9510 threshold of 2 tons/year and implementation of fugitive dust control measures would further reduce the PM_{10} dust emissions by approximately 40 percent. Rule 9510 also requires that NO_x emissions be reduced by 20 percent during construction. Mitigation Measure 4.9-1b also includes a host of measures that will be implemented to reduce exhaust emissions (including NO_x). As stated in Mitigation Measure 4.9-1b, construction equipment engines greater than 50 horsepower will be equipped with Tier 2

diesel engines. Equipment with Tier 2 diesel engines have resulted in tailpipe reductions of 21 to 39 percent for NO_x and 41 to 61 percent for PM (CARB, 2007). Therefore, implementation of this mitigation measure is expected to reduce NO_x emissions from construction significantly and exceed the District Rule 9510 reduction requirements.

Text of the Draft EIR has been revised to include more detailed construction emissions information as follows:

On page 4.9-22 of the Draft EIR, the following text and table are inserted in the first full paragraph:

> Equipment exhaust emissions are generated from the combustion of fuels used for the operation of construction equipment. Fugitive dust emissions are generated by the suspension of particulate during earth-moving activities. Employee vehicle emissions and construction truck emissions are generated from the combustion of fuels and from the entrainment of road dust during travel along roadways on site and off site of the construction area. Asphalt paving emissions are generated from the evaporation of regulated volatiles, or diluents, used to liquefy asphalt cement. Reasonable worst-case uncontrolled construction emissions are summarized in Table 4.9-5.

TABLE 4.9-5
REASONABLE WORST-CASE ANNUAL UNCONTROLLED EMISSIONS AT THE TESLA PORTAL SITE DURING CONSTRUCTION
(TONS PER YEAR)

Project Component	ROG	NO_x	CO	SO_2	PM_{10} (Dust)	PM_{10} (Exhaust)	PM_{10} Total	$PM_{2.5}$ (Dust)	$PM_{2.5}$ (Exhaust)	$PM_{2.5}$ Total	CO_2
Chemical Building	0.30	1.14	0.72	0	0.02	0.07	0.09	0	0.06	0.07	113.04
Office Building	0.18	1.06	0.57	0	0	0.07	0.07	0	0.06	0.06	94.04
UV Building	0.37	1.19	0.81	0	0.02	0.07	0.09	0	0.07	0.07	123.90
Total	**0.85**	**3.38**	**2.10**	**0**	**0.04**	**0.21**	**0.25**	**0.01**	**0.19**	**0.20**	**330.97**

Source: URS, 2008.

On page 4.9-23, the tenth paragraph under Impact 4.9-1: Construction emissions of criteria pollutants, is edited as follows:

> In accordance with the guidance outlined in the GAMAQI, the SFPUC would implement Mitigation Measures 4.9-1a and 4.9-1b, which require a host of actions that the SJVAPCD has determined will reduce fugitive dust (PM) emissions and equipment exhaust emissions. These measures include, but are not limited to: stabilization of dust emissions, hauling restrictions, track out restrictions, speed restrictions, idling restrictions, and activity management. See Section 5.2.5 for a

specific listing of these actions. Implementation of fugitive dust control measures alone would result in a reduction in PM_{10} dust-related emissions by 40 percent and $PM_{2.5}$ emissions by 38 percent. Total PM_{10} and $PM_{2.5}$ emissions would be reduced by 7 and 2 percent, respectively.) related to construction emissions at the Tesla Portal site (URS, 2008). Implementation of ~~these mitigation~~ all of the measures included in Mitigation Measures 4.9-1a and 4.9-1b would reduce the potentially significant air quality impact associated with project construction emissions of criteria pollutants at the Tesla Portal site to less than significant.

On page 4.9-23 of the Draft EIR, after the first paragraph under the title Thomas Shaft, the following paragraph has been modified as follows:

Details regarding the size, scope, and length of construction for the Thomas Shaft site are outlined in the project description (Chapter 3). Chapter 3 also details expected construction equipment that will be operational throughout build out. In general, construction at this location is anticipated to start July 2009 and last for approximately 6 months. The development footprint at the Thomas Shaft site is below the SJVAPCD's Rule 9510 threshold triggering the need for quantification and therefore emissions have not been calculated but are discussed qualitatively.

OPERATION

As stated in the Draft EIR, Section 4.9 Air Quality, Impact 4.9-3, operational emissions from the proposed project are considered to be minor, including emergency generators, diesel tank emissions, employee vehicle trips, and maintenance visits and deliveries at the Tesla Portal site. As described in the Draft EIR on page 4.9-20, project operation at the Thomas Shaft site would not require an emergency generator, diesel tanks, nor result in any increase in the number of employees required onsite and therefore would not result in any operational emissions. At the Tesla Portal site, the employee trips would be two vehicle round trips per day and deliveries and maintenance visits would be five round-trips per day. It was assumed employee and delivery trips would be coming from Tracy. The generators are assumed to be two 2,011-horsepower generators operating one hour per week for routine testing and emergency backup. As shown in Table 2.7-1, estimated emissions would not exceed the 2 tons/year threshold for NO_x or PM_{10}, which exempts operational emissions from District Rule 9510.

Text of the Draft EIR has been revised to include more detailed operations emissions information as follows:

On page 4.9-27 of the Draft EIR, the following text and table are inserted in the first full paragraph:

All operational exhaust emissions are generated from the combustion of fuels. Diesel tank emissions are generated from the displacement of volatile vapors

during refilling and the evaporation of volatiles. Reasonable worst-case uncontrolled operations emissions are summarized in Table 4.9-6.

Table 4.9-6
REASONABLE WORST-CASE ANNUAL UNCONTROLLED EMISSIONS ESTIMATES AT THE TESLA PORTAL SITE DURING OPERATIONS (TONS PER YEAR)

Source	ROG	NO_X	CO	SO_2	PM_{10}	CO_2
Emergency Generator	0.0553	1.0515	0.5996	0.0009	0.0346	82.5757
Transportation	0.0014	0.0274	0.0210	0.0001	0.00069	9.6761
Diesel Tanks	0.0343	--	--	--	--	--
Total	**0.0911**	**1.0789**	**0.6206**	**0.0009**	**0.0353**	**92.2518**

Source: URS, 2008

The text on page 4.9-35 of the Draft EIR is also revised to include the following additional reference:

URS, 2008, San Joaquin Regional Water Quality Improvement Project Air Emissions Estimates. November, 24, 2008.

"Steve Lawrence"
<splawrence@sbcglobal.net>
08/24/2008 07:08 PM

To <jamie.dean@sfgov.org>
cc
bcc
Subject San Joaquin Regional Water Quality Improvement Project: Draft EIR comment

1. From the descriptions of the Tesla and Lawrence-Livermore projects, it appears that the latter addresses giardia while the former does not. The same water is utilized. Is giardia addressed or to be addressed downstream of Tesla Treatment Facility? Is there a reason why one project addresses giardia while the other does not? [01]

2. PG&E power needs will increase. Why can't Hetchy hydropower power be used when available? By using Hetchy hydropower, cost for electricity would be lowered and clean energy would be used, lowering impact on greenhouse gas emission. [02]

Steve Lawrence

10.8 Response to Comments from Steve Lawrence (C-Lawre)

[C-Lawre-01]

The commenter states that it appears that the proposed project at Tesla Portal site does not address *Giardia*. The SFPUC water source is in compliance with the current Surface Water Treatment Rule, which requires *Giardia* inactivation. *Giardia* inactivation is currently accomplished through the addition of chlorine to the regional water supply at the Tesla Disinfection Facility, or at Thomas Shaft, if disinfection does not occur at Tesla. The addition of chlorine at these facilities provides for adequate contact time for the regional water supply to inactivate *Giardia*. This process would continue, unchanged, with implementation of the proposed project.

The new Long Term 2 Surface Water Treatment Rule requires that an unfiltered supply use two different disinfectants to inactivate three organisms: *Cryptosporidium*, *Giardia*, and viruses. For the proposed project, the two disinfectants would be ultraviolet light and chlorine.

In addition to providing for disinfection of the regional water supply, the Thomas Shaft facility also serves as the supply point for Lawrence Livermore National Laboratory (LLNL) Site 300. Since there is not sufficient contact time between the Tesla Treatment Facility and the Thomas Shaft site during certain periods to adequately treat the LLNL Site 300 water supply, the proposed project activities at the Thomas Shaft site (installation of a small UV unit) would ensure that *Giardia* inactivation for the water supply serving LLNL Site 300 can be achieved in accordance with the Surface Water Treatment Rule. The proposed project would therefore allow the SFPUC to satisfy their contractual agreement with LLNL to provide potable water to LLNL Site 300.

The following text on page 3-7 of the Draft EIR has been added as follows:

> *Giardia* inactivation is currently accomplished through the addition of sodium hypochlorite (chlorine) to the regional water supply at the Tesla Disinfection Facility or at Thomas Shaft, which provides adequate contact time for the inactivation of *Giardia*. To provide adequate *Giardia* disinfection to LLNL Site 300, additional ultraviolet (UV) facilities would be installed at Thomas Shaft (see Section 3.2). ~~Sodium hypochlorite~~ Chlorine would be fed from the Chemical Process Building and injected into the out flow manifolds. Although the location of the chlorination function at the site would change, the chlorine injection process itself would be essentially unchanged. In addition, to lower the pH of the water, fluoride and CO_2 would be added to improve current water quality management capabilities.

[C-Lawre-02]

The commenter states that the need for PG&E power will increase and questions why Hetch Hetchy hydropower is not used. As stated in the Draft EIR on pp. 4.11-4 and 4.14-2, SFPUC

Power Enterprise hydroelectric power is used to power the existing facilities at the Tesla Portal site and will continue to be used to power the new Tesla Treatment Facility. The City and County of San Francisco has an interconnection agreement in place with PG&E where SFPUC Power Enterprise hydroelectric power is distributed through PG&E's transmission lines. The City and County of San Francisco pays PG&E a per kWh charge to transmit SFPUC Power Enterprise hydroelectric power.

Plasterers' and Cement Masons' Local Union

Local 300, Modesto Area 429

Operative Plasterers and Cement Masons International Association
A.F.of. L. – C. I. O.

101 College Ave., Suite 1-A, Modesto, California, 95350
Phone: (209) 524-0614
Fax: (209) 544-7292

September 15, 2008

Bill Wycko, Environmental Review Officer
San Joaquin Regional Water Quality Improvement Project
San Francisco Planning Department
1650 Mission Street, Suite 400
San Francisco, CA 94103

Dear Mr. Wycko:

I am the Business Agent for the Plasterer's & Cement Masons Local 300, Area 429 representing skilled trades people from the Central Valley. I also serve on the San Francisco Public Utilities Commission (SFPUC) Water System Improvement Program (WSIP) Small Firm Advisory Committee, which assists the SFPUC in providing business opportunities to small, locally based construction companies throughout its service territory. I am writing to express our members' strong support for SFPUC's proposed San Joaquin Regional Water Quality Improvement Project.

We have closely monitored the SFPUC's progress, particularly in the Central Valley, during the development and initial construction of the WSIP, and the San Joaquin Regional Water Quality Improvement Project is especially important for all of our members who live and work in the area. The Tesla Treatment Facility Project and the Lawrence Livermore Water Quality Improvements will ensure that water provided by the Hetch Hetchy System continues to be of the highest quality for years to come. [01]

As a member of the SFPUC WSIP Small Firm Advisory Committee, I assure you that the SFPUC' is committed to utilizing local workers and contractors on this project. The construction of this treatment plant will provide many local residents with work opportunities.

In closing, I strongly urge to approve this project. If you have any questions, please do not hesitate to contact me.

Sincerely,

Lucille Palmer-Byrd
Business Agent, OPCMIA Local #300/Area #429

Cc: Steven Scott, Business Manager/Financial Secretary, OPCMIA Local 300

10.9 Response to Comments from the Plasterers' and Cement Masons' Local Union (G-OPCMIA)

[G-OPCMIA-01]

The commenter strongly urges that the project be approved. The comment is noted for the record. No change to the Draft EIR is required.

SAN FRANCISCO PLANNING DEPARTMENT

Major Environmental Analysis Division

PUBLIC HEARING

SAN JOAQUIN REGIONAL WATER QUALITY

IMPROVEMENT PROJECT

Tuesday, September 16, 2008, 6:42 PM

Hearing held at:

TRACY GOLF & COUNTRY CLUB

35200 South Chrisman Road

Tracy, California

Reported by: KAREN A. JOSEPH, CSR #10919

SPEAKERS:

JAMIE DEAN, San Francisco Planning Department

DAVID J. REEL, URS Corporation

BIJAN AHMADZADEH, San Francisco PUC

DAVID THOMAS, San Joaquin Building Trades

AUGIE BELTRAN, Carpenters Union Local 25

--oOo--

MS. DEAN: Okay. Good evening and welcome to today's public hearing on the draft environmental impact report for the San Joaquin Regional Water Quality Improvement Project. Please help yourself to refreshments over to my left, and the rest rooms are behind you.

My name is Jamie Dean. And I'm the environmental planner with the San Francisco Planning Department major environmental analysis section, and I will be leading this evening's meeting.

The first item on tonight's agenda is introductions, and then we will go through a project overview provided by the Public Utilities Commission. And then we'll open the hearing for public comments.

As I said, my name is Jamie Dean. I'm with the San Francisco Planning Department, and the San Francisco Planning Department is the lead agency under the

California Environmental Quality Act, also referred to as CEQA. The San Francisco Planning Department is the lead agency for all projects sponsored by the City and County of San Francisco.

As I said, the SFPUC is the project proponent, and with us here this evening is Bijan Ahmadzadeh, who's the project manager; Karen Frye, who's the environmental project manager; and Jim Marks with the communications department.

I would now like to turn this over to Bijan who will go through the project overview.

MR. AHMADZADEH: Good evening, everyone. My name is Bijan Ahmadzadeh. I'm the project manager for these two projects. So I guess we'll start out, just want to run through real quickly the project location. This is our Hetch Hetchy water system map. And the two projects that we're going to talk about real briefly tonight is the Tesla Portal site, which is just out on the other side of the golf club -- golf course, and the Thomas Shaft site which is about -- it's off of Corral Hollow Road about a mile away from here.

Okay. Our proposed project is part of the water system improvement program, and our goals pretty much follow the water system improvement goals which is basically maintaining high-quality water, reducing

vulnerability to earthquakes, increasing the water delivery reliability, meeting customer water supply needs, enhancing sustainability, and achieving a cost-effective, fully operational system.

Next slide. This is a little close-up view of the two locations. The Tesla Portal site, and the Thomas Shaft site is just outside of Tracy. And basically our existing Tesla Portal facility is 70 years old. It's the primary disinfection point for the Hetch Hetchy water system which we currently treat with sodium hypochlorite. And the existing facility is not built to current earthquake standards.

Next slide. The project objective for the Tesla treatment facility is basically replacing the existing facilities to meet current seismic safety, fire, and building code standards. Also the other objective of the project is to construct water treatment facilities to meet the new United States Environmental Protection Agency's regulation for inactivation of Cryptosporidium in drinking water.

Basically what this says, this rule says, is that we need to utilize two disinfection processes for treating water. One of them is going to be the advance disinfection, which basically the water going through an array of ultraviolet lights to kill pathogens. The other

disinfection is through the process of sodium hypochlorite which we currently are using.

And also the other object is improved water quality management capabilities. Basically adding fluoride and carbon dioxide to help do some adjustments to the pH of the water.

The Tesla site, which is a bigger picture here, is basically the objective of -- we have the existing San Joaquin -- three San Joaquin pipelines that are coming into the -- this parcel which is owned by the San Francisco PUC. It's a 54-acre parcel. We're going to be intercepting the three San Joaquin pipelines, and then on both upstream and downstream of this new facility.

And the site basically is going to be composed of the new disinfection process which is the UV building, a chemical process building, and also this admin building for our operators.

And then we'll -- the staging area for the construction site is going to be within this cross-hatched area and this cross-hatched area of the parcel. And then we'll have some road improvements to the new facility.

The other site is the Thomas Shaft facility site. Basically this site is our backup chlorination facility in case for some reason the sodium hypochlorite facility goes down, we have a backup facility at Thomas Shaft as backup.

And basically this is our delivery point to our -- one of our delivery points to our current -- well, our customer, to Lawrence Livermore National Laboratory.

Next slide. And the objectives for this project, similar to Tesla, is basically construction of water treatment facilities to meet the United States Environmental Protection Agency requirements for reduction of Cryptosporidium and Giardia, and also to enable delivery of potable water to Lawrence Livermore National Laboratory, which we have a contractual agreement with them to continue providing water to them. And also to be -- it will also continue to provide the backup chlorination capabilities as currently it is.

The Thomas Shaft site, this site is about one and a half miles off of Corral Hollow Road. There's an existing dirt road that we currently use to get up to the site. The UV facility -- the UV equipment is going to be housed within the existing chlorination facility. We'll have some pipe work connecting the existing treatment facility to some well heads that we -- currently is located just across the street from there.

And then we'll have some -- a small percolation tank for treating some of the processed water that comes from the process. And then we're proposing to construct a prefabricated building to protect the exposed

appurtenances over the well heads. And then we have some staging area just at the location of the facility. So those are the big picture overviews of the two projects. And so --

MS. DEAN: Okay. Thank you. So now onto this evening's public hearing. So the purpose of the meeting here tonight is to hear your comments on the accuracy and adequacy of the draft environmental impact report. And we will not be answering your questions here today, but rather your comments will be responded to in a comments and responses document.

So this is where you can submit written comments. You can hand them to me this evening. You can also participate in our next public hearing which will be before the San Francisco Planning Commission on Thursday. And you can also send by e-mail or fax or U.S. mail. And as a reminder, we will accept written comments and verbal comments until October 8th. That is the close of the public comment period.

If you would like to view the draft environmental report in its entirety, it's available on-line or also in print at the San Francisco Planning Department San Francisco main library and the Tracy library.

Okay. I'd like to go over some ground rules for this evening's comment period.

MR. REEL: Sorry about that, Jamie. Something happened.

MS. DEAN: That's okay.

MR. REEL: It's skipping that.

MS. DEAN: Well, the first is please complete any speaker cards. Those are on the table when you came in. And I will call your name, and if you could please just stand up and speak your points. We ask that you do keep it to a time limit of three minutes typically, but given that there are not a whole lot of us here, you can extend it to five minutes if you'd like.

You can also submit verbal comments directly to our court reporter if you are uncomfortable speaking to all of us. Okay. So with that --

MR. REEL: Did you want to call the two?

MS. DEAN: Sure. And with that, I'll get started. David Thomas.

MR. THOMAS: Where do I go to speak?

MR. REEL: I think if you're in front of the court reporter, then she can take your -- it will be easier to hear.

MS. DEAN: Yeah.

MR. THOMAS: Okay. Good evening. My name is Dave Thomas, and I'm with the San Joaquin Building Trades Council. And I'm here tonight to speak in favor of the [G-SJBTC-01]

project. I've been to many meetings regarding the Hetch Hetchy project, and this is a greatly needed facility here for the treatment of water for San Francisco. And it's going to be greatly needed in the area for jobs in the near future hopefully that's going to be starting pretty soon.

And I can speak on behalf of the Stanislaus Building Trades Council also who is in favor of this project, and there is another speaker here that will reiterate my comments. But we're in favor of it. And it's been EIR'd to death, I'm sure, and we have no reason to believe that there's anything wrong with the environmental impact reports. And San Francisco is a very conscientious county when it comes to construction and building.

And I just want to end my comments by saying we're in favor of the project and let's build it. Thank you.

[G-SJBTC-01] cont.

MS. DEAN: Okay. Augie Beltran.

MR. BELTRAN: Good evening. My name is Augie Beltran. I represent the Carpenters Union in the Central Valley. We've reviewed the EIR, and I think that since there are not a lot of people here, it's pretty much a testament to the work that is done over by you people over in San Francisco.

[G-CVCU-01]

You guys have done a great job of educating our public officials, educating our local citizens in letting them know that this is a good project. Anything that San Francisco puts their name on has got to be quality because you guys inspect the heck out of everything. [G-CVCU-01] cont.

So just know that the trades are behind you guys 100 percent. We fully endorse this EIR and we're here to help in any way. Thank you.

MS. DEAN: Okay. Is there anyone else that would like to speak? Okay. Well, I guess with that we can close the comment period for this evening. Can we put up the slide with where they can send additional comments? Okay.

MR. BELTRAN: You guys are lucky. Our plan took six hours in public hearing with 150 people.

MR. AHMADZADEH: So there's some billboards here, so if you have any more questions on these, on these pictures or some clarification, we'd be more than welcome to answer them.

(Time noted: 6:57 PM.)

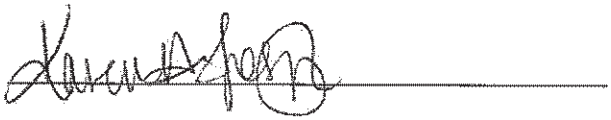
STATE OF CALIFORNIA,)
)
COUNTY OF SAN JOAQUIN)

I, KAREN A. JOSEPH, a Certified Shorthand Reporter in and for the County of San Joaquin, State of California, do hereby certify;

That on September 16, 2008, thereof, I reported verbatim in shorthand writing the foregoing proceedings;

That I thereafter caused my shorthand writing to be reduced to typewriting, and that the foregoing transcript constitutes a full, true, and correct transcription of all proceedings had and given.

IN WITNESS HEREOF, I have hereunto set my hand and affixed my Official Seal this 19th day of September, 2008.



KAREN A. JOSEPH, CSR #10919
Certified Shorthand Reporter

10.10 Response to Comments from the Public Hearing in Tracy (September 16, 2008)

[G-SJBTC-01]

The commenter is in favor of the project. The comment is noted for the record. No change to the Draft EIR is required.

[G-CVCU-01]

The commenter gives full endorsement of the project. The comment is noted for the record. No change to the Draft EIR is required.

San Joaquin Regional Water Quality Improvement Project

Reporter's Transcript of Proceedings

September 18, 2008

Reported By: Freddie Reppond
Job: 7427

SAN FRANCISCO PLANNING COMMISSION

Regular Meeting

Thursday, September 18, 2008

Agenda Item 12, 2007.0427E,

San Joaquin Regional Water Quality Improvement Project

Presentation and Public Comment

on the Draft Environmental Impact Report

City Hall, Room 400

Dr. Carlton B. Goodlett Place

San Francisco, CA 94102

Reported by: Freddie Reppond

A P P E A R A N C E S

FOR THE PLANNING COMMISSION:

Commissioner Christina R. Olague, President

Linda D. Avery, Commission Secretary

Commissioner Michael J. Antonini

Commissioner Gwyneth Borden

Commissioner William L. Lee

Commissioner Kathrin Moore

Commissioner Hisashi Sugaya

FOR THE SAN FRANCISCO PLANNING DEPARTMENT:

Jamie Dean, EIR Coordinator

--oOo--

[The item was called at 6:12 p.m.]

COMMISSION SECRETARY AVERY: This is Case No. 2007.0427. This is the San Joaquin Regional Water Quality Improvement Project.

COMMISSIONER SUGAYA: I would like to say, though, that we did -- Carey and Company did work on a related project on the -- not this San Joaquin but a different San Joaquin. And the report that we contributed to is referenced in the document, but I have no direct conflicts of interest, so I'm going to participate.

COMMISSION PRESIDENT OLAGUE: Thank you.

MS. DEAN: Good evening, President Olague and members of the Commission. My name is Jamie Dean and I'm with the major environmental analysis section of the Planning Department. I'm the EIR coordinator for the San Joaquin Regional Water Quality Improvement project. This project is sponsored by the SFPUC and it is one of the many facility-improvement projects that comprise the larger water-system-improvement program.

A programmatic EIR was prepared by the Planning Department on this larger program and published in June 2007. A responses-and-comments document for this program will be published at the end of September.

With me here today are some members of the

PUC, should you have any questions on the proposed project description.

COMMISSION PRESIDENT OLAGUE: Thank you.

At this time, we will open it up for comments on the EIR.

Is there any public comment on this item?

Seeing none, public comment is closed.

Commissioners?

COMMISSIONER LEE: There's no action --

COMMISSION PRESIDENT OLAGUE: No action required, but do we have comments? I'm not asking if you have action. I'm asking if you have comments.

COMMISSIONER SUGAYA: No. The cultural resources section is really great.

COMMISSION PRESIDENT OLAGUE: Okay. There we are. So thank you. There's no public comment. The Commissioners have no comments, other than Commissioner Sugaya's, so we are --

COMMISSION SECRETARY AVERY: Madam President, I would read into the record that written comments will be accepted at the Planning Department's offices until the close of business on October 8th, 2008.

With that, this item has been concluded. Thank you.

--oOo--

STATE OF CALIFORNIA)
COUNTY OF SAN FRANCISCO)

CERTIFICATE OF REPORTER

I, the undersigned, a duly authorized Shorthand Reporter and licensed Notary Public, do hereby certify that on the date indicated herein that the above proceedings were taken down by me in stenotype and thereafter transcribed into typewriting and that this transcript is a true record of the said proceedings.

IN WITNESS WHEREOF I have hereunto set my hand on this 29th day of September, 2008.

_____

FREDDIE REPPOND

10.11 Response to Comments from the Public Hearing in San Francisco (September 18, 2008)

No comments were received.

10.12 References

California Burrowing Owl Consortium, Burrowing Owl Survey Protocol and Mitigation Guidelines, 1993.

Federal Energy Regulatory Commission (FERC), Reservoir Release Requirements for Fish at the New Don Pedro Project [FERC Project No. 2299-024], California, Draft Environmental Impact Statement, April 1996.

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SFPUC, Appendix C of the DB-116 Request for Proposal Tesla Treatment Facility Project Reference Documents, Revision 2 – 14 July 2008f.

San Joaquin Council of Governments (SJCOG), San Joaquin County Multi-Species Habitat Conservation and Open-Space Plan, 2006.

URS, San Joaquin Regional Water Quality Improvement Project Air Emissions Estimates. November 24, 2008.

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CHAPTER 3
Staff-Initiated Text Changes

3.1 Introduction

The following changes to the text of the San Joaquin Regional Water Quality Improvement Project (SJRWQIP, or proposed project) Draft Environmental Impact Report (Draft EIR) are made in response to comments on the Draft EIR, and to reflect changes made in the Water System Improvement Program (WSIP) Program EIR (PEIR) and the approval of the WSIP, or are included to clarify the Draft EIR text. The text revisions are organized by page number (or the first page number if there is more than one) that appears in the Draft EIR. In each change, new language is double underlined, while deleted text is shown in ~~strike-out~~.

3.2 Water System Improvement Program

As discussed in the Draft EIR, the SJRWQIP is part of the San Francisco Public Utilities Commission's (SFPUC) WSIP. The San Francisco Planning Department prepared a Draft PEIR on the WSIP, which was published in June 2007. Information on the originally proposed WSIP, as described in the Draft PEIR, was presented in the SJRWQIP Draft EIR. In response to comments on the Draft PEIR, the SFPUC proposed several changes to the WSIP. These changes are detailed in the Final PEIR along with the environmental effects of the revised program. The Final PEIR was certified by the San Francisco Planning Commission on October 30, 2008 (Motion No. 17734) and the revised WSIP (known as the "Phased WSIP Variant" in the Final PEIR) was adopted by the SFPUC (Resolution No. 08-0200) on the same day.

This chapter includes revisions to the SJRWQIP Draft EIR to account for the changes that were made to the WSIP subsequent to publication of the Draft EIR on the SJRWQIP, certification of the Final PEIR on the WSIP, and adoption of the WSIP by the SFPUC. Appendix B.4, B.5, and B.6 supplements this chapter by including the actual text from the Final PEIR on the revised WSIP along with other information from the Final PEIR that is relevant to the revised WSIP, such as its environmental effects.

3.3 Text Revisions

Table of Contents

Page v of the Draft EIR, Table of Contents, under Appendices the text is edited as follows:

A. NOP and Scoping Summary Report ~~(Provided on CD)~~ A-1
B. WSIP ~~Draft~~ PEIR Reference Chapters (Provided on CD) B-1
B.1 WSIP ~~Draft~~ PEIR Chapter 5 – Water Supply and System Operation-Setting and Impacts

B.2 WSIP ~~Draft~~ PEIR Chapter 7 – Growth Inducement Potential and Indirect Effects of Growth
B.3 WSIP ~~Draft~~ PEIR Chapter 9 – CEQA Alternatives
B.4 WSIP PEIR Revisions
B.~~4~~5 WSIP Draft PEIR Appendix E – Growth Inducement and Supporting Information
B.6 WSIP Draft PEIR Appendix O – Hydrologic Modeling – Additional Supporting Information

Page vi of the Draft EIR, Table of Contents, under List of Tables the following text is added per comment L-SJVAPCD-02:

Table 4.9-5 Reasonable Worst-Case Annual Uncontrolled Emissions at the Tesla Portal Site during Construction (Tons per Year)
Table 4.9-6 Reasonable Worst-Case Annual Uncontrolled Emissions at the Tesla Portal Site during Operation (Tons per Year)

Chapter 1 Executive Summary

Page 1-4 of the Draft EIR under 1.3 Summary of the Environmental Impacts and Mitigation the second paragraph has been changed as follows:

> As discussed in Chapter 6, Growth Inducement, the proposed project is one of several improvement projects that comprise the SFPUC's Water System Improvement Program (known as the "Phased WSIP Variant"), and implementation of the WSIP would support growth in the SFPUC service area, thereby contributing indirectly, to environmental impacts caused by that growth. Because the proposed project is part of the WSIP and would contribute to the WSIP's growth inducement impact, the project therefore would contribute to the potentially significant and unavoidable program-level impacts associated with growth inducement.

Page 1-5 of the Draft EIR under "1.6 Overview of SFPUC Regional Water System" the following paragraphs have been changed as follows:

1.6 Overview of SFPUC Regional Water System

The proposed project is a component of the SFPUC's ~~Water System Improvement Program (~~WSIP~~)~~. As a component of the WSIP, it contributes to the impacts that the WSIP, as a program, may have on the environment. To address the potential environmental impacts of the proposed WSIP, the San Francisco Planning Department prepared ~~published~~ a ~~Draft~~ Program EIR (~~Draft~~ PEIR) ~~on June 29, 2007~~that was certified by the San Francisco Planning Commission on October 30, 2008 (Motion No. 17734). At a project-level of detail, the ~~Draft~~ PEIR evaluated~~s~~ the environmental impacts of the WSIP~~SFPUC's proposed water supply option~~ and, at a program-level of detail, it evaluated~~s~~ the environmental impacts of the WSIP's facility improvement

projects. This section provides background on the SFPUC's water system, and the following sections provide background on the ~~proposed~~ WSIP and the ~~WSIP Draft~~ PEIR.

The CCSF, through the SFPUC, owns and operates a regional water system that extends from the Sierra Nevada to San Francisco and serves retail and wholesale customers in San Francisco, San Mateo, Santa Clara, Alameda, and Tuolumne counties. The regional water system consists of water conveyance, treatment, and distribution facilities, and delivers water to retail and wholesale customers. The existing regional system includes over 280 miles of pipelines, over 60 miles of tunnels, 11 reservoirs, five pump stations, and two water treatment plants. The SFPUC currently delivers an annual average of about 265 mgd of water to its customers. The source of the water supply is a combination of local supplies from streamflow and runoff in the Alameda Creek watershed and in the San Mateo and Pilarcitos Creeks watersheds (referred to together as the Peninsula watersheds), augmented with imported supplies from the Tuolumne River watershed. Local watersheds provide about 15 percent of total supplies and the Tuolumne River provides the remaining 85 percent.

Beginning on **Page 1-5** of the Draft EIR, "1.6.1 SFPUC Water System Improvement Program" has been changed as follows:

1.6.1 SFPUC Water System Improvement Program

On October 30, 2008, t~~T~~he SFPUC ~~is proposing to~~ adopted ~~and implement~~ a regional WSIP (known as the "Phased WSIP Variant") (refer to www.sfwater.org; SFPUC, 2008~~6; see also SFPU Resolution 08-0200~~). The WSIP would improve the regional system with respect to water quality, seismic response, water delivery, and water supply to meet water delivery needs in the service area through the year 2018~~2030~~ and would establish level of service goals and system performance objectives. The proposed program area spans seven counties—Tuolumne, Stanislaus, San Joaquin, Alameda, Santa Clara, San Mateo, and San Francisco.

The WSIP includes ~~would implement~~ a ~~proposed~~ water supply strategy and modifications to ~~option, modify~~ system operations, and construction of a series of facility improvement projects. The proposed project, along with several other facility improvement projects, is a component of the WSIP.[1] The overall goals of the WSIP are to maintain high-quality water; reduce vulnerability to earthquakes; increase delivery reliability and improve the ability to maintain the system; meet customer water supply needs ~~purchase requests in nondrought and drought periods~~; enhance sustainability in all system activities; and achieve a

[1] The proposed project is listed as three separate projects in the WSIP ~~Draft~~ PEIR: the Tesla Portal Disinfection Facility, the Hetch Hetchy Advanced Disinfection, and the Lawrence Livermore Supply Improvements. For purposes of this EIR, these three projects are evaluated as one project given their geographic proximity, construction schedule, and the interrelated function of the two proposed facilities at the Tesla Portal site.

cost-effective, fully operational system (refer to Table 2-1, WSIP Goals and Objectives). To further these program goals, the WSIP also includes objectives that address system performance in the areas of water quality, seismic reliability, delivery reliability, and water supply through the year 2018~~2030~~. (See SFPUC Resolution No. 08-0200.)~~The regional water system consists of water conveyance, treatment, and distribution facilities, and delivers water to retail and wholesale customers.~~

To address the potential environmental impacts of the WSIP, the San Francisco Planning Department prepared a Program EIR (PEIR), which was certified by the San Francisco Planning Commission on October 30, 2008 (San Francisco Planning Commission Motion No. 17734). At a project-level of detail, the PEIR evaluated the environmental impacts of the WSIP's water supply strategy and, at a program level of detail, it evaluated the environmental impacts of the WSIP's facility improvement projects. The following sections summarize the WSIP and system operation strategy, along with WSIP's impacts and mitigation measures, as identified in the PEIR.

~~The following sections summarize the analysis contained in the Draft PEIR regarding the WSIP water supply option and system operation strategy, as well as the impacts and mitigation measures, as identified in the Draft PEIR. The San Francisco Planning Department is currently preparing responses to the comments received from public agencies and the general public on the Draft PEIR.~~

Program Description ~~WSIP Water Supply Option~~

The WSIP involves phased implementation of a water supply strategy to meet projected water demand through 2018. It also includes full implementation of all proposed WSIP facility improvement projects to insure that the public health, seismic safety and delivery reliability goals are achieved as soon as possible.[2] Under the WSIP, the SFPUC established an interim mid-term planning horizon – 2018. Thus, the SFPUC made a decision about providing water supply to its customers through 2018 only, and is deferring a decision regarding long-term water supply after 2018 and through 2030 until it undertakes further water supply planning and demand analysis.

The WSIP includes the following key program elements:

- Full implementation of all of the 17 proposed WSIP facility improvement projects described in the PEIR.

[2] The size and design of the WSIP facility improvement projects are driven by the SFPUC's system performance objectives and would not change as a result of the water supply decision included as part of the WSIP. (SFPUC Resolution No. 08-0200.)

- Water supply delivery to regional water system customers through 2018 only of 265 mgd average annual target delivery originating from the Tuolumne, Alameda and Peninsula watersheds. This includes 184 mgd for the wholesale customers (including 9 mgd for the cities of San Jose and Santa Clara), and 81 mgd for the retail customers.

- Development of 20 mgd of conservation, recycled water and groundwater within the SFPUC service area (10 mgd in the retail service area and 10 mgd wholesale service area).

- Dry year transfer from Modesto and/or Turlock Irrigation Districts of about 2 mgd coupled with the Westside Groundwater Basin conjunctive-use project to meet the drought year goal of limiting rationing to no more than 20 percent on a systemwide basis.

- Re-evaluation of 2030 demand projections, potential regional water system purchase requests, and water supply options by 2018 and a separate SFPUC decision in 2018 regarding regional water system water deliveries after 2018.

- Financial incentives to limit water sales to an annual average of 265 mgd from the watersheds.

The WSIP would not provide water supply to meet 300 mgd average annual customer purchase requests in 2030 as proposed under the original WSIP. Rather, under the WSIP, the SFPUC will deliver to customers up to 265 mgd from the SFPUC watersheds on an average annual basis. While average annual deliveries from the SFPUC watersheds would be limited to 265 mgd, such that there would be no increase in diversions from the Tuolumne River to serve additional demand, there would be a small increase in average annual Tuolumne River diversions of about 2 mgd over existing conditions in order to meet delivery and drought reliability goals through 2018.

The SFPUC must maintain water deliveries to all its customers for the protection of public health and safety. Therefore, the SFPUC will work with its customers to develop financial incentives to limit water sales to an average annual amount of 265 mgd from the watersheds through 2018. With the projected 20 mgd of conservation, recycled water, and groundwater projects, the system would meet average daily demand of 285 mgd in 2018. ~~Through the WSIP, the SFPUC proposes a water supply option to address the water supply level of service objective of meeting a projected 35 mgd increase in customer purchase requests by 2030, and to provide drought-year delivery with a maximum systemwide rationing of 20 percent. This strategy includes maximizing the use of local watershed supplies, increasing diversions from the Tuolumne River under existing water rights, and development of new local resources, including additional conservation, water recycling, and groundwater supply programs in~~

~~San Francisco. This combination of water supply sources is expected to fully meet customer purchase requests during non-drought years through 2030.~~

~~During periods of prolonged drought, the WSIP proposes supplemental sources to augment the non-drought sources described above. The SFPUC proposes to secure a water transfer with the Turlock Irrigation District and/or Modesto Irrigation District to provide supplemental dry-year water from the Tuolumne River. Further, the SFPUC proposes to implement a groundwater banking program in the Westside Groundwater Basin in San Mateo County. In addition, two of the WSIP facility improvement projects involve restoring the historic operating capacities of the Calaveras and Lower Crystal Springs reservoirs, which would augment drought supplies for the regional system. Also, during drought years under the WSIP the SFPUC would include up to 20 percent systemwide rationing.~~

Beginning on **Page 1-7** of the Draft EIR, text beginning with the title "Summary of Water Supply/Operations Impacts and Mitigation Measures" has been changed as follows:

Summary of Water Supply/Operations Impacts ~~and Mitigation Measures~~

The ~~WSIP Draft~~ PEIR analyze~~s~~d potential water supply and system operations impacts within the following geographic regions: the Tuolumne River, Alameda Creek, Peninsula, and Westside Basin groundwater resources systems. The ~~WSIP Draft~~ PEIR also identifie~~s~~d the cumulative effects of implementing the WSIP ~~water supply option~~ and system operations in combination with other past, present, and reasonably foreseeable future projects within each of these watersheds. It also discusse~~s~~d the potential effects of climate change and global warming on the regional water system.

~~Because of the proposed increased Tuolumne River diversions and operational changes, t~~The WSIP would result in changes in reservoir levels and associated changes in downstream flows in rivers and~~or~~ creeks in the three affected watersheds, potentially resulting in ~~geomorphology,~~ groundwater, water quality, fisheries, and terrestrial biological resource~~s recreational, and visual~~ impacts. In the event that deliveries to customers exceed 265 mgd, ~~Tuolumne River watershed,~~ streamflow changes in the Tuolumne River watershed could affect fisheries and terrestrial biological resources~~downstream water supplies and hydropower generation~~. In the Alameda Creek and Peninsula watersheds, the ~~proposed~~ WSIP, which includes ~~would include~~ restoring the historical storage capacities of Calaveras and Lower Crystal Springs Reservoirs, could affect~~potentially affecting~~ reservoir levels, downstream flows, fisheries, and terrestrial biological resources~~, and visual resources~~. In addition, similar to the originally proposed WSIP, the WSIP will ~~would~~ develop groundwater supplies in

the North Westside Groundwater Basin as well as a conjunctive-use program in the South Westside Groundwater Basin.

~~The WSIP Draft PEIR identifies potential beneficial effects on energy resources (increased hydroelectric resource) and on fisheries in Calaveras Reservoir, Calaveras Creek, Alameda Creek below the convergence with Calaveras Creek, and San Antonio Reservoir.~~

The following list summarizes the WSIP ~~water supply~~ impacts identified in the ~~Draft~~ PEIR that are potentially significant but mitigable; potentially significant and unavoidable; and significant and unavoidable. As set forth in the PEIR, the San Francisco Planning Department ~~The WSIP Draft PEIR has~~ determined the potential environmental impacts on all resources not listed below would be less than significant and no mitigation measures would be required. (Refer to Chapter 6 and Appendix B.1 for further discussion of the WSIP water supply impact analysis).

Page 1-8 of the Draft EIR, the section under "Potentially Significant But Mitigable WSIP Water Supply Impacts" has been changed as follows:

Potentially Significant But Mitigable WSIP Water Supply Impacts

- Fisheries Resources: Tuolumne River (below La Grange Dam, only when average annual deliveries from the watersheds exceed 265 mgd); Alameda Creek~~; Pilarcitos Reservoir and Creek~~

- Terrestrial Biological Resources: Tuolumne River (below La Grange Dam – only when average annual deliveries exceed 265 mgd; and impacts on alluvial features that support meadow and riparian habitat from O'Shaughnessy Dam to Don Pedro Reservoir); Calaveras Reservoir; Alameda Creek; Calaveras Creek; Upper and Lower Crystal Springs Reservoir~~; Pilarcitos Reservoir; Pilarcitos Creek~~

- ~~Recreational and Visual Resources: Alameda Creek system~~

- ~~Streamflow: Pilarcitos Reservoir; Pilarcitos Creek~~

- Groundwater: Pumping overdraft; change in water levels in Lake Merced and other surface water features; seawater intrusion due to decreased groundwater levels; contamination of drinking water

Page 1-8 of the Draft EIR, the section under "Potentially Significant and Unavoidable WSIP Water Supply Impacts" the following text has been revised per an editorial error:

Potentially Significant and Unavoidable WSIP Water Supply Impacts

- Fisheries: Upper and Lower Crystal Springs Reservoir
- Growth Inducement: SFPUC Service Area

Page 1-8 of the Draft EIR, the first paragraph under "Alternatives to the WSIP" has been changed as follows:

Alternatives to the WSIP

The ~~Draft~~ PEIR evaluated~~s~~ seven alternatives to the ~~proposed~~ WSIP, listed below, because of their apparent ability to meet most of the WSIP's goals, their ability to reduce one or more of the potentially significant impacts associated with program implementation, their potential feasibility, and their collective ability to provide a reasonable range of alternatives to foster informed decision-making and public participation. Analysis of the No Program Alternative is included as required by CEQA. Section 9.2 in the Alternatives chapter, and Appendix B.3 presents a more detailed summary of these alternatives.

Page 1-9 of the Draft EIR, following the last bulleted item the following sentence has been added and the subsequent paragraph modified as follows:

The adopted WSIP (see SFPUC Resolution No. 08-0200) incorporates elements of three alternatives: the No Purchase Request Alternative, the Aggressive Conservation/Water Recycling and Groundwater Alternative, and the Modified WSIP Alternative.

CEQA also requires the identification of an environmentally superior alternative from among the proposed project and the set of alternatives evaluated. The ~~WSIP~~ Draft PEIR identified the Modified WSIP Alternative as the environmentally superior alternative~~.~~ for the 2030 planning horizon because it would reduce key impacts of the originally proposed WSIP on natural resources along the lower Tuolumne River, in Alameda and Pilarcitos Creeks, and in/around Crystal Springs and Pilarcitos Reservoirs, but it would continue to meet the WSIP's primary goals and objectives. Like the adopted WSIP (known as the "Phased WSIP Variant" in the Final PEIR), the Modified WSIP Alternative would maximize the use of existing facilities and the largely gravity-driven system without also requiring the construction of additional major facilities called for under many other alternatives, or substantially increasing the energy demand of the system or need for pumping. The Modified WSIP Alternative would have more impacts on the upper Tuolumne River, and possibly less on the Lower Tuolumne River. The adopted WSIP is substantially similar to the Modified WSIP Alternative in that it includes essentially the same elements through 2018.

Beginning on **Page 1-10,** portions of Table 1-1 of the Draft EIR have been changed as follows:

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
Biological Resources			
Impact 4.6-1: Impacts on wetlands and aquatic resources (construction-related impacts) and Impact 4.6-4: Impacts on wetlands and aquatic resources (operational impacts)	Tesla Portal: PSM Thomas Shaft: N/A	Mitigation Measure 4.6-1a – Participate in the SJMSCP: Prior to the commencement of construction activities, SFPUC shall coordinate with the Joint Powers Authority (JPA)/Technical Advisory Committee (TAC), implement relevant ITMMs for applicable species (as identified in Mitigation Measures 4.6-3b through 4.6-3l, below) and pay any necessary fees to fund offsite compensation under the terms of the SJMSCP to provide replacement values that are equal to that of the permanent loss of ~~0.308~~ 3.2 acres of California annual grasslands and 0.01 acre of ruderal/disturbed land, and temporary impacts to 11.72 acres of California annual grassland and 0.96 acre of ruderal/disturbed land ~~habitat values of the artificial wetland, the temporary loss of <0.001 acre of ephemeral drainage, the temporary loss and permanent conversion of natural lands~~, and incidental take authorization for special-status species.	Tesla Portal and Thomas Shaft
Impact 4.6-2: Impacts to sensitive habitats, common habitats, and heritage trees	Tesla Portal: PSM Thomas Shaft: LS	Mitigation Measure 4.6-2 – Return Site to Pre-Construction Condition: Vegetation removal and soil disturbance shall be limited to the minimum amount necessary for project implementation, especially where the existing access road comes near the artificial wetland, and where the proposed pipeline would cross both the artificial wetland and the ephemeral drainage. Where soils are disturbed and/or vegetation removed on the project site, such as in the construction staging area, the site shall be returned to pre-project conditions (i.e., return site contours to pre-project profiles, restore original grades where possible, lightly compact loose soils or aerate compacted soils) where necessary. Where grading occurs, 12 inches of topsoil shall be salvaged and respread in graded areas as appropriate. When natural vegetation is disturbed, small areas (e.g., less than 100 square feet in size) shall be allowed to re-vegetate passively, while larger disturbed areas (e.g., more than 100 square feet in size or in areas prone to erosion such as sloped areas) shall be re-seeded with locally available native grasses and forbs (as needed).	Tesla Portal ~~and Thomas Shaft~~
		Mitigation Measure 4.6-3c – Implement Incidental Take Minimization Measures for San Joaquin Kit Fox: SFPUC shall implement the ITMMs identified for the San Joaquin kit fox under the SJMSCP to reduce the level of impact on the San Joaquin kit fox. Mitigation measures defined by the SJMSCP and the USFWS to protect the San Joaquin kit fox include the following: • A qualified biologist with demonstrated experience in kit fox biology, identification, and survey techniques shall conduct preconstruction surveys two calendar weeks to 30 calendar days prior to commencement of ground disturbance. Surveys shall be conducted by qualified biologists. When surveys identify potential dens (potential dens are defined as burrows at least four inches in diameter which open up within two feet), potential den entrances shall be dusted for three	Tesla Portal and Thomas Shaft

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		calendar days to register track of any San Joaquin kit fox present. If no San Joaquin kit fox activity is identified, potential dens may be destroyed. • If San Joaquin kit fox activity is identified, then dens shall be monitored to determine if occupation is by an adult fox only or is a natal den (natal dens usually have multiple openings). If the den is occupied by an adult only, the den may be destroyed when the adult fox has moved or is temporarily absent. If the den is a natal den, a buffer zone of 250 feet shall be maintained around the den until the biologist determines that the den has been vacated. • Where San Joaquin kit fox are identified, the provisions of the U.S. Fish and Wildlife Service's published "Standardized Recommendations for Protection of the San Joaquin kit fox Prior to or During Ground Disturbance" shall apply (except that preconstruction survey protocols shall remain as established in this paragraph). These standards include provisions for educating construction workers regarding the kit fox, keeping heavy equipment operating at safe speeds, checking construction pipes for kit fox occupation during construction and similar low or no-cost activities.	
		Mitigation Measure 4-6.3e – Breeding Season Surveys: ~~Conduct Pre-Construction Surveys for Burrowing Owls: In January, and again no more than two weeks before construction, a survey for burrows and burrowing owls shall be conducted by a qualified biologist within 500 feet of the project (access permitting). The survey will conform to the protocol described by the California Burrowing Owl Consortium in the Burrowing Owl Survey Protocol and Mitigation Guidelines (California Burrowing Owl Consortium, 1993), which includes up to four surveys on different dates if there are suitable burrows present.~~ ~~If occupied owl burrows are found within the survey area, a determination will be made by a qualified biologist, in consultation with the California Department of Fish and Game (CDFG), as to whether or not work will affect the occupied burrows or disrupt reproductive behavior.~~ ~~If it is determined that construction will not affect occupied burrows or disrupt breeding behavior, construction will proceed without any restriction or mitigation measures.~~ ~~If it is determined that construction will affect occupied burrows during August through February, the subject owls will be passively relocated from the occupied burrow(s) using one-way doors. There will be at least two unoccupied burrows suitable for burrowing owls within 300 feet of the occupied burrow before one-way doors are installed. Artificial burrows will be in place at least one-week before one-way doors are installed on occupied burrows. One-way doors will be in place for a minimum of 48 hours before burrows are excavated.~~ Measures to avoid and minimize impacts on the western burrowing owl will be implemented as described below:	Tesla Portal~~ and Thomas Shaft~~

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		• If project schedule permits, a qualified biologist will survey for burrows and burrowing owls during the breeding season (February 1 to August 31), immediately preceding construction. Surveys will be conducted within 500 feet of the project boundary (access permitting) in accordance with the California Burrowing Owl Consortium (1993) guidelines or as otherwise determined by CDFG. Burrows would be inspected for signs of owl activity (tracks, pellets, feathers, etc.). The locations of burrowing owl sightings, occupied burrows, and burrows with signs of owl activity will be marked on a map of the project area at a scale sufficient to accurately show the distance of active burrows to the limits of construction. Surveys will be conducted on at least four separate dates during the breeding season in areas where suitable burrows are present. If possible, surveys will be conducted during the peak of the burrowing owl breeding season, generally between April 15 and July 15. • If occupied owl burrows are found within the survey area, a determination will be made by a qualified biologist, in consultation with CDFG, as to whether work will affect the occupied burrows or disrupt reproductive behavior. • If it is determined that construction will not affect occupied burrows or disrupt breeding behavior, construction will proceed without any restrictions or mitigation measures.	
		Mitigation Measure 4-6.3f – Winter Surveys: ~~– Relocate Burrowing Owls: During the non-breeding season (September 1 through January 31) burrowing owls occupying the project site should be evicted from the project site by passive relocation as described in the CDFG's Staff Report on Burrowing Owls.~~ Measures to avoid and minimize impacts on the western burrowing owl will be implemented as described below: • If birds are not observed during breeding season surveys, or if breeding season surveys are infeasible due to project scheduling, or if construction will occur during the wintering season, a winter survey will be conducted to identify non-breeding residents of the project site. Winter surveys will be conducted within 500 feet of the project site (access permitting) or as otherwise determined by CDFG during the period when wintering owls are most likely to be present (December 1 to January 31). The locations of burrowing owl sightings, occupied burrows, and burrows with signs of owl activity will be marked on a map of the project area at a scale sufficient to accurately show the distance of active burrows to the limits of construction. • If occupied owl burrows are found within the survey area, a determination will be made by a qualified biologist, in consultation with CDFG, as to whether or not work will affect the occupied burrows.	Tesla Portal ~~and Thomas Shaft~~

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		• If it is determined that construction will not affect occupied burrows, construction will proceed without any restrictions or mitigation measures. • If it is determined that construction will affect occupied burrows, the subject owls will be passively relocated from the occupied burrow(s) using one-way doors prior to the onset of breeding season. Owls will be encouraged to relocate to alternate burrows that are at least 160 feet from the construction limits. One alternate natural or artificial burrow for each burrow excavated will be in place at least one week before one-way doors are installed on occupied burrows. One-way doors will be in place for a minimum of 48 hours before burrows are excavated.	
		Mitigation Measure 4-6.3g – Fall Surveys: ~~– Buffer Zone around Burrows Occupied by Burrowing Owls: During the breeding season (February 1 through August 31) occupied burrows shall not be disturbed and shall be provided with a 100-foot protective buffer until and unless the TAC, with the concurrence of the Permitting Agencies' representatives on the TAC; or unless a qualified biologist approved by the Permitting Agencies verifies through noninvasive means that either: 1) the birds have not begun egg laying, or 2) juveniles from the occupied burrows are foraging independently and are capable of independent survival. Once the fledglings are capable of independent survival, the burrow can be destroyed.~~ Measures to avoid and minimize impacts on the western burrowing owl will be implemented as described below: • If surveys must be conducted between September 1 and November 30 (which is outside of the time windows specified above), a qualified biologist will conduct a survey for burrows and burrowing owls no more than thirty (30) days prior to ground-disturbing activity. If necessary, resident owls will be passively relocated from occupied burrows, as described above. If construction activities are still ongoing beyond November 30, then winter surveys will be conducted during December and January.	Tesla Portal
		Mitigation Measure 4.6-3h – Conduct Pre-Construction Surveys for Swainson's Hawk: A qualified biologist shall conduct a preconstruction survey for Swainson's hawk, prior to the commencement of any ground disturbing construction activities (e.g., grass/vegetation/brush/tree removal, soil excavation, grading, vehicle access, staging of materials or vehicles, large scale materials off-haul or delivery, construction of temporary or permanent access roads). In the case that Swainson's hawks are found nesting in the area, the SFPUC will notify CDFG. At a minimum~~In addition,~~ the following mitigations regarding Swainson's hawk, as listed from the SJMSCP, will be implemented:	Tesla Portal ~~and Thomas Shaft~~

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		• If a nest tree becomes occupied during construction activities, then all construction activities shall remain a distance of two times the dripline of the tree, measured from the nest. • If any nest trees need to be removed, they may be removed between September 1 and February 15, when the nests are unoccupied. The following two measures will also be implemented: • If any unoccupied nests are found during preconstruction surveys, these nests may be removed when the nests are unoccupied. • If any occupied nests are found during preconstruction surveys, then all construction activities shall remain at a distance of ¼ mile (1,320 feet), unless CDFG agrees to other equally effective measures ~~are agreed to by CDFG~~ (e.g., monitor occupied nest during construction in the buffer zone, limit hours of construction, restrict construction activities, etc).	
		Mitigation Measure 4.6-3i – Implement Incidental Take Minimization Measures for White-Tailed Kite: SFPUC shall implement the ITMM identified for the white-tailed kite under the SJMSCP, which consists of the following: • A qualified biologist shall conduct preconstruction surveys and investigate all potential nesting trees on the project site (e.g., especially tree tops 15-59 feet above the ground in oak, willow, eucalyptus, cottonwood, or other deciduous trees), during the nesting season (February 15 to September 15) whenever white-tailed kites are noted on site or within the vicinity of the project site during the nesting season. • If the species is found nesting, a setback of 100 feet from nesting areas shall be established and maintained during the nesting season for the period encompassing nest building and continuing until fledglings leave nests, unless CDFG agrees to other equally effective measures ~~are agreed to by CDFG~~ (e.g., monitor occupied nest during construction in the buffer zone, limit hours of construction, restrict construction activities, etc.) and CDFG shall be notified of the proposed buffer zone. This setback applies whenever construction or other ground-disturbing activities must begin during the nesting season in the presence of nests which are known to be occupied. Setbacks shall be marked by brightly colored temporary fencing.	Tesla Portal and Thomas Shaft
		Mitigation Measure 4.6-3j – Implement Incidental Take Minimization Measures for California Horned Lark and Northern Harrier: SFPUC shall implement the ITMM identified for the California horned lark and northern harrier under the SJMSCP, which consists of the following:	Tesla Portal and Thomas Shaft

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		• A qualified biologist shall conduct a preconstruction survey and investigate all potential nesting trees to determine the presence or absence of the species on the project site. • If species are found, a setback of 500 feet from nesting areas shall be established and maintained during the nesting season (February 16 – August 31) for the period encompassing nest building and continuing until fledglings leave nests, unless CDFG agrees to other equally effective measures ~~are agreed to by CDFG~~ (e.g., monitor occupied nest during construction in the buffer zone, limit hours of construction, restrict construction activities, etc.), or offsite compensation shall be provided, and CDFG shall be notified of the proposed buffer zone. If a setback is used, this setback would apply whenever construction or other ground-disturbing activities must begin during the nesting season in the presence of nests which are known to be occupied. Setbacks shall be marked by brightly colored temporary fencing.	
		Mitigation Measure 4.6-3k – Conduct Pre-Construction Surveys for Golden Eagle: Prior to the start of construction, a qualified biologist shall conduct golden eagle surveys as required by the SJMSCP. Additionally, SFPUC shall implement the ITMM identified for the golden eagle under the SJMSCP, which consists of the following: • When a site inspection indicates the presence of a nesting golden eagle, CDFG will be notified and a setback of 500 feet from the nesting area shall be established and maintained during the nesting season (normally approximately February 1 – June 30) for the period encompassing nest building and continuing until fledglings leave nests, unless CDFG agrees to other equally effective measures ~~are agreed to by CDFG~~ (e.g., monitor occupied nest during construction in the buffer zone, limit hours of construction, restrict construction activities, etc.). This setback applies whenever construction or other ground-disturbing activities must begin during the nesting season in the presence of nests which are known to be occupied. Setbacks shall be marked by brightly colored temporary fencing.	Tesla Portal and Thomas Shaft
		Mitigation Measure 4.6-3l – Conduct Pre-Construction Surveys for Ferruginous Hawk and Prairie Falcon: Prior to the start of construction, a qualified biologist shall conduct surveys for ferruginous hawk and prairie falcon as required by the SJMSCP. These species currently do not nest in San Joaquin County and are not expected to nest in the County over the life of the SJMSCP. Therefore, in the highly unlikely event that one of these species is found nesting on a project site, SFPUC shall notify CDFG of the proposed buffer zone and a setback of 500 feet from the nesting area shall be established and maintained for the period encompassing nest building and continuing until fledglings leave the nests, unless CDFG agrees to other equally effective measures. ITMMs shall be formulated prior to ground	Tesla Portal and Thomas Shaft

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		disturbance by the TAC and approved by the JPA with the concurrence of the Permitting Agencies' representatives on the TAC in accordance with the SJMSCP's Adaptive Management Plan. ITMMs may consist of preconstruction surveys, avoidance techniques, and buffer areas.	
Cultural Resources			
Impact 4.7-1: Potential to disturb or destroy paleontological resources.	Tesla Portal: PSM Thomas Shaft: PSM	Mitigation Measure 4.7-1a – Paleontological Monitoring During Excavation ~~Work~~: The SFPUC shall retain a qualified professional paleontologist to monitor excavations starting at the depth of 10 feet deep during construction at the Tesla Portal site for paleontological resources. Monitoring shall continue at the Tesla Portal site until the supervising qualified paleontologist determines that no native sediments are present or that significant paleontological resources are not likely to be discovered.	Tesla Portal
Impact 4.7-2: Potential to disturb or destroy unknown prehistoric archaeological resources or human remains.	Tesla Portal: PSM Thomas Shaft: PSM	Mitigation Measure 4.7-2a – Accidental Archaeological Discovery: SFPUC Standard Construction Measure #9 for cultural resources requires that construction activities be suspended immediately if there is any indication of an archaeological resource. To avoid any potential adverse effect from the proposed project on accidentally discovered buried or submerged historical resources as defined in CEQA Guidelines Section 15064.5(a)(c), the SFPUC shall distribute the Planning Department archaeological resource "ALERT" sheet to the project prime contractor; to any project subcontractor (including firms specializing in demolition, excavation, grading, foundation, pile driving, etc.); or utilities firm involved in soil disturbing activities within the project site. Prior to any soil disturbing activities being undertaken, each contractor is responsible for ensuring that the "ALERT" sheet is circulated to all field personnel including, machine operators, field crew, pile drivers, supervisory personnel, etc. The SFPUC shall provide the Environmental Review Officer (ERO) with a signed affidavit from the responsible parties (prime contractor, subcontractor(s), and utilities firm) ~~to the ERO~~ confirming that all field personnel have received copies of the "ALERT" sheet. Should any indication of an archaeological resource be encountered during any soils disturbing activity of the project, the contractor and/or the SFPUC will immediately notify the ERO and will immediately suspend any soils disturbing activities within 100 feet of the discovery until the ERO has determined what additional measures should be undertaken. If the ERO determines that an archeological resource may be present within the project site, the SFPUC shall retain the services of a qualified archeological consultant. The archeological consultant shall advise the ERO as to whether the discovery is an archeological resource that ~~,~~ retains sufficient integrity, and is of potential scientific/historical/cultural significance. If an archeological resource is present, the archeological consultant shall identify and evaluate the archeological resource. The	Tesla Portal and Thomas Shaft

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		archeological consultant shall make a recommendation as to what action, if any, is warranted. Based on this information, the ERO may require, if warranted, specific additional measures to be implemented by the SFPUC. Measures might include: preservation in situ of the archeological resource; an archaeological monitoring program; or an archeological ~~testing~~ evaluation program. If an archeological monitoring program or archeological ~~testing~~ evaluation program is required, it shall be consistent with the MEA WSIP Archaeological Guidance (San Francisco Planning Department 2008) ~~guidelines~~ for such programs. The ERO may also require that the SFPUC immediately implement a site security program if the archeological resource is at risk from vandalism, looting, or other damaging actions. The project archeological consultant shall submit an accidental discovery Archaeological Data Recovery Report (ADRR) to the ERO, which, in addition to the usual contents of the ADRR, includes an evaluation of ~~the appropriate report(s) in accordance with the MEA WSIP Projects Archaeological Guidance series that evaluates~~ the historical significance of any discovered archeological resource, as well as describing ~~and describes~~ the archeological and historical research methods employed in the archeological monitoring/data recovery program(s) undertaken, and presenting, analyzing, and interpreting the recovered data.. Information that may put at risk any archeological resource shall be provided in a separate removable insert within the final report. Once approved by the ERO, copies of the ADRR ~~report(s)~~ shall be distributed as follows: the relevant California Historical Resources Information System Information Center shall receive one (1) copy and the ERO shall receive a copy of the transmittal letter of the ADRR ~~report~~ to the Information Center. The MEA shall receive three copies of the ADRR ~~each report~~ along with copies of any formal site recordation forms (CA DPR 523 series) and/or documentation for nomination to the National Register of Historic Places/California Register of Historical Resources. The SFPUC shall receive copies of the ADRR~~report(s) as requested~~ in the number requested. In instances of high public interest in or the high interpretive value of the resource, the ERO may require a different final report content, format, and distribution than that presented above.	
		Mitigation Measure 4.7-2b – Treatment of Human Remains: The treatment of human remains and of associated or unassociated funerary objects discovered during any soils disturbing activity shall comply with applicable State laws. This shall include immediate notification of the San Joaquin County Coroner and in the event of the coroner's determination that the human remains are Native American ~~remains~~, notification of the California State Native American Heritage Commission (NAHC) who shall appoint a Most Likely Descendant (MLD) (Public Resources Code Section 5097.98). The	Tesla Portal and Thomas Shaft

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		archaeological consultant, SFPUC, and MLD shall make all reasonable efforts to develop an agreement for the treatment of, with appropriate dignity, human remains and associated or unassociated funerary objects (CEQA Guidelines Section 15064.5(~~e~~d)). The agreement should take into consideration the appropriate excavation, removal, recordation, analysis, custodianship, curation, and final disposition of the human remains and associated or unassociated funerary objects. California Public Resources Code ~~State law~~ allows 24 hours to reach agreement on these matters. If the MLD~~s~~ and the other parties do not agree on the reburial method, the project will follow Section 5097.98(b) of the California Public ~~r~~Resources ~~c~~Code which states, "the landowner or his or her authorized representative shall reinter the human remains and items associated with Native American burials with appropriate dignity on the property in a location not subject to further subsurface disturbance."	
Air Quality			
Impact 4.9-1: Construction emissions of criteria pollutants	Tesla Portal: PSM Thomas Shaft: PSM	Mitigation Measure 4.9-1b – SJVAPCD Exhaust Control Measures: The following mitigation measures will be implemented during construction of the proposed project to reduce exhaust emissions: *(1) SJVAPCD Guide to Assessing and Mitigating Air Quality Impacts Mitigation Measures:* To limit exhaust emissions within the San Joaquin Region, the SJVAPCD specifies the following exhaust controls for heavy-duty equipment (scrapers, graders, trenchers, earthmovers, etc.). The SFPUC will include these measures, where feasible and applicable, in contract specifications: • Idling time (e.g., ~~10~~5-minute maximum) shall be minimized. • The hours of operation of heavy-duty equipment and/or the amount of equipment in use shall be limited. • Activity management (e.g., rescheduling activities to reduce short-term impacts) shall be implemented. *(2) Regulation IX – Mobile and Indirect Sources, Rule 9510 Mitigation Measures:* Rule 9510 applies to any project subject to discretionary approval by a public agency that ultimately results in the construction of a new building, facility, or structure or reconstruction of a building, facility, or structure for the purpose of increasing capacity or activity and also involving 9,000 square feet of space. Rule 9510 requires exhaust emissions for construction equipment greater than 50 horsepower used or associated with a development project to be reduced by the following amounts from the statewide average as estimated by the California Air Resources Board (CARB): • 20% of the total NOX emissions	Tesla Portal and Thomas Shaft

TABLE 1-1
SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Environmental Impact	Impact Designation	Mitigation Measures	Applicable Site
		• 45% of the total PM10 exhaust emissions An applicant may reduce construction emissions on-site by using less polluting construction equipment, which can be achieved by utilizing add-on controls, cleaner fuels, or newer lower emitting equipment. The requirements listed above can also be met through the payment of an off-site emissions reduction fee. The following mitigation measures will be selectively applied to achieve compliance with the emission reductions set forth by Rule 9510: • Selected construction equipment with engines equal to or greater than 50 horsepower will: – Be equipped with Tier 2 diesel engines as defined in Title 13, CCR, §2423 – Must be equipped with verified Level 3 (at least 85% reduction of PM from the baseline emission level) Diesel Emission Control Strategies as defined in Title 13, CCR, §2700 through 2710 • All construction vehicles will undergo monthly maintenance. Preventive maintenance includes complying with the manufacturer's service recommendations, using recommended types of fuel, maintaining proper fluid levels (such as oil, coolant, brake, and transmission), ensuring proper tire pressure, working signals, lights (including headlamps, turn-signal lights, tail lights, and brake lights), and brakes.	

Page 1-27, the references section for the Executive Summary of the Draft EIR has been modified as follows:

~~San Francisco Public Utilities Commission (SFPUC), *Water System Improvement Program*, January 2006d.~~

San Francisco Public Utilities Commission (SFPUC), Water System Improvement Program California Environmental Quality Act Findings: Findings of Fact, Evaluation of Mitigation Measures and Alternatives, and Statement of Overriding Considerations, SFPUC Resolution No. 08-0200, October 30, 2008.

Chapter 2 Introduction

Page 2-1 of the Draft EIR**,** the paragraph under "2.1.1 SFPUC Regional Water System Overview" has been revised as follows:

2.1.1 SFPUC Regional Water System Overview

The City and County of San Francisco (CCSF), through the SFPUC, owns and operates a regional water system that extends from the Sierra Nevada to San Francisco and serves 2.4 million people in San Francisco, San Mateo, Santa Clara, Alameda, and Tuolumne counties. The regional water system consists of water conveyance, treatment, and distribution facilities, and delivers water to retail and wholesale customers. The existing regional system includes over 280 miles of pipelines, over 60 miles of tunnels, 11 reservoirs, five pump stations, and two water treatment plants. The SFPUC currently delivers an annual average of about 265 million gallons per day (mgd) of water to its customers. The source of the water supply is a combination of local supplies from streamflow and runoff in the Alameda Creek watershed and in the San Mateo and Pilarcitos Creeks watersheds (referred to together as the Peninsula watersheds), augmented with imported supplies from the Tuolumne River watershed. Local watersheds provide about 15 percent of total supplies and the Tuolumne River provides the remaining 85 percent. Figure 2-1 (SFPUC Regional Water System) illustrates the general location of the SFPUC regional system and water supply watersheds.

Page 2-3 of the Draft EIR**,** the paragraph under "2.1.2 SFPUC Water System Improvement Program" has been revised as follows:

2.1.2 SFPUC Water System Improvement Program

On October 30, 2008, t~~T~~he SFPUC ~~is proposing to~~ adopted ~~and implement~~ a regional Water System Improvement Program (known as the "Phased WSIP Variant") (refer to www.sfwater.org; SFPUC, 2008~~6~~; also see SFPUC Resolution No. 08-0200). The adopted WSIP would improve the regional system with respect to water quality, seismic response, water delivery, and water supply to meet water delivery needs in the service area through the year 2018~~2030~~ and

would establish level of service goals and system performance objectives. The proposed program area spans seven counties—Tuolumne, Stanislaus, San Joaquin, Alameda, Santa Clara, San Mateo, and San Francisco.

The WSIP includes ~~would implement~~ a ~~proposed~~ water supply strategy, ~~option, modify~~ modifications to system operations, and construction of ~~construct~~ a series of facility improvement projects. The proposed project, along with several other facility improvement projects, is a component of the WSIP.[1] The overall goals of the WSIP are to maintain high-quality water; reduce vulnerability to earthquakes; increase delivery reliability and improve the ability to maintain the system; meet customer purchase requests in nondrought and drought periods; enhance sustainability in all system activities; and achieve a cost-effective, fully operational system (refer to Table 2-1). To further these program goals, the WSIP also includes objectives that address system performance in the areas of water quality, seismic reliability, delivery reliability, and water supply through the year 2018.~~2030. The regional water system consists of water conveyance, treatment, and distribution facilities, and delivers water to retail and wholesale customers.~~

Beginning on **Page 2-3** of the Draft EIR**,** Table 2-1 has been revised as follows:

TABLE 2-1
WSIP GOALS AND OBJECTIVES

Program Goal	System Performance Objective
Water Quality – *maintain high quality water*	▪ Design improvements to meet current and foreseeable future federal and state water quality requirements. ▪ Provide clean, unfiltered water originating from Hetch Hetchy Reservoir and filtered water from local watersheds. ~~filter all other surface water sources.~~ ▪ Continue to implement watershed protection measures.
Seismic Reliability – *reduce vulnerability to earthquakes*	▪ Design improvements to meet current seismic standards. ▪ Deliver basic service to the three regions in the service area (East/South Bay, Peninsula, and San Francisco) within 24 hours after a major earthquake. Basic service is defined as average winter-month usage, and the performance objective for the regional system is 229 million gallon per day (mgd). The performance objective is to provide delivery to at least 70 percent of the turnouts (i.e., water diversion connecting points from the regional system to customers) in each region, with 104, 44 and 81 mgd delivered to East/South Bay, Peninsula, and San Francisco regions, respectively. ▪ Restore facilities to meet average-day demand of up to 300 mgd within 30 days after a major earthquake.

[1] The proposed project is listed as three separate projects in the WSIP ~~Draft~~ PEIR: the Tesla Portal Disinfection Facility, the Hetch Hetchy Advanced Disinfection, and the Lawrence Livermore Supply Improvements. For purposes of this EIR, these three projects are evaluated as one project given their geographic proximity, construction schedule, and the interrelated function of the two proposed facilities at the Tesla Portal site.

TABLE 2-1
WSIP GOALS AND OBJECTIVES

Delivery Reliability – *increase delivery reliability and improve the ability to maintain the system*	▪ Provide operational flexibility to allowed planned maintenance shutdown of individual facilities without interrupting customer service. ▪ Provide operational flexibility to minimize the risk of service interruption due to unplanned facility upsets or outages. ▪ Provide operational flexibility and system capacity to replenish local reservoirs as needed. ▪ Meet estimated average annual demand of up to 300 mgd ~~for 2030~~ under the conditions of one planned shutdown of a major facility for maintenance concurrent with one unplanned facility outage due to a natural disaster, emergency, or facility failure/upset.
Water Supply – *meet customer water needs in nondrought and drought periods*	▪ Meet average annual water demand ~~purchase requests~~ of 265~~300~~ mgd from the SFPUC watersheds for retail and wholesale customers during nondrought years for system demands through 2018~~2030~~. ▪ Meet dry-year delivery needs through 2018~~2030~~ while limiting rationing to a maximum 20 percent systemwide reduction in water service during extended droughts. ▪ Diversify water supply options during nondrought and drought periods. ▪ Improve use of new water sources and drought management, including ~~use of~~ groundwater, recycled water, conservation, and transfers
Sustainability – *enhance sustainability in all system activities*	▪ Manage natural resources and physical systems to protect watershed ecosystems. ▪ Meet, at a minimum, all current and anticipated legal requirements for protection of fish and ~~other~~ wildlife habitat. ▪ Manage natural resources and physical systems to protect public health and safety.
Cost-effectiveness – achieve a cost-effective, fully operational system	▪ Ensure cost-effective use of funds. ▪ Maintain gravity-driven system. ▪ Implement regular inspection and maintenance program for all facilities.

Source: SFPUC Resolution No. 08-0200, 2008~~, 2006~~

Page 2-4 of the Draft EIR**,** the paragraph following Table 2-1 has been revised as follows:

> To address the potential environmental impacts of the ~~proposed~~ WSIP, the San Francisco Planning Department prepared a ~~published a Draft~~ Program EIR (~~Draft~~ PEIR), which was certified by the San Francisco Planning Commission in its Motion No. 17734 on October 30, 2008 (San Francisco Planning Department, 2008). ~~on June 29, 2007.~~ At a program-level of detail, the ~~Draft~~ PEIR evaluated~~s~~ the environmental impacts of the WSIP ~~SFPUC's proposed water supply option~~ and, at a program level of detail, it evaluated~~s~~ the environmental impacts of the WSIP's facility improvement projects. ~~The San Francisco Planning Department is currently preparing responses to the comments received from public agencies and the general public on the Draft PEIR.~~

Page 2-12, the references section for the Introduction of the Draft EIR has been modified as follows:

2.5 References

~~San Francisco Public Utilities Commission (SFPUC), *Water System Improvement Program*, January 2006d.~~

San Francisco Planning Department, Program Environmental Impact Report on the San Francisco Public Utilities Commission's Water System Improvement Program, Motion No. 17734, October 30, 2008.

San Francisco Public Utilities Commission (SFPUC), Water System Improvement Program California Environmental Quality Act Findings: Findings of Fact, Evaluation of Mitigation Measures and Alternatives, and Statement of Overriding Considerations, Resolution No. 08-0200, October 30, 2008.

Chapter 3 Project Description

Page 3-1 of the Draft EIR**,** following "3.1.1 Relation to Water System Improvement Program Goals" has been modified as follows:

> The proposed project is part of the San Francisco Public Utilities Commission's (SFPUC's) Water System Improvement Program (WSIP). The WSIP goals and objectives (refer to Table 2-1 in Chapter 2.0, Introduction) were developed based on a planning horizon through 2018 ~~2030~~. The overall goals of the WSIP for the regional water system are to:

Page 3-1 of the Draft EIR**,** following the bulleted list the following paragraph has been added:

> The size and design of the individual WSIP facility improvement projects are driven by the WSIP's system performance objectives and would not change as a result of the WSIP's water supply strategy. The originally proposed WSIP included multiple program goals for improving seismic reliability and water delivery reliability, meeting current and future water quality regulations, and meeting water supply reliability goals. Design and capacity of the WSIP facility improvement projects is driven by all four of the WSIP objectives -- the need to improve system performance for seismic reliability and water delivery reliability as well as maintaining high water quality standards and meeting water supply goals. All four of these objectives are factored into the decision on how to size the WSIP's individual facilities. Even if the goal of meeting projected increases in water supply demands were dropped from the mix of program objectives, the other program goals would cause the SFPUC to design WSIP facility improvement projects of the same size. All the WSIP facilities are sized to reliably deliver an average annual amount of 265 mgd (and up to 300 mgd) in light of the regional system's needs for seismic and delivery reliability during both drought and non-drought periods, and to meet water quality requirements (SFPUC Resolution No. 08-0200).

Page 3-7 of the Draft EIR**,** the paragraph beginning with "Sodium hypochlorite. . ." has been revised per comment C-Larwe-01 as follows:

> *Giardia* inactivation is currently accomplished through the addition of sodium hypochlorite (chlorine) to the regional water supply at the Tesla Disinfection

Facility, which provides adequate contact time for the inactivation of *Giardia*. To provide adequate *Giardia* disinfection to LLNL Site 300, additional ultraviolet (UV) facilities would be installed at Thomas Shaft (see Section 3.2). ~~Sodium hypochlorite~~Chlorine would be fed from the Chemical Process Building and injected into the out flow manifolds. Although the location of the chlorination function at the site would change, the chlorine injection process itself would be essentially unchanged. In addition, to lower the pH of the water, fluoride and CO_2 would be added to improve current water quality management capabilities.

Page 3-11, the heading after the first full paragraph of the Draft EIR has been changed as follows:

3.~~2.3~~3.2 Lawrence Livermore Water Quality Improvements (Thomas Shaft Site)

Page 3-11 of the Draft EIR**,** the last paragraph is revised per comment L-SFLPAB-03 as follows:

Other improvements proposed at the Thomas Shaft site include installation of a 360-square-foot prefabricated structure 10 feet in height within the fenced area atop Thomas Shaft and replacing two existing 100 horse power (hp) pumps with two 30 hp pumps (one active and one standby). A trench, approximately 150 foot by 3 foot by 3 foot would be excavated from the existing Chlorination Facility building to the Thomas Shaft and to the percolation tank (as shown on Figure 3-2). Prior to commencement of this project, fencing will be installed as part of another project (Thomas Shaft Roadway Improvement Project, SFPUC Resolution No. 08-0061) and will remain installed around the steam engine foundation and bucket assembly; this fence will avoid potential inadvertent physical impacts or damage to the resource that could occur during project construction.

Page 3-21 of the Draft EIR, after the last bullet point on the page the following bullet point has been added per comment L-BAWSCA-03:

- Modification to Regional Operational Permit will be issued by the California Department of Public Health for changes in disinfection equipment used (Tesla Portal and Thomas Shaft sites).

Page 3-22, the following reference has been added to the Project Description reference for the Draft EIR:

SFPUC, Thomas Shaft Roadway Improvement Project, SFPUC Resolution No. 08-0061. April 8, 2008.

Chapter 4 Environmental Setting and Impacts

4.1 Approach to Analysis

Beginning on **Page 4.1-4** of the Draft EIR, the section "4.1.2 Water System Improvement Program" has been modified as follows:

4.1.2 Water System Improvement Program

As discussed in Section 1.2, the proposed project, along with several other facility improvement projects, are components of the SFPUC's WSIP. The ~~WSIP Draft~~ Program EIR (~~Draft~~ PEIR), which was certified ~~was issued on June 29, 2007,~~ by the San Francisco Planning Commission on October 30, 2008, ~~Department to~~ addressed the potential environmental impacts of the WSIP ~~on a programmatic level~~ and evaluated regional water supply alternatives. Because the proposed project is a component of the WSIP the project would also contribute to the WSIP's ~~program level~~ water supply impacts.

The ~~WSIP Draft~~ PEIR analyzed~~s~~ potential water supply and system operations impacts (separate from environmental impacts associated with the facility improvements) within the following geographic regions: the Tuolumne River, Alameda Creek, Peninsula, and Westside Basin groundwater resources systems. The ~~WSIP Draft~~ PEIR also identified~~s~~ the cumulative effects of implementing the WSIP ~~water supply option~~ and system operations in combination with other past, present, and reasonably foreseeable future projects within each of these watersheds. It also discussed~~s~~ the potential effects of climate change and global warming on the regional water system.

The WSIP would result in changes in reservoir levels and associated changes in downstream flows in rivers and creeks in the three affected watersheds, potentially resulting in groundwater, water quality, fisheries, and terrestrial biological resources,. In the event that deliveries to customers exceed 265 mgd (average annual), streamflow changes in the Tuolumne River watershed could affect fisheries and terrestrial biological resources. In the Alameda Creek and Peninsula watersheds, the WSIP, which includes restoring the historical storage capacities of Calaveras and Lower Crystal Springs Reservoirs, could affect reservoir levels, downstream flows, fisheries, and terrestrial biological resources. In addition, similar to the originally proposed WSIP, the WSIP will develop groundwater supplies in the North Westside Groundwater Basin as well as a conjunctive-use program in the South Westside Groundwater Basin.

~~Because of the proposed increased Tuolumne River diversions and operational changes, the WSIP would result in changes in reservoir levels and associated changes in downstream flows in rivers or creeks in the three affected watersheds, potentially resulting in geomorphology, groundwater, water quality, fisheries, terrestrial biological resources, recreational, and visual impacts. In the Tuolumne River watershed, streamflow changes could affect downstream water supplies~~

~~and hydropower generation. In the Alameda Creek and Peninsula watersheds, the proposed WSIP would include restoring the historical storage capacities of Calaveras and Lower Crystal Springs Reservoirs, potentially affecting reservoir levels, downstream flows, fisheries, terrestrial biological resources, and visual resources. In addition, the proposed WSIP would develop groundwater supplies in the North Westside Groundwater Basin as well as a conjunctive use program in the South Westside Groundwater Basin.~~

~~The WSIP Draft PEIR identifies potential beneficial effects for energy resources (increased hydroelectric resource) and for fisheries in Calaveras Reservoir, Calaveras Creek, Alameda Creek below the convergence with Calaveras Creek, and San Antonio Reservoir.~~

As stated above, t~~T~~he proposed project is a component of the WSIP and therefore would contribute also to the ~~program-level~~ water supply impacts included in the tables below. Tables 4.1-1 through 4.1-4 summarize the WSIP water supply impacts and mitigation measures for each geographic region as analyzed in the ~~Draft~~ PEIR. Table 4.1-5 lists cumulative water supply impacts. Appendix B.1 presents the program-level environmental impact analysis and mitigation measures for the water supply and system operations associated with the ~~proposed~~ WSIP. In addition to water supply impacts and mitigation measures, the ~~WSIP Draft~~ PEIR provides a program-level analysis of the impacts associated with facility improvement projects, including construction and cumulative construction, and operation impacts. This EIR addresses the same issues as the ~~WSIP Draft~~ PEIR for the proposed project at a project-level detail.

Beginning on **Page 4.1-6** of the Draft EIR**,** portions of Table 4.1-1 have been revised as shown on the following pages:

Table 4.1-1
Summary of Water Supply Impacts and Mitigation Measures – Tuolumne River System and Downstream Water Bodies

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts				
		Sensitive Habitats	**Key Special-Status Species**	**Other Species of Concern**	**Common Habitats and Species**	
FISHERIES						
Impact 5.3.6-4: Effects on fishery resources along the Tuolumne River below La Grange Dam.	LS when average annual deliveries from the watersheds are maintained at 265 mgd or less; PSM if deliveries exceed 265 mgd					**Measure 5.3.6-4a, Avoidance of Flow Changes by Reducing Demand for Don Pedro Reservoir Water:** The SFPUC will pursue a water transfer arrangement with MID/TID and/or other water agencies which would offset the WSIP's effects on water storage in Don Pedro Reservoir and minimize WSIP-induced changes in releases from La Grange Dam. **If Measure 5.3.6-4a proves to be infeasible, the SFPUC will implement Measure 5.3.6-4b. **Measure 5.3.6-4b, Fishery Habitat Enhancement:** The SFPUC will implement or fund one of two fishery habitat enhancement projects that are consistent with the Lower Tuolumne River Restoration Plan; augmentation of spawning gravel at five selected sites or the filling or isolation from the river of one of the existing inactive quarry pits.

Table 4.1-1
Summary of Water Supply Impacts and Mitigation Measures – Tuolumne River System and Downstream Water Bodies

TERRESTRIAL BIOLOGY						
Impact 5.3.7-6: Impacts on biological resources along the Tuolumne River below La Grange Dam.		LS when average annual deliveries from the watersheds are maintained at 265 mgd or less; PSM if deliveries exceed 265 mgd ~~PSM~~	LS when average annual deliveries from the watersheds are maintained at 265 mgd or less; PSM if deliveries exceed 265 mgd ~~PSM~~	LS when average annual deliveries from the watersheds are maintained at 265 mgd or less; PSM if deliveries exceed 265 mgd ~~PSM~~	LS when average annual deliveries from the watersheds are maintained at 265 mgd or less; PSM if deliveries exceed 265 mgd ~~PSM~~	The SFPUC will implement Measures 5.3.6-4a or 5.3.7-6 to reduce adverse impacts on sensitive habitats, key special-status species, other species of concern, and common habitats and species to a less-than-significant level. **Measure 5.3.6-4a, Avoidance of Flow Changes by Reducing Demand for Don Pedro Reservoir Water** – see description above. **If Measure 5.3.6-4a proves to be infeasible, the SFPUC will implement Measure 5.3.7-6. **Measure 5.3.7-6, Lower Tuolumne River Riparian Habitat Enhancement:** Consistent with the Lower Tuolumne River Restoration Plan, the SFPUC will protect and enhance one mile of riparian vegetation within the contemporary floodplain.

Beginning on **Page 4.1-12** of the Draft EIR**,** portions of Table 4.1-2 have been revised as follows:

Table 4.1-2
Summary of Water Supply Impacts and Mitigation Measures – Alameda Creek Watershed

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts				
		Sensitive Habitats	Key Special Status-Species	Other Species of Concern	Common Habitats and Species	
RECREATION AND VISUAL						
Impact 5.4.7-1: Effects on recreational facilities and/or activities.	LS~~PSM~~					None required.~~**Measure 5.4.1-2, Diversion Tunnel Operation** – see description above.~~ ~~**Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek** – see description above.~~
Impact 5.4.7-2: Visual effects on scenic resources or visual character of the water bodies.	LS~~PSM~~					None required.~~**Measure 5.4.1-2, Diversion Tunnel Operation** – see description above.~~ ~~**Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek** – see description above.~~

Beginning on **Page 4.1-18** of the Draft EIR**,** portions of Table 4.1-3 have been revised as follows:

Table 4.1-3
Summary of Water Supply Impacts and Mitigation Measures – Peninsula Watersheds

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts				
		Sensitive Habitats	Key Special-Status Species	Other Species of Concern	Common Habitats and Species	
WATER QUALITY						
Impact 5.5.3-2: Effects on water quality in Pilarcitos Reservoir and along Pilarcitos Creek.	LS~~PSM~~					None required. ~~**Measure 5.5.3-2, Revised Operations Plan for Pilarcitos Watershed Facilities:** The SFPUC will develop and implement an operations plan for Pilarcitos Reservoir, Stone Dam, and associated diversions that will mimic current operations and will result in reservoir water levels, stream flows, water quality, and conditions for fisheries and terrestrial biological resources that are similar to the current condition.~~
FISHERIES						
Impact 5.5.5-4: Effects on fishery resources in Pilarcitos Reservoir.	LS~~PSM~~					None required.~~**Measure 5.5.3-2, Revised Operations Plan for Pilarcitos Watershed Facilities** – see description above.~~
Impact 5.5.5-5: Effects on fishery resources along Pilarcitos Creek below Pilarcitos Reservoir.	LS~~PSM~~					None required.~~**Measure 5.5.3-2, Revised Operations Plan for Pilarcitos Watershed Facilities** – see description above.~~

Table 4.1-3
Summary of Water Supply Impacts and Mitigation Measures – Peninsula Watersheds

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts				
		Sensitive Habitats	Key Special-Status Species	Other Species of Concern	Common Habitats and Species	
TERRESTRIAL BIOLOGY						
Impact 5.5.6-4: Impacts on biological resources in Pilarcitos Reservoir.		LS	LS~~PSM~~	LS	LS	None required.~~The SFPUC will implement Measure 5.5.3-2 to reduce adverse impacts on key special-status species to a less-than-significant level.~~ **~~Measure 5.5.3-2, Revised Operations Plan for Pilarcitos Watershed Facilities~~** ~~– see description above.~~
Impact 5.5.6-5: Impacts on biological resources along Pilarcitos Creek below Pilarcitos Reservoir.		LS~~PSM~~	LS	LS	LS	None required.~~The SFPUC will implement Measure 5.5.3-2 to reduce adverse impacts on sensitive habitats to a less-than-significant level.~~ **~~Measure 5.5.3-2, Revised Operations Plan for Pilarcitos Watershed Facilities~~** ~~– see description above.~~

4.2 Plans and Policies

Page 4.2-4 of the Draft EIR, after the paragraph (at the bottom of page 4.2-3) with the title "San Francisco Sustainability Plan" the following text has been inserted to incorporate recent planning efforts applicable to the project:

San Francisco Municipal Green Building Program

San Francisco's Green Building Program was founded in 1999 when the CCSF adopted the Resource Efficient Building Ordinance, which established green building standards for municipal buildings to increase energy efficiency, conserve CCSF finances, reduce the environmental impacts of demolition, construction, and operation of buildings, and create safe workplaces for CCSF employees and visitors. The ordinance created the inter-departmental Resource Efficient Building (REB) Task Force and charged the San Francisco Department of Environment with implementing the ordinance in partnership with the Department of Public Works and other REB Task Force departments. In 2004, amendments to Chapter 7 of the Environment Code set Leadership in Energy and Environmental Design (LEED) Silver Certification by the U.S. Building Council as the minimum environmental performance requirement for all municipal projects over 5,000 square feet. The REB Task Force assists City departments in compliance with the LEED Silver Certification requirement and helps to determine which projects are applicable for LEED ratings. For all municipal construction projects, including those projects that do not involve buildings and are not required to obtain LEED Silver Certification, the REB Task Force provides recommended best practices and sample specifications for building materials (e.g., recycled content of steel and concrete) (San Francisco Department of the Environment, 2004-2007).

Page 4.2-9 of the Draft EIR**,** after the paragraph under the title "San Francisco Sustainability Plan" the following text is added to address recent planning efforts applicable to the proposed project:

San Francisco Municipal Green Building Program

The San Francisco Municipal Green Building Program was developed for the purpose of improving the environmental performance of municipal buildings. The proposed project would be designed, constructed, and operated in accordance with the City's Green Building requirements. The SFPUC would complete and submit LEED checklists to the REB Task Force for the proposed project.

Page 4.2-11, under references for the Plans and Policies Section of the Draft EIR, the following text has been added as the second reference:

San Francisco Department of the Environment, San Francisco Municipal Green Building Report 2004-2007.

4.5 Hydrology and Water Quality

Page 4.5-3 of the Draft EIR, under the title "Groundwater" the second paragraph has been modified as follows:

> The San Joaquin River Hydrologic Region groundwater basin is the source for approximately 30 percent of agricultural and urban water usage annually in the region. Aquifers generally have thicknesses of several hundred feet in the hydrologic region and frequently necessitate well depths of up to 800 feet (DWR, 2003). Unless otherwise designated by the California Regional Water Quality Control Board, all groundwater in the Central Valley region is considered to be suitable or potentially suitable, at a minimum, for municipal and domestic supply, agricultural supply, industrial service supply, and industrial process supply.

4.6 Biological Resources

Page 4.6-7, in Table 4.6-1 of the Draft EIR a footnote has been deleted as USFWS no longer maintains a list of species under the designation of species of local concern.

TABLE 4.6-1

SPECIAL-STATUS PLANT SPECIES POTENTIALLY FOUND ONSITE

Plant Species Common Name	Legal Status Federal/State/CNPS	Potential for Occurrence Thomas Shaft	Potential for Occurrence Tesla Portal	Comments
Alkali milk vetch	SC/-/1B	P	P	Sites lack alkali soils. None found during rare plant surveys.
Bent-Flowered fiddleneck	-/-/1B	P	P	None found during rare plant surveys.
Beaked clarkia	SC/-/1B	P	P	None found during rare plant surveys.
Big tarplant	SC/-/1B	P	P	None found during rare plant surveys.
Brittlescale	SC/-/1B	P	P	Sites lack alkali soils. None found during rare plant surveys.
Diamond-petaled California poppy	SC/-/1B	P	P	None found during rare plant surveys.
Heartscale	SC/-/1B	P	P	Sites lack alkali soils. None found during rare plant surveys.
Large flowered fiddleneck	FE/SE/1B	P	P	None found during rare plant surveys.
Lemmon's jewelflower	~~SLC~~/-/1B	P	P	None found during rare plant surveys.
Mt. Diablo cottonweed	SC/-/2	P	P	None found during rare plant surveys. Population nearby at Thomas Shaft roadway project.
Rayless ragwort	-/-/2	P	N	Sites lack chaparral and cismontane woodlands. None found during rare plant surveys.
Recurved larkspur	SC/-/1B	P	P	Sites lack cismontane woodlands and clay soils. None found during rare plant surveys.
Round leaved filaree	-/-/2	P	P	Sites lack clay soils. None found during rare plant surveys.
Showy Indian clover	FE/-/1B	P	P	None found during rare plant surveys.
Showy madia	SC/-/1B	P	P	None found during rare plant surveys.
San Joaquin spearscal	SC/-/1B	P	P	Sites lack alkali soils, chenopod scrub and alkali wetlands. None found during rare plant surveys
Succulent owl's clover	FT/SE/1B	P	P	None found during rare plant surveys. Sites lack vernal pools.

Federal

- FE Endangered
- FT Threatened
- SC Federal Species of Concern
- ~~SLC Species of Local Concern~~

California Native Plant Society (CNPS) Categories

- 1A Plants presumed extinct in California
- 1B Plant species considered rare, threatened, or endangered in California and elsewhere
- 2 Plant species considered rare, threatened, or endangered in California but more common elsewhere
- 4 Plants of Limited Distribution- A Watch List

State

- SE Endangered
- ST Threatened
- SSC Species of Special Concern
- FP Fully Protected

Occurrence Information

- N = Not likely to occur
- C = Confirmed presence of the species in the project study area
- P = Potential to occur based on habitat suitability

Page 4.6-10, in Table 4.6-2 of the Draft EIR the designation SLC been deleted as USFWS no longer maintains a list of species under this designation.

TABLE 4.6-2
SPECIAL STATUS WILDLIFE SPECIES POTENTIALLY FOUND ONSITE

Wildlife Species Common/Scientific Name	Legal Status Federal/State	Potential for Occurrence Thomas Shaft	Potential for Occurrence Tesla Portal	Potential Wildlife Use
California Red-legged frog	FT/SSC	N (B)	N (B)	Marginal aestivation habitat in grasslands – low potential for occurrence.
California Horned lizard	SC/SSC	P (B) (F)	P (B) (F)	Potentially occurs in grasslands.
California tiger salamander	FT/SSC	N (B)	N (B)	Marginal aestivation habitat in grasslands – low potential for occurrence.
San Joaquin whipsnake	SC/SSC	P (B) (F)	P (B) (F)	Low potential in grasslands.
Pallid bat	-/SSC	P (F)	P (F)	Potential foraging in grasslands.
Townsend's big-eared bat	SC/SSC	P (F)	P (F)	Potential foraging in grasslands.
Mastiff bat	SC/SSC	P (F)	P (F)	Potential foraging in grasslands.
San Joaquin pocket mouse	SC/-	P (B) (F)	P (B) (F)	Potential foraging in grasslands.
San Joaquin kit fox	FE/ST	P (B) (F)	P (B) (F)	Marginal breeding and foraging habitat in grasslands – low potential for occurrence.
Golden Eagle	-/SSC and FP	C (F)	P (F)	Foraging in grasslands.
Ferruginous hawk	SC/SSC	P (F)	C (F)	Foraging in grasslands.
Swainson's hawk	-/ST	N	P (B) (F)	Potential foraging in grasslands and nesting at Tesla Portal site.
Northern harrier	SC/SSC~~, SLC~~	C (F)	C (F)	Foraging in grasslands.
White-tailed kite	-/FP	P (F) N (B)	C (F) P (B)	Foraging in grasslands and nesting at Tesla site.
Prairie falcon	-/SSC	C (F)	P (F)	Foraging in grasslands.
Burrowing owl	SC/SSC~~, SLC~~	N	P (B) P (F)	Potential breeding and foraging in grasslands.
California horned lark	-/SSC	P (B) (F)	P (B) P (F)	Potential breeding and foraging in grasslands.
Tricolored blackbird	SC/SSC	P (F)	C (F)	Foraging in grasslands.

Federal
- FE Endangered
- FT Threatened
- SC Federal Species of Concern

State
- SE Endangered
- ST Threatened
- SR Rare
- SSC State Species of Concern
- FP Fully Protected Species

Occurrence Information
N = Not likely to occur
C = Confirmed presence of the species in the Project Study Area
P = Potential to occur based on habitat suitability
(F) = Foraging (B) = Breeding

Page 4.6-18 of the Draft EIR, the third full paragraph has been modified as follows:

> The state's authority to regulate activities in wetlands and waters at the project sites resides primarily with the California Regional Water Quality Control Board (RWQCB), which regulates construction in waters of the United States and waters of the state, including activities in wetlands, under both the Clean Water Act and the State of California's Porter-Cologne Water Quality Control Act.~~State Water Resources Control Board (SWRCB), which is delegated to the Regional Water Quality Control Board (RWQCB) for project review under Section 401 of the Clean Water Act and the Porter-Cologne Act. The SWRCB, acting through the nine Regional Water Quality Control Boards~~RWQCB, must certify that a USACOE permit action meets state water quality objectives (Section 401, Clean Water Act). In response to the SWANCC Supreme Court decision, the SWRCB issued a guidance for the protection of these waters previously within the USACOE's jurisdiction. The RWQCB now takes the lead role in regulating impacts to "isolated" waters that are no longer within federal jurisdiction. These waters are still considered "Waters of the State" pursuant to the Porter-Cologne Water Quality Control Act.

Page 4.6-25 of the Draft EIR, the third paragraph has been changed as follows:

> *Burrowing Owl*. The Tesla Portal project site supports suitable habitat (breeding and foraging) conditions for burrowing owls. Construction activities at the Tesla Portal site would temporarily reduce the amount of breeding and foraging habitat onsite and may result in take of this special-status species. Implementation of Mitigation Measures 4.6-3a, 4.6-3e, 4.6-3f, and 4.6-3g would reduce potential impacts to a less than significant level. Mitigation Measure 4.6-3a requires the SFPUC to implement a worker awareness program. Mitigation Measures 4.6-3e, 4.6-3f, and 4.6-3g require~~s~~ the SFPUC adopt all applicable ITMMs related to burrowing owls that have been identified in the SJMSCP. The ITMMs include preconstruction surveys~~,~~ and eviction of birds from the project site prior to ground disturbance or construction activities~~, the implementation of a 100-foot buffer until the burrow can be safely destroyed~~.

Page 4.6-26 of the Draft EIR, the paragraph under "Other Special-Status Raptor Species (Golden Eagle, Ferruginous Hawk and Prairie Falcon)" has been corrected as follows:

> *Other Special-Status Raptor Species (Golden Eagle, Ferruginous Hawk and Prairie Falcon).* Each special status raptor species is known or has potential to forage on both project sites. The proposed construction activities would temporarily impact potential foraging and breeding habitat of special-status raptor species. The temporary loss of the small amount of habitat (11.716 acres of grassland), from the project would not substantially affect overall habitat availability in the area or affect foraging behavior of these species or use of the surrounding area. Therefore, the temporary loss of a small amount of disturbed grassland habitat is considered negligible. Impacts would be reduced to less than significant with implementation of Mitigation Measures 4.6-3, 4.6-3i, 4.6-3~~4~~j, ~~and~~ 4.6-3~~4~~k, and 4.6-3l, requiring a workers awareness program and SJMSCP ITMMs for each species.

Page 4.6-26 of the Draft EIR, the paragraph under "Tricolored Blackbird" has been corrected as follows:

> *Tricolored Blackbird.* Foraging habitat for tricolored blackbirds is present at both project sites, and tricolored blackbirds are known to forage at Tesla Portal. Construction activities at the project sites would temporarily reduce the overall amount of tricolored blackbird foraging habitat onsite. However, given that suitable foraging habitat is so widespread in the region surrounding the project sites, impacts would be minimal and localized. Therefore, the temporary loss of foraging habitat for tricolored blackbirds is considered minor. Impacts would be ~~reduced to~~ less than significant.

4.7 Cultural Resources

Page 4.7-6 of the Draft EIR, per comment L-SFLPAB-03, the following text has been added to the second paragraph as follows:

> The Sierra Club, along with San Joaquin Valley farmers and the Spring Valley Water Company, contested the damming of the Tuolumne River. Opposition to construction of the Hetch Hetchy project came from a variety of interests. Understandably, the Spring Valley Water Company opposed this project, which effectively ended its role as the utility company supplying San Francisco with its municipal and domestic water (SFPUC, 1949). The Hetch Hetchy project was designed to transmit electrical power to San Francisco from a power plant at Moccasin. A politically charged conflict over this electric power and associated revenue pitted public power advocates against the privately financed electric power industry. Opposition came from electrical power generating companies like Pacific Gas and Electric Company (PG&E) and Great Western Power Company (GWP), two utilities that served San Francisco and the Bay Area at the time. These private power companies opposed the competing generation and sale of electricity by public agencies, which was a provision of the Raker Act. The City and County of San Francisco (CCSF) planned to acquire PG&E and GWP's distribution systems within its service area, but between 1927 and 1941 the public consistently rejected bond issues required to fund their acquisition; allegedly, this opposition to the bond measures was largely funded by PG&E (Hundley, 1992; Sayles, 1985). The CCSF's agreements to have PG&E (which had acquired GWP in the 1930s) wheel its power through the company's existing transmission and distribution systems for delivery to San Francisco agencies, and its purchase of city power for resale, caused a longstanding controversy between the federal government, public power advocates, and the CCSF.

Page 4.7-29, in response to comment L-SFLPAB-03, the following references have been added to the Cultural Resources section of the Draft EIR:

> Hundley, Norris, *The Great Thirst: Californians and Water, 1770s–1990s*, pp. 187–189, University of California Press, Berkeley, California, 1992.
>
> SFPUC, *San Francisco Water and Power*, pp. 57–61, June 1949.

Page 4.7-29, the eleventh reference for the Cultural Resources section of the Draft EIR has been deleted:

~~SFPUC, *Regional Water System Facility Data Sheets*, 2004.~~

Page 4.7-30, in response to comment L-SFLPAB-03, the following references have been added to the Cultural Resources section of the Draft EIR:

SFPUC, Thomas Shaft Roadway Improvement Project, SFPUC Resolution No. 08-0061, April 8, 2008.

Sayles, Stephen P., Hetch Hetchy Reversed: A Rural Urban Struggle for Power. *California History*, 64:4, pp. 256, Fall 1985.

4.9 Air Quality

Page 4.9-22 of the Draft EIR**,** in response to comment L-SJVAPC-02, the first full paragraph is modified and Table 4.9-5 is inserted as follows:

Equipment exhaust emissions are generated from the combustion of fuels used for the operation of construction equipment. Fugitive dust emissions are generated by the suspension of particulate during earth-moving activities. Employee vehicle emissions and construction truck emissions are generated from the combustion of fuels and from the entrainment of road dust during travel along roadways on site and off site of the construction area. Asphalt paving emissions are generated from the evaporation of regulated volatiles, or diluents, used to liquefy asphalt cement. Reasonable worst-case uncontrolled construction emissions are summarized in Table 4.9-5.

TABLE 4.9-5
REASONABLE WORST-CASE ANNUAL UNCONTROLLED EMISSIONS AT THE TESLA PORTAL SITE DURING CONSTRUCTION (TONS PER YEAR)

Project Component	ROG	NO_x	CO	SO_2	PM_{10} (Dust)	PM_{10} (Exhaust)	PM_{10} Total	$PM_{2.5}$ (Dust)	$PM_{2.5}$ (Exhaust)	$PM_{2.5}$ Total	CO_2
Chemical Building	0.30	1.14	0.72	0	0.02	0.07	0.09	0	0.06	0.07	113.04
Office Building	0.18	1.06	0.57	0	0	0.07	0.07	0	0.06	0.06	94.04
UV Building	0.37	1.19	0.81	0	0.02	0.07	0.09	0	0.07	0.07	123.90
Total	**0.85**	**3.38**	**2.10**	**0**	**0.04**	**0.21**	**0.25**	**0.01**	**0.19**	**0.20**	**330.97**

Source: URS, 2008.

Page 4.9-23, of the Draft EIR**,** in response to comment L-SJVAPC-02, after the first paragraph under the title Thomas Shaft, the following paragraph has been modified as follows:

> Details regarding the size, scope, and length of construction for the Thomas Shaft site are outlined in the project description (Chapter 3). Chapter 3 also details expected construction equipment that will be operational throughout build out. In general, construction at this location is anticipated to start July 2009 and last for approximately 6 months. The development footprint at the Thomas Shaft site is below the SJVAPCD's Rule 9510 threshold triggering the need for quantification and therefore emissions have not been calculated but are discussed qualitatively.

Page 4.9-23 of the Draft EIR, in response to comment L-SJVAPC-02, the tenth paragraph under Impact 4.9-1 is edited as follows:

> In accordance with the guidance outlined in the GAMAQI, the SFPUC would implement Mitigation Measures 4.9-1a and 4.9-1b, which require a host of actions that the SJVAPCD has determined will reduce fugitive dust (PM) emissions and equipment exhaust emissions. These measures include, but are not limited to: stabilization of dust emissions, hauling restrictions, track out restrictions, speed restrictions, idling restrictions, and activity management. See Section 5.2.5 for a specific listing of these actions. Implementation of fugitive dust control measures alone would result in a reduction in PM_{10} dust-related emissions by 40 percent and $PM_{2.5}$ emissions by 38 percent. Total PM_{10} and $PM_{2.5}$ emissions would be reduced by 7 and 2 percent, respectively.) related to construction emissions at the Tesla Portal site (URS, 2008). Implementation of ~~these mitigation~~ all of the measures included in Mitigation Measures 4.9-1a and 4.9-1b would reduce the potentially significant air quality impact associated with project construction emissions of criteria pollutants at the Tesla Portal site to less than significant.

Page 4.9-27, of the Draft EIR**,** in response to comment L-SJVAPC-02, the following text and table are inserted in the first paragraph:

> All operational exhaust emissions are generated from the combustion of fuels. Diesel tank emissions are generated from the displacement of volatile vapors during refilling and the evaporation of volatiles. Reasonable worst-case uncontrolled operations emissions are summarized in Table 4.9-6.

Table 4.9-6
REASONABLE WORST-CASE ANNUAL UNCONTROLLED EMISSIONS ESTIMATES AT THE TESLA PORTAL SITE DURING OPERATIONS (TONS PER YEAR)

Source	ROG	NO_X	CO	SO_2	PM_{10}	CO_2
Emergency Generator	0.0553	1.0515	0.5996	0.0009	0.0346	82.5757
Transportation	0.0014	0.0274	0.0210	0.0001	0.00069	9.6761
Diesel Tanks	0.0343	--	--	--	--	--
Total	**0.0911**	**1.0789**	**0.6206**	**0.0009**	**0.0353**	**92.2518**

Source: URS, 2008

Page 4.9-35, in response to comment L-SJVAPC-02, the Draft EIR is revised to include the following reference:

URS, 2008, San Joaquin Regional Water Quality Improvement Project Air Emissions Estimates. November 24, 2008.

4.11 Public Services and Utilities

Page 4.11-4 of the Draft EIR, the paragraph under the title "California Integrated Waste Management Act of 1989" is revised as follows to correct an editorial error:

California Integrated Waste Management Act of 1989

The California Integrated Waste Management (CIWM) Act of 1989 (Public Resources Code [PRC], Division 30), enacted through Assembly Bill (AB) 939 and modified by subsequent legislation, requires all California cities and counties to implement programs to reduce, recycle, and compost at least 50 percent of wastes by the year 2000 ~~beginning January 1, 2000, and divert at least 75 percent by 2010~~ (PRC Section 41780). The state determines compliance with this mandate (which includes both disposed and diverted waste) through a complex formula. This formula requires cities and counties to conduct empirical studies to establish a "base year" waste generation rate against which future diversion is measured. The actual determination of the diversion rate in subsequent years is arrived at through deduction, not direct measurement. Instead of counting the amount of material recycled and composted, the city or county tracks the amount of material disposed at landfills, then subtracts the disposed amount from the base year amount. The difference is assumed to be diverted (PRC Section 41780.2).

4.14 Energy Resources

Page 4.14-6 of the Draft EIR, the first paragraph under the title "Tesla Portal Site" has been revised as follows:

Tesla Portal Site

SFPUC Power Enterprise provides power to the SFPUC's regional water system facilities, which use an estimated total energy usage of approximately 44 million kWh per year. This annual estimate includes the Tesla Portal facilities, which has a current demand of approximately 175,000 kWh per year. Operation of the new facilities at the Tesla Portal site could substantially increase overall on-site energy consumption. The SFPUC estimates that, in total, operation of the proposed improvements at the Tesla Portal ~~facility~~ site would require approximately six million kWh per year. This estimate includes approximately 1,800,000 kWh for operation of the three new buildings (UV building, Chemical Process building and Office/Control building), approximately 3,550,000 kWh for the UV reactors, and approximately 650,000 kWh for the proposed pumps).

Accounting for current energy use ~~This additional energy demand~~ at the Tesla Portal site ~~would~~, the project would result in a net increase of approximately 5,825,000 kWh, which represents roughly 13 percent of the regional water system's current annual energy use. ~~Under the significance criterion for energy, this additional energy demand represents the use of a large amount of energy, which is considered a potentially significant impact.~~ As described in the setting, the energy use by the regional water system is a fraction (less than three percent) of the long-term annual average energy production of the Hetch Hetchy system, and would remain at approximately three percent including the project's increased operational energy use.

Page 4.14-7 of the Draft EIR, the first paragraph has been changed as follows to correct an editorial error:

The project's energy impacts would be reduced to less than significant with implementation of the project design features, described above, and implementation of Mitigation Measure 4.14-1, which would ensure that energy efficient equipment is used in the proposed project at the Tesla Portal site ~~and the Thomas Shaft sites~~. It would also require the preparation of a repair and maintenance plan for each facility to minimize power use and the use of renewable energy, such as solar power, at the Tesla Treatment Facility.

Page 4.14-7 of the Draft EIR, the second paragraph has been deleted to correct an editorial error:

~~implement energy efficiency measures consistent with the *California Energy Action Plan II* priorities, and also requires the development and use of solar power at Tesla Treatment Facility, would reduce the project's energy impact to a less-than-significant level.~~

4.15 Cumulative Effects

Beginning on **Page 4.15-23** of the Draft EIR, the second paragraph under "Energy Resources" has been modified to correct an editorial error as follows:

The SFPUC estimates that, in total, the proposed improvements at the Tesla Portal ~~facility~~ site would require the use of approximately 6,000,000 kWh per year, an increase from the existing annual consumption of 175,000 kWh. ~~The additional demand generated by the improvements made to the Tesla Portal facility would increase the facility's annual usage by approximately 35 times over its existing annual consumption, which is approximately 175,000 kWh per year.~~ Operation of project facilities at Thomas Shaft would result in an annual energy demand of 110,800 kWh, an increase ~~of 40,000 kWh per year (or 36 percent)~~ from its current average annual consumption of 70,800 kWh. The additional energy demand would represent roughly 13 percent of the regional water system's current annual energy use of 44 million kWh per year. Additionally, the energy use by the regional water system is a fraction (less than 3 percent) of

the long-term annual average energy production of the Hetch Hetchy system, and would remain at approximately 3 percent, including the project's increased operational energy use. ~~Implementation of the proposed project (facilities at both Tesla Portal and Thomas Shaft) would result in a combined annual energy use increase in the SFPUC Power Enterprise's San Joaquin Region approximately 51 times above its current consumption level.~~

Page 4.15-24 of the Draft EIR, the beginning of the third paragraph has been clarified as follows:

Mitigation Measure 4.14-1 requires energy efficiency measures consistent with the *California Energy Action Plan II* priorities to be undertaken at both sites. Mitigation Measure 4.14-1 also requires preparation of a repair and maintenance plan for each facility to minimize power use and include the use of renewable energy at the Tesla Treatment Facility.

Chapter 5 Mitigation Measures

Page 5-2, part of Table 5-1 of the Draft EIR has been revised as follows to correct editorial errors:

Mitigation Measures (summarized here – refer to complete text in section below)	Tesla Treatment Facility (Tesla Portal Site)	Lawrence Livermore Water Quality Improvements (Thomas Shaft Site)
Section 4.6 Biological Resources		
Mitigation Measure 4.6-2 – Return Site to Pre-Construction Condition	X	~~X~~
Mitigation Measures 4.6-3e, 3f and 3g – Conduct Pre-Construction Surveys for Burrowing Owls	X	~~X~~
Mitigation Measure 4.6-3h – Conduct Pre-Construction Surveys for Swainson's Hawk	X	~~X~~

Page 5-4, Mitigation Measure 4.6-1a of the Draft EIR is revised in response to comment S-CDFG-04 as follows:

Participate in the SJMSCP

Mitigation Measure 4.6-1a: Prior to the commencement of construction activities, SFPUC shall coordinate with the Joint Powers Authority (JPA)/Technical Advisory Committee (TAC), implement relevant ITMMs for applicable species (as identified in Mitigation Measures 4.6-3b through 4.6-3l, below) and pay any necessary fees to fund offsite compensation under the terms of the SJMSCP to provide replacement values that are equal to that of the permanent loss of ~~0.308~~ 3.2 acres of California annual grasslands and 0.01 acre of ruderal/disturbed land, and temporary impacts to 11.72 acres of California annual grassland and 0.96 acre of ruderal/disturbed land ~~habitat values of the artificial wetland, the temporary loss of <0.001 acre of ephemeral drainage, the~~

~~temporary loss and permanent conversion of natural lands~~, and incidental take authorization for special-status species.

Page 5-6, the second paragraph of Mitigation Measure 4.6-3c of the Draft EIR has been changed in response to comment S-CDFG-09 as follows:

A qualified biologist with demonstrated experience in kit fox biology, identification, and survey techniques, shall conduct preconstruction surveys two calendar weeks to 30 calendar days prior to commencement of ground disturbance. Surveys shall be conducted by qualified biologists. When surveys identify potential dens (potential dens are defined as burrows at least four inches in diameter which open up within two feet), potential den entrances shall be dusted for three calendar days to register track of any San Joaquin kit fox present. If no San Joaquin kit fox activity is identified, potential dens may be destroyed.

Page 5-7, Mitigation Measures 4.6-3e, 4.6-3f, and 4.6-3g of the Draft EIR have been changed in response to comment S-CDFG-10 as follows:

Conduct Pre-Construction Surveys for Burrowing Owls

Mitigation Measure 4.6-3e: Breeding Season Surveys. ~~In January, and again no more than two weeks before construction, a survey for burrows and burrowing owls shall be conducted by a qualified biologist within 500 feet of the project (access permitting). The survey will conform to the protocol described by the California Burrowing Owl Consortium in the Burrowing Owl Survey Protocol and Mitigation Guidelines (California Burrowing Owl Consortium, 1993), which includes up to four surveys on different dates if there are suitable burrows present.~~

~~If occupied owl burrows are found within the survey area, a determination will be made by a qualified biologist, in consultation with the California Department of Fish and Game (CDFG), as to whether or not work will affect the occupied burrows or disrupt reproductive behavior.~~

~~If it is determined that construction will not affect occupied burrows or disrupt breeding behavior, construction will proceed without any restriction or mitigation measures.~~

~~If it is determined that construction will affect occupied burrows during August through February, the subject owls will be passively relocated from the occupied burrow(s) using one-way doors. There will be at least two unoccupied burrows suitable for burrowing owls within 300 feet of the occupied burrow before one-way doors are installed. Artificial burrows will be in place at least one week before one-way doors are installed on occupied burrows. One-way doors will be in place for a minimum of 48 hours before burrows are excavated.~~ Measures to

avoid and minimize impacts on the western burrowing owl will be implemented as described below:

- If project schedule permits, a qualified biologist will survey for burrows and burrowing owls during the breeding season (February 1 to August 31), immediately preceding construction. Surveys will be conducted within 500 feet of the project boundary (access permitting) in accordance with the California Burrowing Owl Consortium (1993) guidelines or as otherwise determined by CDFG. Burrows would be inspected for signs of owl activity (tracks, pellets, feathers, etc.). The locations of burrowing owl sightings, occupied burrows, and burrows with signs of owl activity will be marked on a map of the project area at a scale sufficient to accurately show the distance of active burrows to the limits of construction. Surveys will be conducted on at least four separate dates during the breeding season in areas where suitable burrows are present. If possible, surveys will be conducted during the peak of the burrowing owl breeding season, generally between April 15 and July 15.

- If occupied owl burrows are found within the survey area, a determination will be made by a qualified biologist, in consultation with CDFG, as to whether work will affect the occupied burrows or disrupt reproductive behavior.

- If it is determined that construction will not affect occupied burrows or disrupt breeding behavior, construction will proceed without any restrictions or mitigation measures.

Mitigation Measure 4.6-3f: Winter Surveys. ~~During the non-breeding season (September 1 through January 31) burrowing owls occupying the project site should be evicted from the project site by passive relocation as described in the CDFG's Staff Report on Burrowing Owls (CDFG, 1995).~~ Measures to avoid and minimize impacts on the western burrowing owl will be implemented as described below:

- If birds are not observed during breeding season surveys, or if breeding season surveys are infeasible due to project scheduling, or if construction will occur during the wintering season, a winter survey will be conducted to identify non-breeding residents of the project site. Winter surveys will be conducted within 500 feet of the project site (access permitting) or as otherwise determined by CDFG during the period when wintering owls are most likely to be present (December 1 to January 31). The locations of burrowing owl sightings, occupied burrows, and burrows with signs of owl activity will be marked on a map of the project area at a scale sufficient to accurately show the distance of active burrows to the limits of construction.

- If occupied owl burrows are found within the survey area, a determination will be made by a qualified biologist, in consultation with CDFG, as to whether or not work will affect the occupied burrows.

- If it is determined that construction will not affect occupied burrows, construction will proceed without any restrictions or mitigation measures.

- If it is determined that construction will affect occupied burrows, the subject owls will be passively relocated from the occupied burrow(s) using one-way doors prior to the onset of breeding season. Owls will be encouraged to relocate to alternate burrows that are at least 160 feet from the construction limits. One alternate natural or artificial burrow for each burrow excavated will be in place at least one week before one-way doors are installed on occupied burrows. One-way doors will be in place for a minimum of 48 hours before burrows are excavated.

Mitigation Measure 4.6-3g: Fall Surveys.~~During the breeding season (February 1 through August 31) occupied burrows shall not be disturbed and shall be provided with a 100-foot protective buffer until and unless the TAC, with the concurrence of the Permitting Agencies' representatives on the TAC; or unless a qualified biologist approved by the Permitting Agencies verifies through noninvasive means that either: 1) the birds have not begun egg laying, or 2) juveniles from the occupied burrows are foraging independently and are capable of independent survival. Once the fledglings are capable of independent survival, the burrow can be destroyed.~~ Measures to avoid and minimize impacts on the western burrowing owl will be implemented as described below:

- If surveys must be conducted between September 1 and November 30 (which is outside of the time windows specified above), a qualified biologist will conduct a survey for burrows and burrowing owls no more than thirty (30) days prior to ground-disturbing activity. If necessary, resident owls will be passively relocated from occupied burrows, as described above. If construction activities are still ongoing beyond November 30, then winter surveys will be conducted during December and January.

Page 5-8, Mitigation Measure 4.6-3h of the Draft EIR has been changed in response to comment S-CDFG-11 as follows:

Conduct Pre-Construction Surveys for Swainson's Hawk

Mitigation Measure 4.6-3h: A qualified biologist shall conduct a preconstruction survey for Swainson's hawk, prior to the commencement of any ground disturbing construction activities (e.g., grass/vegetation/brush/tree removal, soil excavation, grading, vehicle access, staging of materials or vehicles, large scale materials off-haul or delivery, construction of temporary or permanent access roads).

In the case that Swainson's hawks are found nesting in the area, the SFPUC will notify CDFG. At a minimum~~In addition,~~ the following mitigations regarding Swainson's hawk, as listed from the SJMSCP, will be implemented:

- If a nest tree becomes occupied during construction activities, then all construction activities shall remain a distance of two times the dripline of the tree, measured from the nest.

- If any nest trees need to be removed, they may be removed between September 1 and February 15, when the nests are unoccupied.

The following two measures will also be implemented:

- If any unoccupied nests are found during preconstruction surveys, these nests may be removed when the nests are unoccupied.

- If any occupied nests are found during preconstruction surveys, then all construction activities shall remain at a distance of ¼ mile (1,320 feet), unless CDFG agrees to other equally effective measures ~~are agreed to by CDFG~~ (e.g., monitor occupied nest during construction in the buffer zone, limit hours of construction, restrict construction activities, etc).

Page 5-8, Mitigation Measure 4.6-3i of the Draft EIR has been changed in response to comment S-CDFG-12 as follows:

Implement Incidental Take Minimization Measures for White-Tailed Kite

Mitigation Measure 4.6-3i: SFPUC shall implement the ITMM identified for the white-tailed kite under the SJMSCP, which consists of the following:

- A qualified biologist shall conduct preconstruction surveys and investigate all potential nesting trees on the project site (e.g., especially tree tops 15-59 feet above the ground in oak, willow, eucalyptus, cottonwood, or other deciduous trees), during the nesting season (February 15 to September 15) whenever white-tailed kites are noted on site or within the vicinity of the project site during the nesting season.

- If the species is found nesting, a setback of 100 feet from nesting areas shall be established and maintained during the nesting season for the period encompassing nest building and continuing until fledglings leave nests, unless CDFG agrees to other equally effective measures ~~are agreed to by CDFG~~ (e.g., monitor occupied nest during construction in the buffer zone, limit hours of construction, restrict construction activities, etc.) and CDFG shall be notified of the proposed buffer zone. This setback applies whenever construction or other ground-disturbing activities must begin during the nesting season in the presence of nests which are known to be occupied. Setbacks shall be marked by brightly colored temporary fencing.

Page 5-9, Mitigation Measure 4.6-3j of the Draft EIR has been changed in response to comment S-CDFG-13 as follows:

Implement Incidental Take Minimization Measures for California Horned Lark and Northern Harrier

Mitigation Measure 4.6-3j: SFPUC shall implement the ITMM identified for the California horned lark and northern harrier under the SJMSCP, which consists of the following:

- A qualified biologist shall conduct a preconstruction survey and investigate all potential nesting trees to determine the presence or absence of the species on the project site.

- If species are found, a setback of 500 feet from nesting areas shall be established and maintained during the nesting season (February 16 – August 31) for the period encompassing nest building and continuing until fledglings leave nests, unless CDFG agrees to other equally effective measures ~~are agreed to by CDFG~~ (e.g., monitor occupied nest during construction in the buffer zone, limit hours of construction, restrict construction activities, etc.), or offsite compensation shall be provided, and CDFG shall be notified of the proposed buffer zone. If a setback is used, this setback would apply whenever construction or other ground-disturbing activities must begin during the nesting season in the presence of nests which are known to be occupied. Setbacks shall be marked by brightly colored temporary fencing.

Page 5-9, Mitigation Measure 4.6-3k of the Draft EIR has been changed in response to comment S-CDFG-14 as follows:

Conduct Pre-Construction Surveys for Golden Eagle

Mitigation Measure 4.6-3k: Prior to the start of construction, a qualified biologist shall conduct golden eagle surveys as required by the SJMSCP. Additionally, SFPUC shall implement the ITMM identified for the golden eagle under the SJMSCP, which consists of the following:

- When a site inspection indicates the presence of a nesting golden eagle, CDFG will be notified and a setback of 500 feet from the nesting area shall be established and maintained during the nesting season (normally approximately February 1 – June 30) for the period encompassing nest building and continuing until fledglings leave nests, unless CDFG agrees to other equally effective measures ~~are agreed to by CDFG~~ (e.g., monitor occupied nest during construction in the buffer zone, limit hours of construction, restrict construction activities, etc). This setback applies whenever construction or other ground-disturbing activities must begin

during the nesting season in the presence of nests which are known to be occupied. Setbacks shall be marked by brightly colored temporary fencing.

Page 5-9, Mitigation Measure 4.6-3l of the Draft EIR has been changed in response to comment S-CDFG-15 as follows:

Conduct Pre-Construction Surveys for Ferruginous Hawk and Prairie Falcon

Mitigation 4.6-3l: Prior to the start of construction, a qualified biologist shall conduct surveys for ferruginous hawk and prairie falcon as required by the SJMSCP. These species currently do not nest in San Joaquin County and are not expected to nest in the County over the life of the SJMSCP. Therefore, in the highly unlikely event that one of these species is found nesting on a project site, SFPUC shall notify CDFG of the proposed buffer zone and a setback of 500 feet from the nesting area shall be established and maintained for the period encompassing nest building and continuing until fledglings leave the nests, unless CDFG agrees to other equally effective measures. ITMMs shall be formulated prior to ground disturbance by the TAC and approved by the JPA with the concurrence of the Permitting Agencies' representatives on the TAC in accordance with the SJMSCP's Adaptive Management Plan. ITMMs may consist of preconstruction surveys, avoidance techniques, and buffer areas.

Starting on **Page 5-10**, Mitigation Measure 4.7-2a of the Draft EIR has been changed as follows:

Accidental Archaeological Discovery

Mitigation Measure 4.7-2a: SFPUC Standard Construction Measure #9 for cultural resources requires that construction activities be suspended immediately if there is any indication of an archaeological resource.

To avoid any potential adverse effect from the proposed project on accidentally discovered buried or submerged historical resources as defined in CEQA Guidelines Section 15064.5(a)(c), the SFPUC shall distribute the Planning Department archaeological resource "ALERT" sheet to the project prime contractor; to any project subcontractor (including firms specializing in demolition, excavation, grading, foundation, pile driving, etc.); or utilities firm involved in soil disturbing activities within the project site. Prior to any soil disturbing activities being undertaken, each contractor is responsible for ensuring that the "ALERT" sheet is circulated to all field personnel including, machine operators, field crew, pile drivers, supervisory personnel, etc. The SFPUC shall provide the Environmental Review Officer (ERO) with a signed affidavit from the responsible parties (prime contractor, subcontractor(s), and utilities firm) ~~to the ERO~~ confirming that all field personnel have received copies of the "ALERT" sheet.

Should any indication of an archaeological resource be encountered during any soils disturbing activity of the project, the contractor and/or the SFPUC will immediately notify the ERO and will immediately suspend any soils disturbing activities within 100 feet of the discovery until the ERO has determined what additional measures should be undertaken.

If the ERO determines that an archeological resource may be present within the project site, the SFPUC shall retain the services of a qualified archeological consultant. The archeological consultant shall advise the ERO as to whether the discovery is an archeological resource that ~~,~~ retains sufficient integrity, and is of potential scientific/historical/cultural significance. If an archeological resource is present, the archeological consultant shall identify and evaluate the archeological resource. The archeological consultant shall make a recommendation as to what action, if any, is warranted. Based on this information, the ERO may require, if warranted, specific additional measures to be implemented by the SFPUC.

Measures might include: preservation in situ of the archeological resource; an archaeological monitoring program; or an archeological ~~testing~~ evaluation program. If an archeological monitoring program or archeological ~~testing~~ evaluation program is required, it shall be consistent with the MEA WSIP Archaeological Guidance (San Francisco Planning Department, 2008) ~~guidelines~~ for such programs. The ERO may also require that the SFPUC immediately implement a site security program if the archeological resource is at risk from vandalism, looting, or other damaging actions.

The project archeological consultant shall submit an accidental discovery Archaeological Data Recovery Report (ADRR) to the ERO, which, in addition to the usual contents of the ADRR, includes an evaluation of ~~the appropriate report(s) in accordance with the MEA WSIP Projects Archaeological Guidance series that evaluates~~ the historical significance of any discovered archeological resource, as well as describing ~~and describes~~ the archeological and historical research methods employed in the archeological monitoring/data recovery program(s) undertaken, and presenting, analyzing, and interpreting the recovered data.. Information that may put at risk any archeological resource shall be provided in a separate removable insert within the final report.

Once approved by the ERO, copies of the ADRR ~~report(s)~~ shall be distributed as follows: the relevant California Historical Resources Information System Information Center shall receive one (1) copy and the ERO shall receive a copy of the transmittal letter of the ADRR ~~report~~ to the Information Center. The MEA shall receive three copies of the ADRR ~~each report~~ along with copies of any formal site recordation forms (CA DPR 523 series) and/or documentation for nomination to the National Register of Historic Places/California Register of Historical Resources. The SFPUC shall receive copies of the ADRR~~report(s) as requested~~ in the number requested. In instances of high public interest in or the

high interpretive value of the resource, the ERO may require a different final report content, format, and distribution than that presented above.

Page 5-11, Mitigation Measure 4.7-2b of the Draft EIR has been changed as follows:

Treatment of Human Remains

Mitigation Measure 4.7-2b: The treatment of human remains and of associated or unassociated funerary objects discovered during any soils disturbing activity shall comply with applicable State laws. This shall include immediate notification of the San Joaquin County Coroner and in the event of the coroner's determination that the human remains are Native American ~~remains~~, notification of the California State Native American Heritage Commission (NAHC) who shall appoint a Most Likely Descendant (MLD) (Public Resources Code Section 5097.98). The archaeological consultant, SFPUC, and MLD shall make all reasonable efforts to develop an agreement for the treatment of, with appropriate dignity, human remains and associated or unassociated funerary objects (CEQA Guidelines Section 15064.5(~~e~~d)). The agreement should take into consideration the appropriate excavation, removal, recordation, analysis, custodianship, curation, and final disposition of the human remains and associated or unassociated funerary objects. California Public Resources Code ~~State law~~ allows 24 hours to reach agreement on these matters. If the MLD~~s~~ and the other parties do not agree on the reburial method, the project will follow Section 5097.98(b) of the California Public ~~r~~Resources ~~c~~Code which states, "the landowner or his or her authorized representative shall reinter the human remains and items associated with Native American burials with appropriate dignity on the property in a location not subject to further subsurface disturbance."

Page 5-14, under Mitigation Measure 4.9-1b of the Draft EIR the following text of the mitigation measure is changed to be consistent with the text contained within the air quality section:

SJVAPCD Exhaust Control Measures

Mitigation Measure 4.9-1b: The following mitigation measures will be implemented during construction of the proposed project to reduce exhaust emissions:

(1) SJVAPCD Guide to Assessing and Mitigating Air Quality Impacts Mitigation Measures:

To limit exhaust emissions within the San Joaquin Region, the SJVAPCD specifies the following exhaust controls for heavy-duty equipment (scrapers, graders, trenchers, earthmovers, etc.). The SFPUC will include these measures, where feasible and applicable, in contract specifications:

- Idling time (e.g., ~~10~~5-minute maximum) shall be minimized.

- The hours of operation of heavy-duty equipment and/or the amount of equipment in use shall be limited.

- Activity management (e.g., rescheduling activities to reduce short-term impacts) shall be implemented.

Page 5-16, the following reference has been added to the Mitigation Measures section of the Draft EIR:

> San Francisco Planning Department, MEA WSIP Projects Archaeological Guidance Documents. 2008.

Chapter 6 Growth-Inducement Potential and Indirect Effects of Growth

Page 6-1 of the Draft EIR, under the second paragraph the two proceeding paragraphs have been modified as follows:

> The ~~Draft~~ PEIR on the San Francisco Public Utilities Commission's (SFPUC's) Water System Improvement Program (WSIP) concluded that the WSIP as a whole would support growth in the existing SFPUC service area. And, as explained in Chapter 3, Project Description, the proposed project is a component of the WSIP and thus contributes to its indirect growth inducement effect. By providing additional water supply to SFPUC customers within the SFPUC service area, the WSIP, and the proposed project, as part of the WSIP, would have an indirect growth-inducing effect according to the CEQA definition above.[2]
>
> Implementation of the WSIP would meet customer purchase requests through the year 2018~~2030~~, as discussed in the ~~Draft~~ PEIR. Meeting additional purchase requests would provide water to serve additional residential and business customers in the existing SFPUC service area.

Beginning at the top of **Page 6-2** of the Draft EIR the text has been modified as follows:

> below, Indirect Effects of Growth). The SFPUC service area spans seven counties—Tuolumne, Stanislaus, San Joaquin, Alameda, Santa Clara, San Mateo, and San Francisco. ~~The Association of Bay Area Governments (ABAG) is the agency responsible for providing regional growth projections for the San Francisco Bay Area, which covers the majority of the SFPUC service area. Although the proposed project is outside of the Bay Area, the ABAG growth projections, along with other published sources (such as Urban Water Management Plans), are discussed below because of their relevance to the SFPUC service area.~~
>
> The project is primarily proposed to ensure that the SFPUC maintains high-quality water that meets or exceeds regulatory standards for drinking water into

the future and, therefore, would contribute to the WSIP's water quality goal. The proposed project would also contribute to the WSIP's seismic reliability goal by reducing the system's vulnerability to earthquakes through the construction of a new chlorination facility at the Tesla Portal site designed to meet current seismic standards, and designed to treat additional water supply up to 313 million gallons per day consistent with the WSIP ~~Draft PEIR~~. Because the proposed project is part of the WSIP, the project would also contribute indirectly to the WSIP's growth inducement impact.

Page 6-2 of the Draft EIR, the following text has been added preceding the last sentence on the page:

By removing the lack of a reliable water supply and water system (as one potential obstacle to growth within the SFPUC service area) and providing and assisting in development of additional water supply sources, such as recycled water and groundwater projects as well as promotion of more efficient use of water through conservation measures, the WSIP would have an indirect growth-inducing effect according to the CEQA definition above. The WSIP would support growth in the SFPUC service area through 2018, although it appears that some growth would occur irrespective of the WSIP due to increased water delivery efficiencies (e.g., plumbing code changes), conservation, and other water supply sources. Growth would in turn result in indirect effects. In most cases, the effects of population and employment growth have been identified and addressed in the EIRs for the general plans and associated area plans and specific plans adopted by the jurisdictions in the service area. Some of the identified indirect effects of growth are potentially significant and unavoidable; others are significant but can be mitigated.

Potentially significant and unavoidable impacts as a result of growth in the SFPUC service area could occur in the following areas: traffic congestion, air pollution, traffic noise, construction noise, increased demand for public schools and other public services, loss of recreational opportunities and impacts on visual quality resulting from the loss of open space, cumulative effects on over-utilized parks, loss of wildlife habitat and wetlands and impacts on other biological resources, cumulative impacts on cultural resources, increased flooding potential, increased urban runoff pollutants, seismic hazards, induced population growth, failure to meet housing demand for projected population growth, exposure of new development to contaminated soil or groundwater, insufficient water supply, insufficient wastewater disposal capacity, loss of agricultural resources, land use conflicts, conflicts with existing land use plans or policies, and changes in density, scale, and character of an area.

The adopted WSIP would have growth-inducement potential through 2018 because the SFPUC (with the cooperation of the wholesale customers) would provide the additional water supply to meet purchase requests though 2018. The

WSIP would support much of the growth through 2018 in the jurisdictions served by the SFPUC regional water system. In general, development that was planned and approved through the general plan process in the SFPUC service area would have environmental impacts. The environmental consequences of this planned growth have been largely addressed in local plans and the associated CEQA review as well as in other, project-specific documentation. In a number of jurisdictions, negative declarations or mitigated negative declarations were prepared for general plans and related planning documents that were found not to have significant environmental effects.

With the exception of the No Purchase Request Alternative, all of the alternatives analyzed in the PEIR contribute in similar ways to growth inducement impacts, since each of the alternatives provides different ways of meeting future water supply demand as one of the WSIP objectives. It is also likely that the water customers would find alternate sources of water to meet future demand under the alternatives that are not effective in meeting demand like the Aggressive Conservation and Recycling Alternative. Under this scenario, the alternative itself may not be growth-inducing, but growth could still occur. No mitigation measures were proposed for implementation by the SFPUC that could substantially decrease or eliminate growth-inducing impacts because the SFPUC does not have control over the decisions that each local agency will make with respect to growth in their jurisdictions. Individual agencies' general plans and environmental documents contain actions, limitations and mitigation measures that will be implemented in the individual jurisdictions with local development project or program approvals. These types of mitigation measures were identified in the PEIR (see Appendix B of this Draft EIR.)

Page 6-2 of the Draft EIR, the last sentence on the page has been modified as follows:

To assess the growth inducement potential of the WSIP and characterize the secondary effects of growth, the ~~Draft~~ PEIR investigated the following questions:

Beginning on **Page 6-4** of the Draft EIR, beginning with "6.2 Summary of Conclusions" on Page 6-4 and ending with "6.2.4 Indirect Effects of Growth" on Page 6-6, the text has been modified as follows:

6.2 Summary of Conclusions

~~The following bullet items highlight the key findings of the growth inducement analysis included in this Draft EIR as Appendix B.2.~~

~~6.2.1 Service Area Characteristics, Growth Trends and Policies~~

A review of historical growth trends of a selection of jurisdictions in the service area, based primarily on information in general plans and Bay Area Water Supply and Conservation Association profiles, shows that:

- Cities in the service area are largely urbanized, most having experienced their most rapid growth in the postwar decades through the 1970s.
- Milpitas and East Palo Alto have experienced high rates of growth more recently.
- San Francisco's population fluctuated somewhat but on average has been essentially stable over the past 50 years.
- Many jurisdictions cannot grow laterally and their general plans include policies to manage growth; many general plans identify strategies consistent with "smart growth" principles, such as encouraging infill development and the redevelopment of previously developed areas, as means to accommodate future growth.
- The SFPUC's wholesale customers vary widely, in a variety of ways: by size, overall demand projected for 2030, the change that the 2030 demand represents in absolute terms and as a percentage of 2001 demand, and the degree to which the customers depend on the SFPUC for their water supply. As such, the WSIP would remove growth obstacles to varying degrees within the service area.

As stated above, the complete growth inducement analysis is included in this Draft EIR as Appendix B.2.

~~6.2.2 Growth Assumptions Used to Develop 2030 Water Demand and Purchase Requests Compared with ABAG Growth Projections~~

~~As discussed in Sections 7.2.2 through 7.3.2 in Appendix B.2, each SFPUC wholesale customer selected a published source for growth projections to use in developing its service area's projections for total water demand in 2030 and subsequently identified its estimated level of water purchase in 2030 from the SFPUC. The majority of customers (about two-thirds) selected the most current ABAG projections available at the time (*Projections 2002*); while the others (about one third) selected other published sources (such as Urban Water Management Plans) for their population growth projections. *Projections 2002* was used by for almost all of the employment growth projections. These customer-selected growth projections were compared to ABAG's most recent projections series, *Projections 2005*.~~

- The growth assumptions used to derive the 2030 water demand estimates and subsequently the water customer purchase requests from the SFPUC are generally consistent with the most recent ABAG projections for jurisdictions in the service area. For the most part, the analysis demonstrates that, compared to the forecasts in ABAG's *Projections 2005*, the customer-selected projections used to derive water demand in the wholesale and retail service areas indicate:

  - Somewhat less growth in employment and population (fewer added jobs and residents) through 2030, due largely to the expectation of more existing jobs in the area in 2005 than ABAG's *Projections 2005* estimates

  - More total employment in 2030 than ABAG's *Projections 2005* projects by about 5 percent overall

  - Less total population in 2025 and 2030 by about 5 percent overall

- The growth that would be supported by the WSIP is generally consistent with current ABAG 2005 projections for jurisdictions in the service area. Because of differences in geographic area covered by most of the water customers and the jurisdictions they serve, they do not match exactly, and a few cannot be reasonably compared.

6.2.3 Growth Assumptions Used to Develop 2030 Water Demand and Purchase Requests Compared to General Plan Growth Projections

As discussed in Section 7.3.3 in Appendix B.2, the existing, adopted general plans for cities within the SFPUC wholesale customer service area and for San Francisco were reviewed to compare the level of growth projected in these land use plans with that reflected in the growth assumptions used in the WSIP planning studies. The key findings of this review are:

- The horizon years for projections in the general plans considered in the analysis vary from 2005 to 2025; none of the plans extend out to 2030, which is the WSIP planning horizon. Due to the WSIP's longer planning horizon, in some areas the WSIP could support a degree of growth that has not been addressed in adopted land use plans.

- Comparison of the growth assumed in the development of the WSIP demand projections with growth forecasted in locally adopted land use plans indicates that much of the WSIP-related growth has been addressed in the adopted plans. A comparison of general plan projections with those selected by the water customers shows that:

- ~~The population growth assumed in the demand projections for most (17 of 20) of the water customers for which comparable general plan projections are available is similar to the growth anticipated in the general plans of the cities served by them.~~

- ~~The employment growth assumed in the demand projections for most (11 of 16) of the water customers for which comparable general plan projections are available are generally consistent with (within 20 percent of) the employment growth anticipated in the general plans of the cities served by them. This general consistency was found despite the extraordinary job growth that occurred as a result of the economic boom in the 1990s, which was substantially reflected in employment projections used for the water demand projections (*Projections 2002*) but was not reflected to the same degree in earlier projections series used for many of the general plan employment estimates.~~

- ~~The employment growth assumed for four wholesale customers is substantially greater (between 20 and 70 percent greater) than the growth anticipated in the respective general plans, due to the economic boom that occurred in the 1990s in the Bay Area, which affected various jurisdictions differently. This difference in growth assumptions suggests that a degree of commercial and industrial growth assumed in the demand projections is not fully addressed in the respective general plans.~~

- ~~The general plans of jurisdictions in the SFPUC service area vary substantially in age, whereas the ABAG projections are updated every two years.~~

6.2.41 Indirect Effects of Growth

Chapter 7 Significant Environmental Effects That Cannot Be Avoided if the Proposed Project Is Implemented

Page 7-1 of the Draft EIR, the second paragraph has been modified as follows:

> However, as discussed in this Draft EIR, ~~Chapter 6, Growth Inducement,~~ the proposed project is one of several improvement projects that comprise the San Francisco Public Utilities~~y~~ Commission (SFPUC) Water System Improvement Program (WSIP)~~, and implementation of the WSIP would support growth in the SFPUC service area, thereby contributing indirectly, to environmental impacts caused by that growth. Because the proposed project is part of the WSIP and would contribute to the WSIP's growth inducement impact, the project therefore would contribute to the significant and unavoidable program-level impacts associated with growth inducement.~~ Insofar as the proposed project is a component of the WSIP, it would contribute to the WSIP's unavoidable water supply and growth-inducement impacts, as follows:

Potentially Significant and Unavoidable WSIP Water Supply Impacts

- Fisheries (Upper and Lower Crystal Springs Reservoir): Effects in the Peninsula watershed on fishery resources in Crystal Springs Reservoir in San Mateo County; and

- Growth Inducement: Indirect growth-inducement impacts in the SFPUC service area.

Significant and Unavoidable WSIP Water Supply Impacts

- Streamflow (Alameda Creek below Alameda Creek Diversion Dam): Effects on stream flow in Alameda Creek between the diversion dam and the confluence with Calaveras Creek.

Chapter 9 CEQA Alternatives

Page 9-2 of the Draft EIR, the first paragraph has been modified as follows:

The proposed project is a component of the San Francisco Public Utilities Commission's (SFPUC) Water System Improvement Program (WSIP). As required by CEQA, the ~~Draft~~ Program EIR (~~Draft~~ PEIR) ~~on the WSIP~~ evaluated a range of alternatives to the WSIP. This proposed project, which is listed as three separate projects in the ~~WSIP Draft~~ PEIR: the Tesla Portal Disinfection Facility, the Hetch Hetchy Advanced Disinfection, and the Lawrence Livermore Supply Improvements, is included in all of the WSIP alternatives. The ~~WSIP Draft~~ PEIR No Program Alternative includes the Hetch Hetchy Advanced Disinfection as it is an improvement to comply with the new federal drinking water regulatory requirements contained in the Long Term 2 Enhanced Surface Water Treatment Rule. The remainder of the proposed project evaluated in this EIR is not included in the ~~WSIP Draft~~ PEIR No Program Alternative. The WSIP alternatives are summarized in Section 9.2 and are analyzed in detail in Chapter 9 of the ~~Draft~~ PEIR, which is included in Appendix B.3 of this document.

Page 9-2 of the Draft EIR, under "9.2 WSIP Alternative" the text has been modified as follows:

9.2 WSIP Alternatives

The ~~WSIP Draft~~ PEIR evaluated~~s~~ seven alternatives to the ~~proposed~~ WSIP, summarized below, because of their apparent ability to meet most of the WSIP's goals, their ability to reduce one or more of the potentially significant impacts associated with program implementation, their potential feasibility, and their collective ability to provide a reasonable range of alternatives to foster informed decision-making and public participation. Analysis of the No Program Alternative is included as required by CEQA. Appendix B.3 includes more detailed descriptions of these WSIP alternatives, and also presents the associated program-level environmental analysis.

The WSIP that was ultimately adopted by the SFPUC incorporates elements of three alternatives to the originally proposed WSIP: the No Purchase Request Alternative, the Aggressive Conservation/Water Recycling and Groundwater Alternative, and the Modified WSIP Alternative.

Page 9-3 of the Draft EIR, under "9.2.3 Aggressive Conservation/Water Recycling and Local Groundwater Alternative" the text has been modified as follows:

9.2.3 Aggressive Conservation/Water Recycling and Local Groundwater Alternative

Under the Aggressive Conservation/Water Recycling and Local Groundwater Alternative, the SFPUC would implement all of the ~~proposed~~ WSIP facility improvement projects, but would endeavor to serve the projected increase in customer purchase requests through 2030 only through additional conservation, water recycling, and local groundwater projects. Under this Alternative the SFPUC would have to either: (a) limit future customer purchase deliveries to the level that can be met, short of 2030 requests (approximately 294 mgd instead of 300 mgd average annual) and increase the level of rationing to 25 percent or more during droughts, or (b) provide a supplemental supply to make up the delivery shortfall to meet the 300 mgd.

Page 9-3 of the Draft EIR, under "9.2.4 Lower Tuolumne River Diversion Alternative" the text has been modified as follows:

9.2.4 Lower Tuolumne River Diversion Alternative

Under the Lower Tuolumne River Diversion Alternative, the SFPUC would implement all of the proposed facility improvement projects and would serve the projected increase in customer purchase requests through 2030 through diversions from the lower Tuolumne River near its confluence with the San Joaquin River, assuming an agreement can be reached with the Turlock Irrigation District and the Modesto Irrigation District. This alternative would include construction and operation of additional conveyance and treatment facilities to divert, transport, treat, and blend the new supply into the regional water system.

Page 9-3 of the Draft EIR, under "9.2.7 Modified WSIP Alternative" the text has been modified as follows:

9.2.7 Modified WSIP Alternative

Under the Modified WSIP Alternative, the SFPUC would implement all of the proposed facility improvement projects, but would modify proposed system operations to minimize environmental effects. This alternative would include the implementation of key mitigation measures identified in the ~~Draft~~ PEIR.

Page 9-4 of the Draft EIR, under "9.2.8 Comparison of Alternatives to the Proposed WSIP" the text has been modified as follows:

9.2.8 Comparison of Alternatives to the ~~Proposed~~ WSIP

The seven ~~eight~~ alternatives analyzed in the ~~Draft~~ PEIR would have varying abilities to meet the goals and objectives established by the SFPUC for the WSIP and would have a wide range of additional environmental effects. The No Program, No Purchase Request Increase, and Aggressive Conservation/Water Recycling and Local Groundwater Alternatives would fail to meet one or more key program objectives, while the Lower Tuolumne River Diversion, Year-round Desalination at Oceanside, Regional Desalination for Drought, and Modified WSIP Alternatives would meet most of the basic program objectives. The SFPUC found that many of the Alternatives would have greater environmental impacts than the adopted WSIP. (See SFPUC Resolution No. 08-0200.)

Page 9-10 of the Draft EIR, under "Conclusions" the text has been modified as follows:

Conclusions

The No Project Alternative (Status Quo) would reduce potentially significant, but mitigable direct impacts associated with construction and operation of the proposed project, including, alteration of views as viewed from a scenic route and nighttime light and glare at the Tesla Portal site, impacts on biological and cultural resources, and noise, and air quality impacts. This alternative would also avoid the project's contribution to the SFPUC's ~~Water System Improvement Program's (~~WSIP~~)~~ potentially significant and unavoidable program-level impacts associated with growth inducement. However, under the No Project Alternative (Status Quo), if existing disinfection facilities at the Tesla Portal site were to become damaged during a seismic event, impacts similar to the proposed project, or potentially greater since facility replacement would occur during emergency conditions, would be expected. Damage to existing disinfection facilities resulting from a seismic event could also affect the SFPUC's ability to deliver water to meet demands in the Sunol Valley, Bay Division, Peninsula, and San Francisco sub-regions of its regional water service area. The No Project Alternative (Status Quo) would not meet any of the project objectives and would not meet contractual obligations to LLNL. Furthermore, under the No Project Alternative (Status Quo), the SFPUC would not comply with LT2ESWTR.[1]

Page 9-14 of the Draft EIR, under "Conclusions" the text has been modified as follows:

Conclusions

The No Project Alternative (Compliance with Safe Drinking Water Regulations) would reduce potentially significant but mitigable direct impacts associated with construction and operation of the proposed project since fewer facilities would be

built. These reduced impacts include alteration of views as viewed from a scenic route and nighttime light and glare at the Tesla Portal site, impacts on biological and cultural resources, and noise, and air quality impacts. This alternative would also avoid the project's contribution to the SFPUC's WSIP's potentially significant and unavoidable program-level impacts associated with growth inducement. However, under this alternative, if existing disinfection facilities at the Tesla Portal site were damaged during a seismic event, impacts similar to the proposed project, or potentially greater, since facility replacement would occur during emergency conditions, would be expected. Damage to existing disinfection facilities resulting from a seismic event could also affect the SFPUC's ability to deliver water to meet demands in the Sunol Valley, Bay Division, Peninsula, and San Francisco sub-regions of its regional water service area. This alternative would construct new water treatment facilities, and therefore, would meet the project objective related to compliance with LT2ESWTR. However, it would not meet contractual obligations to LLNL and it would not seismically upgrade existing facilities.

Page 9-16 of the Draft EIR, under "Conclusions" the text has been modified as follows:

Conclusion

Alternative 3: Continue Water Source to Artificial Wetland at Tesla Portal ~~S~~site would meet all of the project objectives and, therefore, would be expected to have similar growth inducement impacts compared to the proposed project. This alternative would contribute to the SFPUC's WSIP's potentially significant and unavoidable program-level impacts associated with growth inducement. This alternative would avoid impacts associated with permanent loss of 0.308 acre of artificial wetland at the Tesla Portal site and the associated loss of habitat value to dependent plant and wildlife species that are identified as potentially significant but mitigable under the proposed project. Other potentially significant but mitigable biological resources impacts during project construction would be the same as the proposed project under this alternative. This alternative would implement the Lawrence Livermore Water Quality Improvements at the Thomas Shaft site as described in Chapter 3. Therefore, the impact analysis and conclusions presented in Chapter 4 related to the Thomas Shaft site would be the same under this alternative, and are not discussed further in this section. Given that this alternative would implement all the same improvements as the project (excluding discontinuing the permanent, year round water supply to the artificial wetland at the Tesla Portal site), its potential impacts would be the same as the project's potential impacts for the following resource areas:

Page 9-18 of the Draft EIR, under "Conclusions" the text has been modified as follows:

Conclusion

Alternative 4: Combine Office/Control Building and UV Building at Tesla Portal ~~S~~site would meet all of the project objectives and, therefore, would be expected to have similar growth inducement impacts compared to the proposed project. This alternative would contribute to the SFPUC's WSIP's potentially significant and unavoidable program-level impacts associated with growth inducement. This alternative would reduce the severity of impacts associated with biological and cultural resources, and air quality in the proposed project area; these impacts would remain potentially significant, but mitigable as they are under the proposed project. Additionally, this alternative would reduce the severity of the project's erosion and sedimentation potential (a less than significant impact). It would also slightly increase the amount of land available for cattle grazing at the Tesla Portal site. However, this alternative could result in greater visual impacts because of the increased building height. Because this alternative would implement all project features identified in the project description in Chapter 3 with the exception that it would reduce the development footprint of the project, it would be expected to result in similar impacts as the project for the following resource areas:

Page 9-22 of the Draft EIR, under "Conclusions" the text has been modified as follows:

Conclusion

Alternative 5: Retrofit of Existing Tesla Portal Hypochlorite Station Building would be expected to have similar growth inducement impacts compared to the proposed project, and would contribute to the SFPUC's WSIP's potentially significant and unavoidable program-level impacts associated with growth inducement. This alternative site configuration would reduce the severity of some of the impacts associated with the proposed project but would not reduce the need for mitigation or change the determinations of significant but mitigable impacts. It would reduce the amount of erosion, dust, and temporary California annual grassland and ruderal/disturbed habitat disturbance during construction. During operations, it would have reduced visual, erosion, and water quality impacts; would not convert as much special-status wildlife foraging and/or breeding habitat as the project; and would increase the agricultural productivity potential (grazing) of the site relative to the proposed project. This alternative would not be able to accommodate the pH adjustment equipment and, therefore, that project objective would not be met, and a building for this equipment may be needed in the future. Furthermore, this alternative would not have the reliability and performance capability of a new facility. Due to the minor changes associated with this alternative compared to the proposed project, it would be expected to result in similar impacts as the project for the following resource areas:

Appendix B WSIP PEIR Reference Chapters

Appendix B of the Draft EIR has been revised to include the following introduction as well as additional chapters from the WSIP PEIR; including Chapter 13, Chapter 14, portions of Chapter 16, and Appendix O:

Overview and Introduction

As discussed in this Draft Environmental Impact Report (Draft EIR), the proposed project is part of the San Francisco Public Utilities Commission's (SFPUC) Water System Improvement Program (WSIP). The San Francisco Planning Department prepared a Draft Program Environmental Impact Report (PEIR) on the WSIP, which was published on June 29, 2007. After responding to public comments on the Draft PEIR, the Final PEIR was certified by the San Francisco Planning Commission on October 30, 2007 (Motion No. 17734). On that same day, the revised WSIP (known as the "Phased WSIP Variant" in the Final PEIR) was adopted by the SFPUC (Resolution 08-0200).

Because the proposed project is a component of the WSIP, it would contribute to the impacts that would occur with implementation of the WSIP's water supply strategy, including its growth-inducement impacts. These impacts are summarized in the main body of this Draft EIR in the Executive Summary and in Section 4.1, Approach to Analysis, of this Draft EIR. This appendix supplements the WSIP impact summaries by including the actual text from the Draft and Final PEIR on the WSIP's water supply impacts.

Due to the timing of publication of this Draft EIR, certification of the Final PEIR, and adoption of the WSIP, this appendix was assembled to present information on the impacts of the WSIP's water supply strategy and also to correct some of this information in response to comments on the Draft PEIR, as set forth in the Final PEIR. Specifically, this appendix includes the actual text in the Draft and Final PEIR on the originally proposed and the revised, adopted WSIP along with other information and text changes from the Final PEIR relevant to the WSIP's water supply strategy as it relates to the proposed project.

Contents of this Appendix

Text from the Draft PEIR on the WSIP

This appendix contains the following text on the WSIP's water supply impacts from the Draft PEIR:

- **Chapter 5 (Volume 3 of the PEIR):** This chapter evaluates the potential environmental impacts of the WSIP's water supply strategy and regional water system operations. The impact discussion is organized by watershed and related drainages and reservoirs.

- **Chapter 7 (Volume 4 of the PEIR):** This chapter analyzes the WSIP's growth inducement potential and associated secondary effects of growth impacts.

- **Chapter 9 (Volume 4 of the PEIR):** This chapter presents and evaluates the alternatives to the originally proposed WSIP. In particular, it evaluates alternative water supply strategies that could meet most of the basic objectives of the WSIP.

- **Appendix E (Volume 5 of the PEIR):** This appendix supplements the information contained in Chapter 7 of the Draft PEIR on growth inducement impacts.

Text from the Final PEIR on the WSIP

In response to comments on the Draft PEIR, the SFPUC proposed several changes to the WSIP. These changes are detailed in the Final PEIR along with the environmental effects of the revised program. Therefore, this appendix also contains the following text from the Final PEIR on the WSIP:

- **Sections 13.2, 13.3, and 13.4 (Chapter 13, Volume 7a of the PEIR):** These sections describe changes in the WSIP that have been proposed by the SFPUC since publication of the Draft PEIR. The SFPUC has proposed revisions to the WSIP in three areas, either in response to comments received on the Draft PEIR or as part of its ongoing system operations and planning. These revisions include: (1) changes in the project descriptions of two WSIP facility improvement projects (both of which help reduce impacts associated with the projects as originally proposed) which affect overall system operations; (2) updated water system assumptions and corresponding updates in the system modeling and results; and (3) development of the Phased WSIP Variant, a "hybrid" program that is a combination of the proposed program and one of the alternatives analyzed in the Draft PEIR. The environmental impacts of the revised WSIP are also described.

Master responses provide comprehensive discussions to respond to select sets of issues that received multiple comments. The following master responses are included in this appendix to clarify the description of the WSIP and its impacts:

- **14.3 – Master Response on Proposed Dry-Year Water Transfer (Chapter 14, Volume 7a of the PEIR):** This master response explains the dry-year transfer component of the adopted WSIP.

- **14.5 – Master Response on Water Resources Modeling and Appendix O (Chapter 14, Volume 7a of the PEIR):** This master response addresses questions about the water resources model used for the impact analysis of

WSIP. It references "Appendix O," which is also included as part of this appendix.

- **14.9 – Master Response on Alameda Creek Fishery Issues (Chapter 14, Volume 7a of the PEIR):** This master response addresses comments on the adequacy of the impact analysis and mitigations with respect to the WSIP's effects on the steelhead fishery in Alameda Creek. It describes in detail the changes that were incorporated into two WSIP facility improvement projects: the Calaveras Dam Replacement Project and the Alameda Creek Fishery Enhancement Project.

- **14.10 – Master Response on Modified WSIP Alternative (Chapter 14, Volume 7a of the PEIR):** This master response addresses the issues commenters raised on the Modified WSIP Alternative, which was identified in the Draft PEIR as the environmentally superior alternative.

- **14.11 – Master Response on Climate Change (Chapter 14, Volume 7a of the PEIR):** This master response addresses issues raised by commenters concerning the impacts of the WSIP on climate change and global warming.

Chapters 5, 7, and 9 of the Draft PEIR on the WSIP are included in this appendix as described above. Several changes were made to these chapters in the Final PEIR. This section details these changes.

- **16 – Staff-initiated Text Changes for Chapters 5, 7, and 9 (Volume 7b of the PEIR):** This section contains text changes to the Draft PEIR that resulted from: (1) changes made in response to comments received on the Draft PEIR; (2) changes that reflect the WSIP revisions; or (3) changes to correct errors or to clarify information presented in the Draft PEIR. Where a response to a comment includes a change to the text of the Draft PEIR, the text changes are shown in underline for additions and ~~strikethrough~~ for deletions.

The Draft and Final PEIR on the WSIP may be reviewed in its entirety at the offices of the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, CA 94103.

Appendix E Bibliography

Page E-5, the following reference has been added to Appendix E of the Draft EIR in response to comment L-SFLPAB-03:

Hundley, Norris, 1992. *The Great Thirst: Californians and Water, 1770s–1990s*, pp. 187–189, University of California Press, Berkeley, California, 1992.

Page E-7, the following references have been added to Appendix E of the Draft EIR:

San Francisco Department of the Environment (SFDE), *San Francisco Municipal Green Building Report 2004-2007.*

~~San Francisco Department of the Environment (~~SFDE~~)~~, *Sustainability Plan for San Francisco*, available online at http://www.sfenvironment.org/downloads/library/sustainabilityplan.pdf, October 1996.

Page E-8, the following reference has been added to Appendix E of the Draft EIR in response to comments:

SFPUC, *San Francisco Water and Power*, pp. 57–61, June 1949

SFPUC, Thomas Shaft Roadway Improvement Project, SFPUC Resolution No. 08-0061, April 8, 2008.

Page E-8, the following references in Appendix E of the Draft EIR have been deleted for accuracy:

~~SFPUC, *Regional Water System Facility Data Sheets*, 2004b.~~

~~SFPUC, *San Joaquin Pipeline System Project, Existing Conditions Report. Volume II: Access Roads and Temporary Construction Easements*. June, 2008b.~~

~~SFPUC, *San Joaquin Pipeline System Project, Existing Conditions Report. Volume I: San Joaquin Pipeline Right-of-Way*. June, 2008c.~~

Page E-8, the following references in Appendix E of the Draft EIR have been modified or added for accuracy:

San Francisco Planning Department, MEA WSIP Projects Archaeological Guidance Documents. 2008.

San Francisco Planning Department, Program Environmental Impact Report on the San Francisco Public Utilities Commission's Water System Improvement Program, Motion No. 17734, October 30, 2008.

San Francisco Public Utilities Commission (SFPUC), Water System Improvement Program California Environmental Quality Act Findings: Findings of Fact, Evaluation of Mitigation Measures and Alternatives, and Statement of Overriding Considerations, Resolution No. 08-0200, October 30, 2008.

~~San Francisco Public Utilities Commission (~~SFPUC~~)~~, Advanced Disinfection Workplan, Conceptual Engineering Report, May 2007. ~~February 2008~~.

SFPUC, *Technical Memorandum 6 Advanced Disinfection Workplan Agreement Number CS-751 Task 6 Hetch Hetchy Aqueduct System Recommendations*, ~~May 2007d~~ August 2006.

Page E-9, the following reference has been added to Appendix E of the Draft EIR in response to comment L-SFLPAB-03:

Sayles, Stephen P., Hetch Hetchy Reversed: A Rural Urban Struggle for Power. *California History*, 64:4, pp. 256, Fall 1985.

Page E-10, the following reference has been deleted from Appendix E of the Draft EIR to correct an editorial error:

~~Tetra Tech, *Large Flower Fiddleneck Survey, San Joaquin Regional Water Quality Control Project*, April 21, 2008.~~

Page E-11, the following reference has been added to Appendix E of the Draft EIR in response to comment L-SJVAPCD-02:

URS, 2008, San Joaquin Regional Water Quality Improvement Project Air Emissions Estimates. November 24, 2008.

APPENDIX A

NOP and Scoping Summary Report

San Joaquin Regional Water Quality Improvement Project
Environmental Impact Report
State Clearinghouse No. 2007052109

FINAL SCOPING SUMMARY REPORT

Prepared for
San Francisco Planning Department
Major Environmental Analysis Section

Prepared by
SRT Consultants/RBF Consulting

September 2007

SAN FRANCISCO PUBLIC UTILITIES COMMISSION

San Joaquin Regional Water Quality Improvement Project

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1.0 Project Overview

1.1 Project Background and Description

The City and County of San Francisco, through the San Francisco Public Utilities Commission (SFPUC), owns and operates a regional water system that extends from the Sierra Nevada to San Francisco and serves people in San Francisco, San Mateo, Santa Clara, Alameda, and Tuolumne Counties. The regional water system consists of a network of facilities covering a geographic range of about 167 miles. Two existing components of the SFPUC water system are the Tesla Portal Hypochlorite Station, located at the Tesla Portal site, and the Thomas Shaft Chlorination Facility, located at the Thomas Shaft site. Both of these facilities are located in unincorporated portions of San Joaquin County.

The SFPUC is proposing to construct and operate three new facilities and associated supporting facilities and infrastructure, two at the Tesla Portal site, and one at the Thomas Shaft site. These improvements comprise the proposed San Joaquin Regional Water Quality Improvement Project (SJRWQIP):

- At the Tesla Portal site, the Tesla Portal Disinfection Station would replace the existing Tesla Portal Hypochlorite Station, which disinfects water to make it potable for public consumption, and construct and operate a new 10,000-square-foot building containing disinfection and related equipment, and install supporting facilities and infrastructure. The purpose of this effort is to have a chlorination facility that would fulfill current seismic, safety/fire, and building code standards, which the existing facility does not meet. The new chlorination facility would also improve current water quality management capabilities.

- The Advanced Disinfection Facility (ADF) at Tesla Portal would consist of a new 20,000-square-foot facility that would pass water by a series of ultraviolet (UV) light arrays. The purpose of this effort is to help SFPUC meet U.S. Environmental Protection Agency (USEPA) requirements for *Cryptosporidium* reduction in drinking water, as required under USEPA's Long Term-2 Enhanced Surface Water Treatment Rule (LT2ESWTR). *Cryptosporidium* is a parasite commonly found in lakes and rivers, which has caused several large waterborne disease outbreaks of gastrointestinal illness in other parts of the country.

- At Thomas Shaft, the Lawrence Livermore National Laboratory (LLNL) Supply Improvements would upgrade water treatment facilities. The purpose of this effort is to meet USEPA requirements under the Surface Water Treatment Rule (SWTR) for the inactivation of *Giardia*, as well as assist in meeting LT2ESWTR *Cryptosporidium* requirements. Like *Cryptosporidium*, *Giardia* is a parasite that can contaminate drinking water and cause gastrointestinal illnesses. This upgrade would enable the facility to supply potable water to a reservoir owned by LLNL at their facility serving LLNL Site 300, a 7,000-acre restricted-access parcel about 15 miles southeast of the main LLNL facility and about 1.5 miles north of the Thomas Shaft site, and thereby fulfill a contractual agreement with LLNL that specifies drinking water quantities to be delivered to that site. At the present time,

SFPUC cannot fulfill this agreement because the water at Thomas Shaft does not meet SWTR standards for *Giardia* inactivation.

Construction of the Tesla Portal Disinfection Station and ADF is anticipated to start in July 2009, and last for approximately 18 months to two years. Construction of the LLNL Supply Improvements is anticipated to start May 2010, and last for approximately one year.

The SJRWQIP, along with several other projects, are components of the SFPUC's regional Water System Improvement Program (WSIP). Aging facilities within the system are currently in need of major repair, rehabilitation, upgrade, and/or replacement. In February 2005, the SFPUC developed the WSIP (see www.sfwater.org). The basic goals of the WSIP are to increase the reliability of the regional water system with respect to water quality, seismic response, water delivery, and water supply to meet water delivery needs in the service area through the year 2030. The implementation of the SJRWQIP would contribute to meeting the overall WSIP goals and objectives.

1.2 Environmental Review

The San Francisco Planning Department is the lead agency implementing environmental review under the California Environmental Quality Act (CEQA) for the proposed project. CEQA requires that the decision-making body and the public be informed about the potentially significant adverse environmental effects of a project, and identify ways to avoid or reduce those effects prior to project approval. The Planning Department's Major Environmental Analysis Section (MEA) determined that an Environmental Impact Report (EIR) is the appropriate level of environmental review for this proposed project. MEA will direct preparation of the EIR.

As part of the EIR process, the Planning Department held a public scoping meeting on June 6, 2007, to allow interested parties an opportunity to express their concerns about the proposed project's potential environmental impacts and to comment on the scope and content of the environmental review.

Following consideration of the public comments received during the scoping process, the Planning Department will prepare a Draft EIR on the project. The Draft EIR will include a description of the existing environmental conditions on and around the proposed project sites, and will identify significant impacts on the physical environment that could be caused by construction or operation of the project. The issues raised during the public scoping process will help to identify potentially significant impacts that should be studied and project alternatives that should be discussed in the EIR.

2.0 Public Scoping and Outreach Activities

The purpose of scoping is to provide the CEQA lead agency the opportunity to consult directly with interested public agencies, the public, and organizations and other interested parties on matters related to environmental effects associated with a proposed project. The scoping process helps identify actions, alternatives, and mitigation measures that should be considered in the EIR. It assists with the coordination of regulatory agencies, local agencies and other stakeholders who may have different views and concerns regarding environmental issues. Scoping activities can also serve as a means to engage a community, resolve issues early in the EIR process, and foster public participation.

2.1 Public Notification

On May 17, 2007, the San Francisco Planning Department issued a Notice of Preparation (NOP) of an Environmental Impact Report and Notice of a Public Scoping Meeting for the proposed project. A copy of the NOP is provided in Appendix A. The public comment period was held from May 17, 2007 to June 18, 2007. Public notice was provided as follows.

2.1.1 NOP and Scoping Meeting Notice Mailing

Approximately 750 copies of the NOP and Notice of Public Scoping Meeting were mailed on May 17, 2007 via certified mail to responsible agencies and by U.S. mail to all others on the mailing list. The mailing list included the following project stakeholder groups:

- Elected officials
- Public agencies
- Interest groups (environmental, business, general, civic)
- Water utilities and special districts
- Informational repositories (State Clearinghouse, libraries)
- Media outlets
- Property owners
- Local residents
- Other interested parties

The SFPUC mailed out approximately 600 postcards on May 24, 2007 to members of the public included in the mailing list announcing the scoping meeting.

2.1.2 Legal Notice

A legal notice was published in the Tracy Press and the San Francisco Chronicle on May 19, 2007. Copies of the legal notice are provided in Appendix B.

2.1.3 Project Website Information

The NOP and other information related to the proposed project were posted on the San Francisco Planning Department website http://www.sfgov.org/site/planning/mea.

The NOP information was also posted at the SFPUC website http://www.sfwater.org under "Water System Improvement Program," then "San Joaquin Region."

2.1.4 Copies of the NOP

A copy of the NOP was and is available to anyone upon request from the San Francisco Planning Department's Major Environmental Analysis Section office at 1650 Mission Street, Suite 400, or by calling (415) 575-9028. The NOP is also available online at the web address given above.

2.2 Scoping Meeting Overview

The San Francisco Planning Department's Major Environmental Analysis Section sponsored a public scoping meeting to solicit public input regarding project issues of concern to the community, and identify potential environmental effects and potential alternatives to be considered in the environmental review process. The meeting was held on June 6, 2007, at the Tracy Golf and Country Club, 35200 South Chrisman Road, in Tracy, California. The materials presented at the meeting are provided in Appendix C.

Fifteen people unrelated to the project staff attended the meeting and signed the sign-sheet (Appendix C): twelve members of the public (including one employee of the Tracy Golf and Country Club), and three employees of Lawrence Livermore National Laboratory.

Proceedings of the meeting were provided by a court reporter in the form of a written transcript. In addition, staff took summary notes of issues raised.

2.3 Scoping Meeting Presentations

The scoping meeting format consisted of an overview of the CEQA process by Paul Maltzer, the Environmental Review Officer of the San Francisco Planning Department's Major Environmental Analysis Section, followed by a description of the proposed project by Bijan Ahmadzadeh, the SFPUC Project Manager. A copy of the presentation used at the meeting is presented in Appendix C. Mr. Maltzer explained that the San Francisco Planning Department is the lead agency implementing CEQA for SFPUC projects. Mr. Maltzer summarized the CEQA process and the purpose of public scoping. He explained that the project sponsor and applicant, the San Francisco Public Utilities Commission, must consider the information in the EIR before making a decision to approve, modify or disapprove the project. Mr. Ahmadzadeh described the project in detail.

The EIR schedule and upcoming milestones were reviewed:

- Public Review of the Draft EIR: 2008
- Release of the Final EIR: 2008
- Certification of the Final EIR: 2008

Once the EIR is finalized, it will be considered for certification by the San Francisco Planning Commission. After certification, the SFPUC will evaluate the proposed project in light of the information in the EIR prior to taking any action on the project.

3.0 Summary of Scoping Comments

This section presents a summary of the comments received in verbal and written testimony provided at the June 6, 2007 public scoping meeting, and in subsequent letters received in response to the NOP. Approximately 15 people not affiliated with the project attended the scoping meeting, four of whom made verbal comments, and two of whom made written comments. During the public comment period, the San Francisco Planning Department received written comments in the form of four letters. Two additional letters were received after that period. The transcript of the public scoping meeting is presented in Appendix D. Written comments from the scoping meeting and comment letters are presented in Appendix E. Persons submitting oral and written comments are listed in Table 1. Table 2 provides a matrix of the types of concerns raised in each oral comment, comment card, or letter, showing the commenter's name and organization, if any. A summary or paraphrase of comments, organized by resource area topic, follows Table 2.

TABLE 1
NOP AND SCOPING MEETING COMMENTERS

Federal	• Lawrence Livermore National Laboratory - Keith Graham, Deputy Manager, Site 300 (comment card)
State	• California Department of Transportation – Tom Dumas, Office of Intermodal Planning (letter) • California Regional Water Quality Control Board, Central Valley Region (CVRWQCB) – Greg Vaughn, Senior Engineer, Stormwater and Water Quality Certification Unit (letter)
Regional	• Bay Area Water Supply & Conservation Agency (BAWSCA) – Nicole M. Sandkulla, Senior Water Resources Engineer (letter) • Modesto Irrigation District - Celia Aceves, Risk and Property Analyst (letter) • San Joaquin Valley Air Pollution Control District (SJVAPCD) - David Warner, Director of Permits Services; Arnaud Marjollet, Permit Services Manager (letter)
Public	• Linda Biscocho (oral comment) • Brian Jackman (oral comment) • Charles Tapia (oral comment) • Mark Wihl (oral comment) • Cletus Woo (comment card) • Tuolumne Band of Mi-Wuk Indians - Stanley Robert Cox, Cultural Resources Director (letter)

TABLE 2
INVENTORY OF SCOPING COMMENTS

Source							Issue Raised													
No.	Author's Last Name	Author's First Name	Agency/ Organization Name	Title	Type of Communication	Date	Aesthetic	Air Quality	Biological Resources	Coordination	Cultural Resources	Cumulative Impacts	Energy	Growth	Hazardous Materials	Hydrology and Water Quality	Noise	Project Description	Traffic	Water Supply
1	Biscocho	Linda			Oral comment	06/06/07		x							x			x		x
2	Jackman	Brian			Oral comment	06/06/07												x		
3	Tapia	Charles			Oral comment	06/06/07	x	x							x		x		x	
4	Wihl	Mark			Oral comment	06/06/07		x							x				x	
5	Graham	Keith	Lawrence Livermore National Laboratory (LLNL)	Deputy Manager, Site 300	Comment card	06/06/07												x		
6	Woo	Cletus			Comment card	06/06/07		x							x		x		x	
7	Sandkulla	Nicole	Bay Area Water Supply & Conservation Agency (BAWSCA)	Senior Water Resources Engineer	Letter	06/15/07				x		x	x	x				x		
8[1]	Dumas	Tom	California Department of Transportation	Chief, Office of Intermodal Planning	Letter	06/11/07														
9	Vaughn	Greg	California Regional Water Quality Control Board, Central Valley Region (CVRWQCB)	Senior Engineer, Stormwater and Water Quality Certification Unit	Letter	05/25/07			x						x	x				
10[1]	Aceves	Celia	Modesto Irrigation District	Risk and Property Analyst	Letter	06/11/07														
11	Warner & Marjollet	David & Arnaud	San Joaquin Valley Air Pollution Control District (SJVAPCD)	Director of Permits Services& Permit Services Manager	Letter	06/19/07		x												
12	Cox	Stanley Robert	Tuolumne Band of Mi-Wuk Indians	Cultural Resources Director	Letter	07/05/07					x									

1. These agency letters stated that they had no comments on the NOP.

3.1 Summary of Comments, Organized by Concern

The following paragraphs summarize or paraphrase the public comments received on the Notice of Preparation. The letters received from the California Department of Transportation and the Modesto Irrigation District stated that neither agency had comments on the scope of issues to be addressed in the EIR.

Aesthetics

Questions about the overall appearance of new facilities at Tesla Portal. Will they be taller, wider, brightly painted, or otherwise create visual impacts? Will the facilities be landscaped? (#3 - Tapia at meeting, June 6, 2007)

Air Quality

Questions about chlorine at the Tesla Portal site. Will chlorine be dissipated in the air, and will it affect the air we breathe? (#1 - Biscocho at meeting, June 6, 2007)

Concern about the possible spill of chlorine into the air at the Tesla Portal site. (#3 - Tapia at meeting, June 6, 2007)

EIR should address construction dust impacts on Chrisman residents near the Tesla Portal site. (#4 - Biscocho at meeting, June 6, 2007)

EIR should address dust abatement. (#6 - Woo, comment card)

The project would contribute to the overall decline in air quality due to construction activities in preparation of the site, and ongoing traffic and other operational emissions. The SJVAPCD recommends that the air quality section of the EIR have four main components:

- Description of the regulatory environment and existing air quality conditions impacting the area [information sources are listed];

- Estimates of existing emissions and projected pollutant emissions related to the increase in project source emissions and vehicle use, along with an analysis of the effects of these increases. The analysis should include ozone precursors, toxic air pollutants, carbon monoxide hotspot analysis, and odor analysis;

- Identification and discussion of all existing District regulations that apply to the project [applicable SJVAPCD Rules are listed]; and

- Identification and discussion of all feasible measures that will reduce air quality impacts generated by the project. (#11 - SJVAPCD, letter, June 19, 2007)

Biological Resources

The wetland at Tesla Portal should be delineated to determine whether it is part of waters of the U.S. or waters of the State, with associated regulatory requirements (#9 - CVRWQCB, May 25, 2007)

Cumulative and indirect wetland impacts must be prevented. (#9 - CVRWQCB, May 25, 2007)

Coordination between WSIP and SJRWQIP EIRs

Information developed in the WSIP PEIR that is used in the project EIR should be appropriately referenced. (#7 - BAWSCA, letter, June 15, 2007)

Cultural Resources

The project has the potential to affect cultural resources, and a qualified firm should conduct a cultural resources survey. (#12 - Tuolumne Band of Mi-Wuk Indians letter, July 5, 2007)

Cumulative Impacts

The cumulative impacts discussion in the project EIR must be consistent with the WSIP PEIR. (#7 - BAWSCA, letter, June 15, 2007)

Energy

The project description should note that electrical consumption will increase with operation of the UV system, and the EIR should examine whether on- or off-site electrical upgrades would therefore be required. (#7 - BAWSCA, letter, June 15, 2007)

Growth

The growth-inducement discussion in the project EIR must be consistent with the WSIP PEIR. (#7 - BAWSCA, letter, June 15, 2007)

Hazardous Materials

Concern about the use of chlorine at the Tesla Portal site. (#1 - Biscocho at meeting, June 6, 2007)

Concern about a possible spill of chlorine at the Tesla Portal site. (#3 - Tapia at meeting, June 6, 2007)

Concern about evacuation drills and warning devices at the Tesla Portal site. Resident has never heard any evacuation drills or sirens at Tesla Portal in the 20 years he has lived in the area. Have there been any in response to a problem? Should there be any, as practice? (#4 - Wihl at meeting, June 6, 2007)

Questions about hazards. What are the hazards to the whole population and how can those hazards be mitigated in the case of a problem? (#4 - Wihl at meeting, June 6, 2007)

EIR should address asbestos abatement. (#6 - Woo, comment card)

EIR should address debris abatement. (#6 - Woo, comment card)

EIR should discuss whether there is soil and/or groundwater contamination at the sites. A preconstruction site investigation may be necessary, to evaluate whether contamination is present, and any contamination found should be reported to responsible agencies and remediated. (#9 - CVRWQCB, May 25, 2007)

Hydrology and Water Quality

EIR should evaluate depth to groundwater, whether it is expected to be encountered, how dewatering will be accomplished, and whether the groundwater is contaminated. Recommendations for handling groundwater are provided, including use of Best Management Practices. (#9 - CVRWQCB, May 25, 2007)

Construction activities will require National Pollutant Discharge Elimination System compliance. (#9 - CVRWQCB, May 25, 2007)

The project could increase the amount of impervious surfaces and result in an increase in the amount of stormwater runoff. The development and implementation of a Storm Water Management Plan and incorporation of Best Management Practices is recommended. (#9 - CVRWQCB, May 25, 2007)

Noise

EIR should address demolition/construction noise abatement. (#6 - Woo, comment card)

Will the facility mean more traffic down Vernalis, because I hear those trucks go down this street all the time. (#3 - Tapia at meeting, June 6, 2007)

Project Description

Questions asking whether any of the pipelines will be replaced and whether the project would take place only at the two sites [Tesla Portal and Thomas Shaft]. (#2 - Jackman at meeting, June 6, 2007)

Question about impacts to residents as a property owner. (#1 - Biscocho at meeting, June 6, 2007)

LLNL manager supports the expeditious progress of the LLNL Supply Improvements in meeting the City and County of San Francisco's obligation to deliver high-quality water to LLNL Site 300. (#5 - Graham, comment card)

Better description is needed of Cryptosporidium and Giardia, and their regulatory significance. (#7 - BAWSCA, letter, June 15, 2007)

Description of the LLNL Supply Improvements should clarify that Giardia inactivation is needed to comply with Surface Water Treatment Rule Standards, and reducing Cryptosporidium is necessary to comply with Long Term-2 Enhanced Surface Water Treatment Rule standards. (#7 - BAWSCA, letter, June 15, 2007)

Project description should include the size of the proposed control building, adjacent to the proposed ADF. (#7 - BAWSCA, letter, June 15, 2007)

Objective of the ADF should emphasize that the project is necessary to comply with more stringent federal and state drinking water regulations, and that to not build this project would lead to violation of Long Term-2 Enhanced Surface Water Treatment Rule standards. (#7 - BAWSCA, letter, June 15, 2007)

Traffic

EIR should address traffic impacts. (#4 - Biscocho at meeting, June 6, 2007)

Will the facility provide more water, therefore requiring more chlorine, and increasing the number of truck trips on Vernalis Road? (#3 - Tapia at meeting, June 6, 2007)

EIR should address potential Vernalis Road traffic increases, and road closures/blockages/detours. (#6 - Woo, comment card)

Water Supply

Can the owners of the properties through which the SFPUC water passes have access to that water? (#1 - Biscocho at meeting, June 6, 2007)

Appendix A
Notice of Preparation, NOP Cover Letter, and NOP Report

NOTICE OF PREPARATION OF AN ENVIRONMENTAL IMPACT REPORT AND NOTICE OF PUBLIC SCOPING MEETING

Date of this Notice:	May 17, 2007	
Lead Agency:	San Francisco Planning Department 1650 Mission Street, Suite 400, San Francisco, CA 94103-2479	
Agency Contact Person:	Jamie Dean	**Telephone:** (415) 575-9028
E-mail:	Jamie.Dean@sfgov.org	**Facsimile:** (415) 558-6409
Project Title:	San Joaquin Regional Water Quality Improvement Project	
Project Sponsor:	San Francisco Public Utilities Commission 1145 Market Street, Suite 401, San Francisco, CA 94103	
Contact Person:	Robin Breuer	**Telephone:** (415) 551-2915
E-mail:	RBreuer@sfwater.org	**Facsimile:** (415) 934-5750
Project Location:	Tesla Portal: 9000 West Vernalis Road, unincorporated San Joaquin County, California Thomas Shaft: Thomas Shaft Road (no address), unincorporated San Joaquin County, California	
Assessor's Block and Lot:	Tesla Portal: 253-160-02 Thomas Shaft: 251-330-10, 251-170-03	
Counties:	San Joaquin	

Project Description: The City and County of San Francisco, through the San Francisco Public Utilities Commission (SFPUC), owns and operates a regional water system that extends from the Sierra Nevada mountain range to San Francisco and serves people in San Francisco, San Mateo, Santa Clara, Alameda, and Tuolumne Counties. The system consists of a complex network of facilities covering a geographic range of about 167 miles. Two components of the SFPUC water system are the Tesla Portal Hypochlorite Station, located at the Tesla Portal site, and the Thomas Shaft facility, both located in unincorporated portions of San Joaquin County.

The San Joaquin Regional Water Quality Improvement Project is part of the Water System Improvement Program (WSIP).[1] The basic goals of the WSIP are to increase the reliability of the regional water system with respect to water quality, seismic response, water delivery, and water supply to meet water delivery needs in the service area through the year 2030. The proposed project, which is the subject of this NOP, along with several other projects, are components of the SFPUC's WSIP, and the implementation of this project would contribute to meetings the overall WSIP goals and objectives.

The San Joaquin Regional Water Quality Improvement Project is proposed to improve the disinfection capabilities of the Tesla Portal site and the Thomas Shaft site. The Tesla Portal Disinfection Station would be located at the Tesla Portal site and includes closing the existing Tesla Portal Hypochlorite Station and the construction and operation of replacement facilities. Also at the Tesla Portal site, the project would include the construction and operation of a new Advanced Disinfection Facility that would pass water by a series of ultraviolet light arrays. At the Thomas Shaft site, the Lawrence Livermore National Laboratory Supply Improvements would upgrade water treatment facilities.

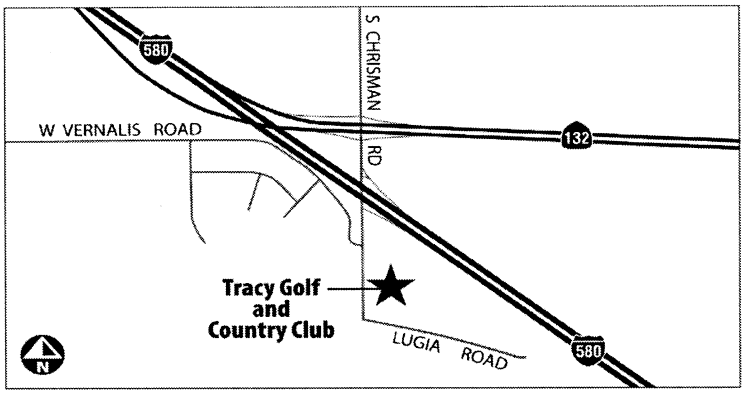
[1] The proposed project is listed as three separate projects in the WSIP NOP: the Tesla Portal Disinfection Facility, the Hetch Hetchy Advanced Disinfection, and the Lawrence Livermore Filtration. For the purposes of this EIR, these three projects are evaluated as one project given their geographic proximity, construction schedule, and the interrelated function of the two proposed facilities at the Tesla Portal site.

THIS PROJECT MAY HAVE A SIGNIFICANT EFFECT ON THE ENVIRONMENT. AN ENVIRONMENTAL IMPACT REPORT IS REQUIRED. This determination is based upon the criteria given in the following sections of the Guidelines of the State Secretary for Resources: 15064 (Determining Significant Effect) and 15065 (Mandatory Findings of Significance).

A **PUBLIC SCOPING MEETING** will be held, pursuant to the State of California Public Resources Code Section 21083.9 and California Environmental Quality Act (CEQA) Guidelines Section 15201, to receive oral comments concerning the scope of the Environmental Impact Report (EIR). The San Francisco Planning Department will hold a public scoping meeting at the following location, date, and time:

Tracy – June 6, 2007
Starting promptly at 6:30 p.m.

Tracy Golf and Country Club
35200 South Chrisman Road
Tracy, CA 95377



The purpose of this meeting is to receive oral comments to assist the San Francisco Planning Department in reviewing the scope and focus of the Project's environmental impact analysis and information to be contained in the EIR. The public will have the opportunity to comment and offer testimony for consideration. The San Francisco Planning Department will also accept written comments at the meeting or by mail, e-mail, or fax until the close of business on June 18, 2007. Written comments should be sent to the San Francisco Planning Department, Attn: Paul Maltzer, Environmental Review Officer, San Joaquin Regional Water Quality Improvement Projects EIR, 1650 Mission Street, Suite 400, San Francisco, CA, 94103-2479, by fax to (415) 558-6409, or sent by e-mail to Jamie.Dean@sfgov.org.

Documents relating to the Project are available for review, by appointment only, at the San Francisco Planning Department's Major Environmental Analysis office at 1650 Mission Street, Suite 400. Please call (415) 575-9028. Documents are also available online at:

http://www.sfgov.org/site/planning/mea
(click on San Joaquin Regional Water Quality Improvement Project EIR)

5/17/07
Date

Paul Maltzer, Environmental Review Officer
San Francisco Planning Department

中文資料請電：(415) 558-5982
Para sa impormasyon sa Tagalog tumawag sa: (415) 558-6251
Para información en Español llame al: (415) 558-5978

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May 17, 2007

To Responsible Agencies, Trustee Agencies, and Interested Parties:

RE: CASE NO. 2007.0427E – SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT
NOTICE OF PREPARATION OF AN ENVIRONMENTAL IMPACT REPORT AND NOTICE OF PUBLIC SCOPING MEETING

A Notice of Preparation (NOP) of an environmental impact report (EIR) pursuant to the California Environmental Quality Act (CEQA) and a Notice of Public Scoping Meeting for the above-referenced project, described below, has been issued by the San Francisco Planning Department. The NOP and Notice of Public Scoping Meeting is either attached or is available upon request from Jamie Dean, whom you may reach at (415) 575-9028, voice; (415) 558-6409, fax; Jamie.Dean@sfgov.org; or by mail at 1650 Mission Street, Suite 400, San Francisco, CA 94103-2479. The combined NOP/Notice of Public Scoping Meeting is also available online at http://www.sfgov.org/site/planning/mea and www.sfwater.org.

Project Description: The City and County of San Francisco, through the San Francisco Public Utilities Commission (SFPUC), owns and operates a regional water system that extends from the Sierra Nevada mountain range to San Francisco and serves people in San Francisco, San Mateo, Santa Clara, Alameda, and Tuolumne Counties. The system consists of a network of facilities covering a geographic range of about 167 miles. Two components of the SFPUC water system are the Tesla Portal Hypochlorite Station, located at the Tesla Portal site, and the Thomas Shaft facility, both located in unincorporated portions of San Joaquin County.

SFPUC proposes the San Joaquin Regional Water Quality Improvement Project, which is part of the Water System Improvement Program (WSIP).[1] The basic goals of the WSIP are to increase the reliability of the regional water system with respect to water quality, seismic response, water delivery, and water supply to meet water delivery needs in the service area through the year 2030. The proposed project, which is the subject of this NOP, along with several other projects, are components of the SFPUC's WSIP, and the implementation of this project would contribute to meeting the overall WSIP goals and objectives.

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[1] The proposed project is listed as three separate projects in the WSIP NOP: the Tesla Portal Disinfection Facility, the Hetch Hetchy Advanced Disinfection, and the Lawrence Livermore Filtration. For the purposes of this EIR, these three projects are evaluated as one project given their geographic proximity, construction schedule, and the interrelated function of the two proposed facilities at the Tesla Portal site.

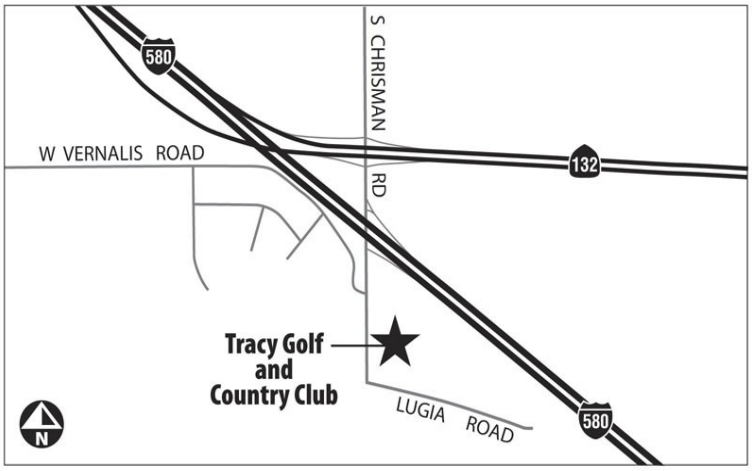
The San Francisco Planning Department's Major Environmental Analysis Division (MEA) is preparing an EIR for consideration by decision-makers prior to a final decision by the SFPUC regarding whether to approve and implement the project. The purpose of the EIR is to provide information about potentially significant adverse environmental effects of the proposed Project, to identify possible ways to minimize those potentially significant adverse effects, and to describe and evaluate feasible alternatives to the proposed Project. Preparation of an NOP or EIR does not indicate a decision by the City to approve or to disapprove the proposed Project. However, prior to making any such decision, the decision makers must review and consider the information contained in the EIR.

The San Francisco Planning Department will hold one **PUBLIC SCOPING MEETING** at the place, date, and time listed below. The purpose of this meeting is to receive oral comments to assist the San Francisco Planning Department in reviewing the scope and focus of the Project's environmental impact analysis and information to be contained in the EIR. Written comments will also be accepted at this meeting and until the close of business on June 18, 2007. Written comments should be sent to the San Francisco Planning Department, Attn: Paul Maltzer, Environmental Review Officer, San Joaquin Regional Water Quality Improvement Project EIR, 1650 Mission Street, Suite 400, San Francisco, CA 94103-2479, or provided via email to Jamie.Dean@sfgov.org, or by fax to (415) 558-6409.

Scoping Meeting

Tracy – June 6, 2007
Starting promptly at 6:30 p.m.

Tracy Golf and Country Club
35200 South Chrisman Road
Tracy, CA 95377



If you work for an agency that is a Responsible or Trustee Agency, we need to know the views of your agency as to the scope and content of the environmental information that is relevant to your agency's statutory responsibilities in connection with the proposed project. Your agency may need to use the EIR when considering a permit or other approval for this project. We will also need the name of the contact person for your agency. If you have questions concerning environmental review of the proposed project under CEQA, please contact Jamie Dean at (415) 575-9028.

San Joaquin Regional Water Quality Improvement Project

CASE NO. 2007.0427E

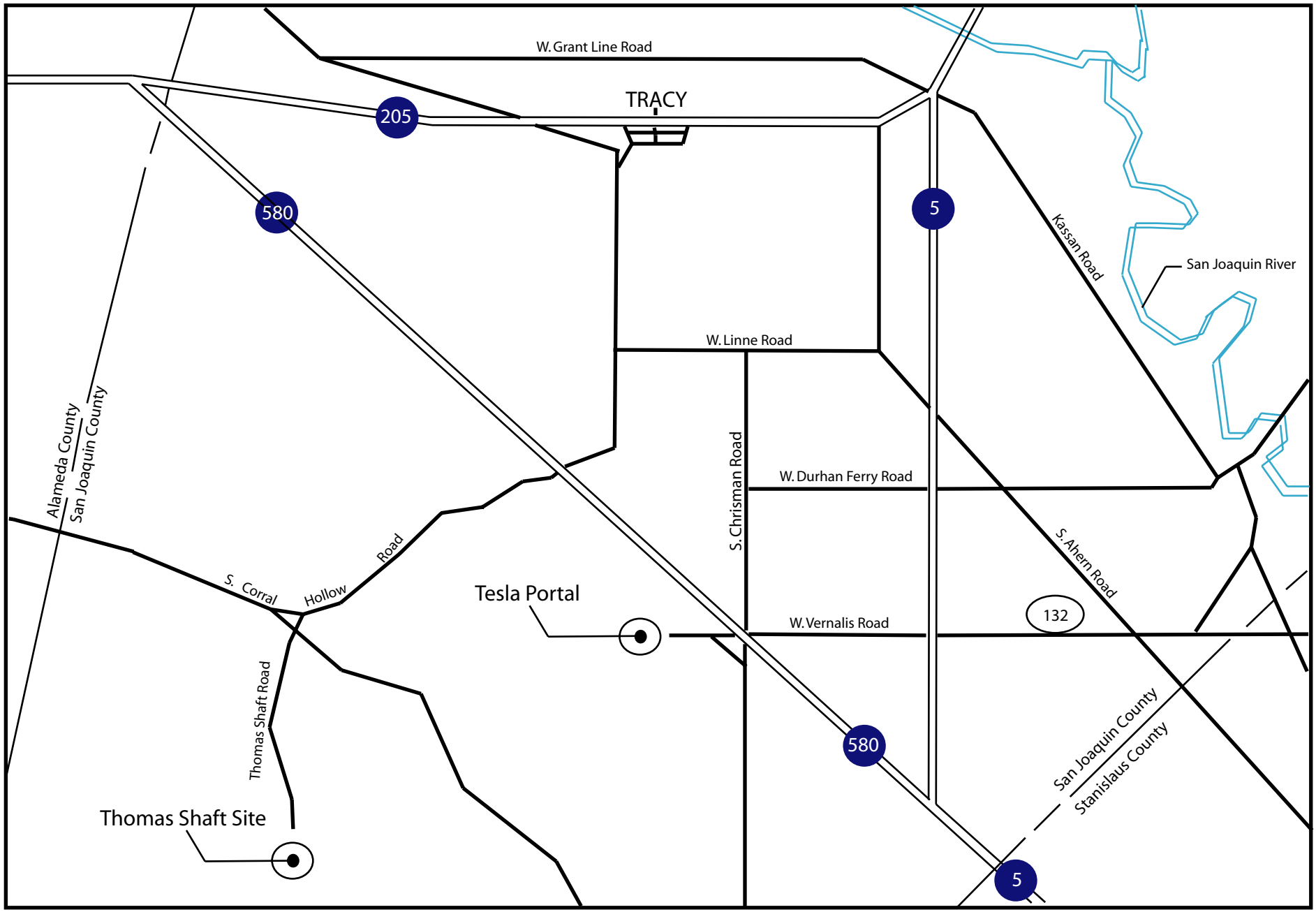
1.0 OVERVIEW AND BACKGROUND

The San Francisco Public Utilities Commission (SFPUC) is proposing to construct and operate three new facilities, two at the Tesla Portal site, and one at the Thomas Shaft site. (Figure 1, Vicinity Map). The three facilities comprise the proposed project, which is titled the *San Joaquin Regional Water Quality Improvement Project*. To meet California Environmental Quality Act (CEQA) requirements, the San Francisco Planning Department's Major Environmental Analysis (MEA) Division will prepare and distribute an Environmental Impact Report (EIR) describing and analyzing the environmental effects of the proposed project. This Notice of Preparation (NOP) describes the existing facilities at the proposed project site, proposed new facilities, and potential environmental effects of the proposed project.

1.1 San Francisco Water System, the Tesla Portal Hypochlorite Station, and the Thomas Shaft Facility

The City and County of San Francisco, through the SFPUC, owns and operates a regional water system that extends from the Sierra Nevada mountain range to San Francisco and serves people in San Francisco, San Mateo, Santa Clara, and Alameda Counties, and some residents in Tuolumne County, including the Town of Groveland. The regional water system consists of a network of facilities covering a geographic range of about 167 miles (Figure 2, SFPUC Regional Water System). Two existing components of the SFPUC water system are the Tesla Portal Hypochlorite Station, located at the Tesla Portal site, and the Thomas Shaft facility, located at the Thomas Shaft site. Both of these facilities are located in unincorporated portions of San Joaquin County.

Although the population within the SFPUC service area has steadily grown, repairs, maintenance, and upgrades have not kept pace with overall system needs to meet the increasing water purchase requests from SFPUC customers. Aging facilities within the system are currently in need of major repair, rehabilitation, upgrade, and/or replacement. In February 2005, the SFPUC developed a regional Water System Improvement Program (WSIP) (see www.sfwater.org). The basic goals of the WSIP are to increase the reliability of the regional water system with respect to water quality, seismic response, water delivery, and water supply to meet water delivery needs in the service area through the year 2030. A programmatic EIR is currently being prepared by the San Francisco Planning Department to address the potential environmental impacts of the WSIP on a programmatic level and evaluate regional water supply alternatives. The proposed project, which is the subject of this NOP, along with several other projects, are

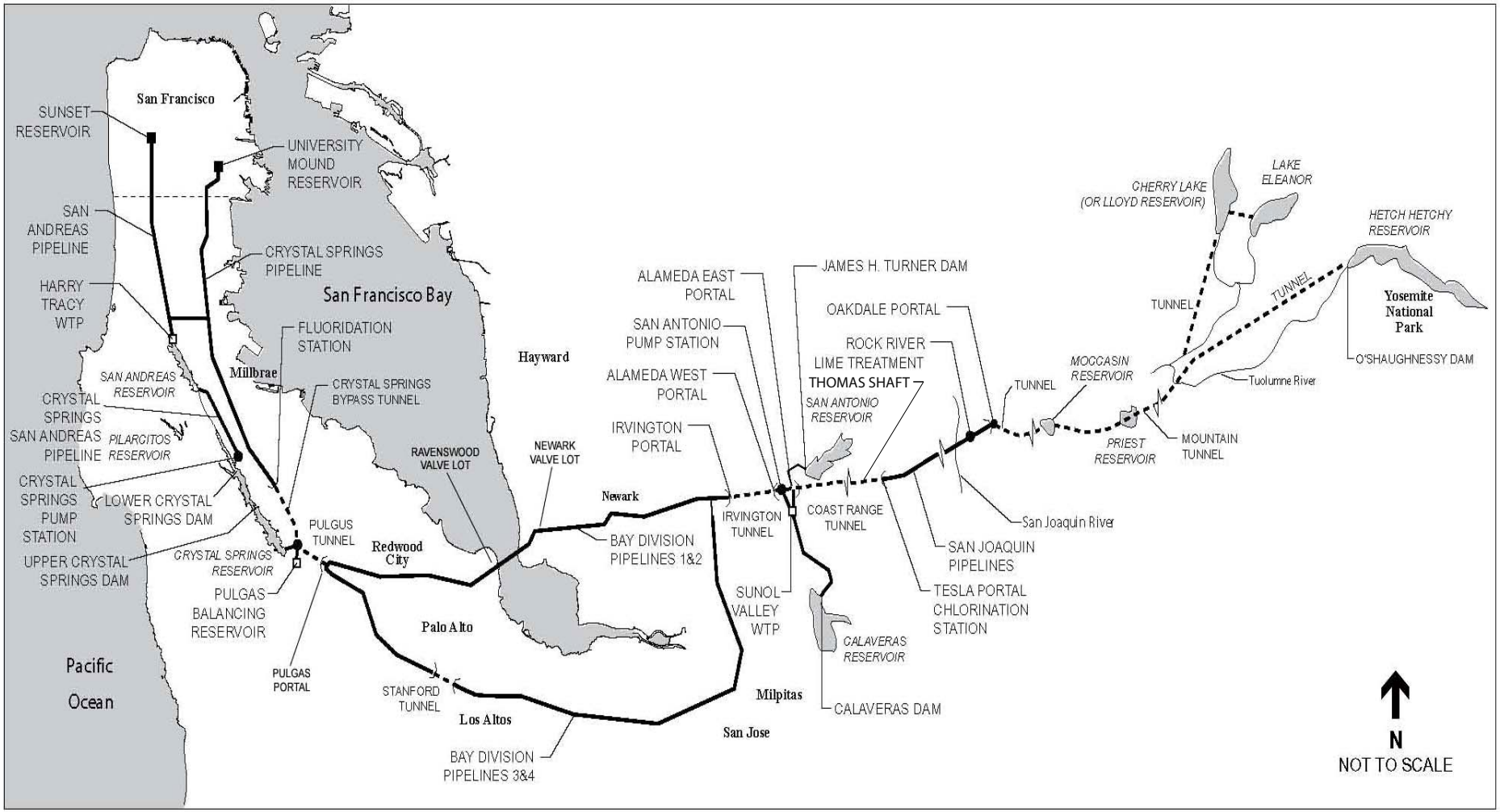


Not To Scale

SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT

Vicinity Map

Figure 1



SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT

SFPUC Regional Water System

Figure 2

components of the SFPUC's WSIP, and the implementation of this project would contribute to meeting the overall WSIP goals and objectives.[1]

1.2 Environmental Review Process

The MEA will prepare a project-specific EIR to evaluate the environmental effects of the San Joaquin Regional Water Quality Improvement Project proposed by the SFPUC. The EIR will be prepared in compliance with CEQA Guidelines Section 15161 and will address the project-specific construction and operational environmental impacts of the proposed project.

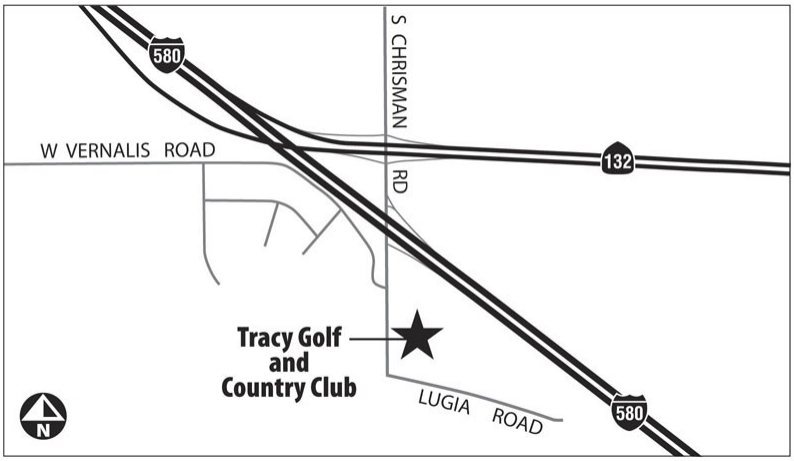
The first step in the environmental review process is the formal public scoping process. Following the public scoping meeting, a Draft EIR will be prepared and circulated for a 45-day public review period. Public comments on the Draft EIR will be accepted in writing during the review period or orally at a formal public hearing to be held by the San Francisco Planning Commission. MEA will then prepare written responses to comments on environmental issues raised during the public review period, and a Response to Comments document will be prepared. This document will be considered by the Planning Commission, along with the Draft EIR and any revisions to the draft based on the responses to comments, for certification as a Final EIR.

1.3 Public Scoping Meeting

MEA will hold one public scoping meeting at the following location, date, and time:

Tracy – June 6, 2007
Starting promptly at 6:30 p.m.

Tracy Golf and Country Club
35200 South Chrisman Road
Tracy, CA 95377



[1] The proposed project, which is the subject of this NOP, is listed as three separate projects in the WSIP NOP: the Tesla Portal Disinfection Facility, the Hetch Hetchy Advanced Disinfection, and the Lawrence Livermore Filtration. For the purposes of this EIR, these three projects are evaluated as one project given their geographic proximity, construction schedule, and the interrelated function of the two proposed facilities at the Tesla Portal site.

The purpose of this meeting is to assist MEA in determining the proposed scope and content of the EIR as summarized in Section 3.0 of this NOP. The public will have the opportunity to comment and offer testimony for consideration. MEA will also accept written comments at the meetings or by mail, e-mail, or fax until the close of business on June 18, 2007. Written comments should be sent to the San Francisco Planning Department, Attn: Paul Maltzer, 1650 Mission Street, Suite 400, San Francisco, CA 94103-2479, by fax to (415) 558-6409, or sent by e-mail to Jamie.Dean@sfgov.org.

1.4 Project Approvals

Following completion of the environmental review, the SFPUC will hold a public hearing to consider approval of the proposed project. Approvals will also be required from the Central Valley Regional Water Quality Control Board, and the San Joaquin Valley Unified Air Pollution Control District.

2.0 PROJECT DESCRIPTION

2.1 Existing Facilities and Project Components

2.1.1 Existing Facilities

Tesla Portal. The Tesla Portal site is located at 9000 West Vernalis Road, about 7.5 miles south of the city of Tracy, in unincorporated southwestern San Joaquin County. The site as a whole is about 52 acres; the proposed project would occur on a small portion (about five acres) of the site.

The Tesla Portal Hypochlorite Station, constructed in 1937, is located at the entrance to the Coast Range Tunnel and is the primary disinfection point for all waters emanating from the Hetch Hetchy Aqueduct. At the Tesla Portal Hypochlorite Station, sodium hypochlorite, a liquid form of chlorine and equivalent to chlorine bleach, is injected into the Coast Range Tunnel, utilizing two 13,000-gallon tanks outside the facility and four 4,000-gallon tanks inside the facility, to inactivate viruses and *Giardia*. No chlorine gas is released during the process. The existing Tesla Portal Hypochlorite Station handles a maximum flowrate of 290 million gallons per day (mgd) and an average flowrate of 220 mgd. It is operated continuously 24 hours per day as an unmanned facility, with routine maintenance of facility components. Facility operations are remotely monitored and controlled via the SFPUC's Supervisory Control and Data Acquisition (SCADA) System.

The primary structure at the site is the Tesla Portal structure, a 10.5-foot diameter steel manifold where three pipelines join and enter the Coast Range Tunnel. A steel overflow/surge shaft rises approximately 100 feet from a hillside near the Tesla Portal structure. The oldest buildings at the site are a wood-frame building housing the chlorination unit, a pump house, and a watershed keeper's cottage, all built in 1936.

Two valve houses were later added in 1949 and 1963. Three 20,000-gallon holding tanks are located on a hillside above the other buildings. Various minor upgrades and improvements have been added over the years, including an improved road and security gates in 2003.

Thomas Shaft Site. The Thomas Shaft site is located about 4.4 miles downstream from Tesla Portal, and about seven miles southwest of the city of Tracy in unincorporated southwestern San Joaquin County. The Thomas Shaft site as a whole is about 28 acres; the proposed project would occur on the developed portion of the site, which totals approximately one acre. Access to the developed portion of the site is via Thomas Shaft Road, a private road starting at Corral Hollow Road about 1.5 miles north of the site.

In the developed portion of the Thomas Shaft site, a tunnel and access shaft were constructed when the Hetch Hetchy Aqueduct was first installed in the area. The site also contains a backup chlorination facility, constructed in 1995 and modernized and upgraded in 2001, to chlorinate Hetch Hetchy water if adequate chlorination does not occur at the Tesla Portal Hypochlorite Station. The facility can be operated either onsite or remotely using the SCADA system. Components of the facility include a chemical receiving and storage facility, a chemical unloading area, and a control and power supply area. The chemical receiving and storage facility contains three 6,000-gallon hypochlorite tanks, several pumps, and associated piping and sensors. The facility also has water quality analyzers that sample water for quality control.

SFPUC and Lawrence Livermore National Laboratory (LLNL) have a contract, executed in 1960 and amended in 1987, under which SFPUC is to supply water to LLNL Site 300 after treatment at Thomas Shaft. To assist in water delivery, LLNL installed a ten-inch water line and pumps in 1995 across Thomas Shaft Road from the chlorination facility. However, because Thomas Shaft cannot meet the U.S. Environmental Protection Agency's (USEPA) Surface Water Treatment Rule (SWTR) standards for the inactivation of *Giardia*, SFPUC has not delivered water to Site 300 to date.[2]

2.1.2 Project Components

Tesla Portal Disinfection Station. The Tesla Portal Disinfection Station would be located at the Tesla Portal site. The proposed project includes replacement and upgrade of the existing disinfection facilities at the Tesla Portal Hypochlorite Station to meet current seismic, safety/fire, and building code standards. Sodium hypochlorite would be fed from a new Chemical Process Building and injected into the San Joaquin Pipelines. Although the location of the chlorination function at the site would move, the chlorine

[2] The current water supply for Site 300 comes from onsite wells serving a population of about 250 workers and visitors. The wells are owned by the Department of Energy/National Nuclear Security Administration, and operated by the contractor in charge of LLNL (currently the University of California).

injection process itself would be essentially unchanged. In addition, to lower the pH of the water, fluoride and sulfuric acid would be added.

The facility would continue to be remotely monitored and operated, although, as is true for the existing system, controls for manual operation would also be provided. Existing disinfection buildings on the site that would no longer be used would be maintained to prevent deterioration, and would not be occupied, although they might be used to store equipment.

Development associated with the new Advanced Disinfection Facility would include:

- Chemical Process Building. This new, approximately 10,000-square-foot building would be bermed into the adjacent hillside to help regulate building temperature. Contents would include the following:

  - Three 15,000-gallon sodium hypochlorite storage tanks

  - Two 10,000-gallon hydrofluosilicic acid (i.e., fluoride) storage tanks

  - Two 10,000-gallon sulfuric acid tanks

  - Sulfuric acid injection pH reduction system

  - Chemical spill containment system

  - Electrical room

  - Shop/storage room

  - Chemical feed equipment: metering pumps, transfer pumps, piping, and instrumentation (e.g., pressure gauges, flow meters, and tank level indicators)

- Office and Control Building. This new, approximately 2,400-square-foot building would contain offices, control room, laboratory, restrooms, lockers, shower, and a multipurpose room.

- Emergency back-up power supply

- Heating, ventilation, and air conditioning systems, installed inside the buildings

- Fire protection systems, using water sprinklers, dry chemical systems and/or fire hydrants; with the exception of the hydrants, installed inside the buildings

- Outdoor lighting.

Advanced Disinfection Facility (ADF). This facility would also be located at the Tesla Portal site. The new facility would allow the SFPUC to achieve the high level of disinfection required to reduce *Cryptosporidium* to levels mandated under Long Term-2 Enhanced Surface Water Treatment Rule (LT2ESWTR) by running Hetch Hetchy water past arrays of ultraviolet (UV) lamps. Facilities to be installed would include:

- UV Building. Contents of this new, approximately 20,000-square-foot building would include the following:

  - Twelve new UV reactors, each containing several UV lamp arrays and various sensors

  - Below-grade piping vaults

  - Two 3,000-gallon food-grade acid tanks (probably citric acid), for periodic cleaning of the UV lamps, attached to a UV lamp cleaning system

  - Diesel standby power generators and two aboveground diesel fuel tanks, probably 5,000 gallons each.

Other activities proposed at the Tesla Portal site that would benefit one or both of the above facilities, include:

- Road improvements. The following would be installed or constructed:

  - Paved approximately 0.5-mile circulation loop road in front of the Chemical Process Building connecting to the existing roadway

  - Chemical truck delivery area adjacent to the proposed Chemical Process Building

  - Paved parking areas on each side of the Office and Control Building, providing a total of three parking spaces

  - New asphalt surfacing of the existing access road

- Valves and valve vaults, to direct adequate flow as required

- Two emergency standby 750 kilowatt propane- or diesel-fueled generators

- Security improvements, including an eight-foot high fence surrounding the approximately five-acre area in which the new treatment facilities would be located (see below), and installing the following new features: controlled gate and entry system, closed circuit television monitoring system, and intrusion detection system.

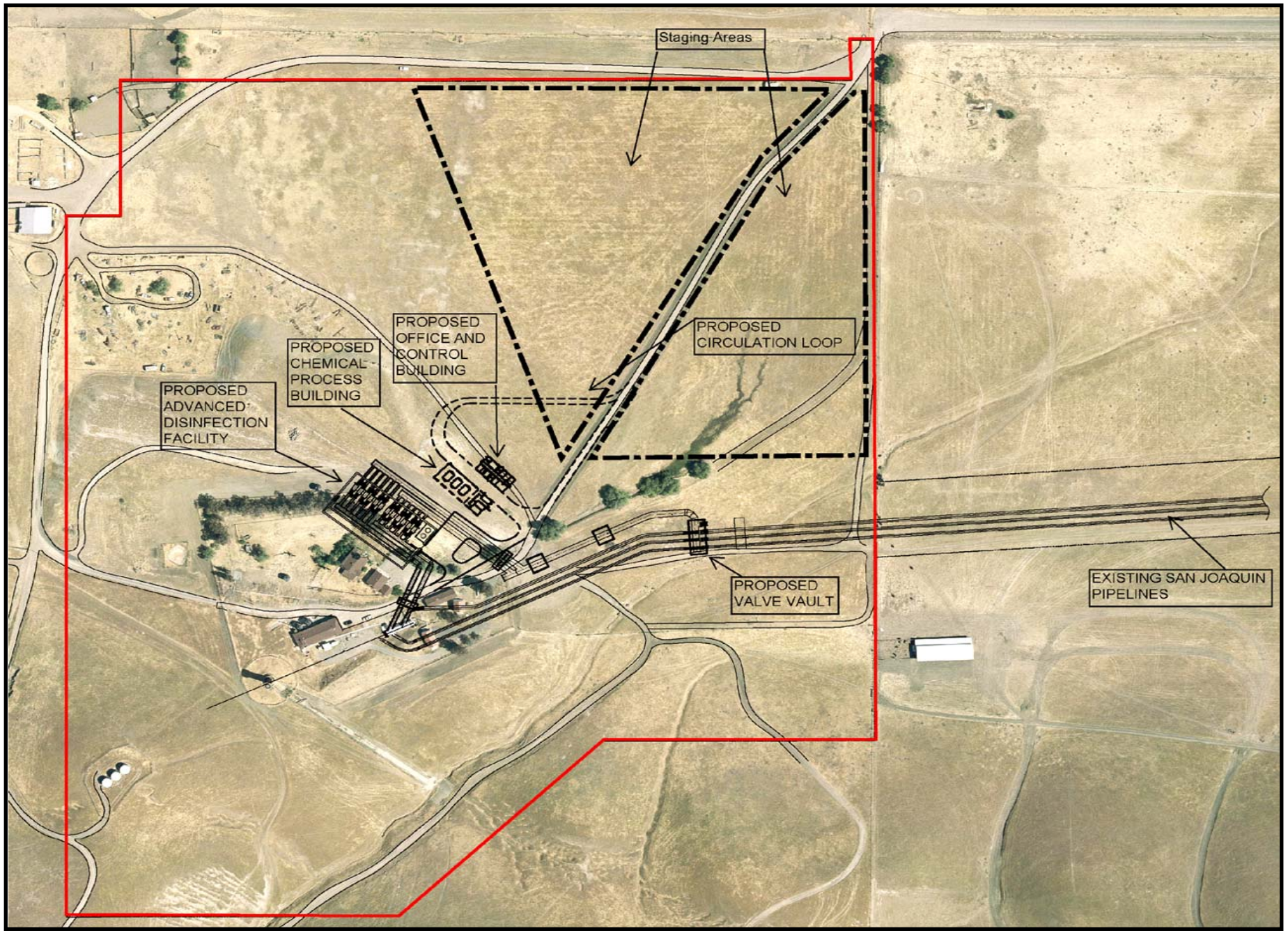
Refer to Figure 3 (Tesla Portal Site Plan) for the location of the proposed Tesla Portal Disinfection Station, ADF, and additional project features. The new facilities, including buildings and paved areas, would be constructed northeast of existing structures at Tesla Portal, on an approximately five-acre site that currently is undeveloped grassland. An additional approximately 12-acre undeveloped grassland area extending on both sides of the entrance road would be used for staging.

For both facilities at the Tesla Portal site, electricity consumption would increase and would require several electrical upgrades. Natural gas service would not be required for the new facilities.

Telephone service would be extended to new structures from existing connections to the Tesla Portal site. Drinking water would be obtained from the existing SFPUC system serving the site. To handle sewage and graywater, a new septic tank and leachfield would be installed to the north of the new facilities. Storm water would be caught and directed away from the new structures and released in a soakaway system that would be located near the leachfield.

Each of these facilities would require that existing vegetation in the vicinity be cleared and the sites graded. The existing disinfection function of Tesla Portal would not be interrupted as a result of the project.

LLNL Supply Improvements. SFPUC has a contractual agreement with LLNL to deliver drinking water to LLNL Site 300, under which the maximum rate of flow contracted will not exceed 0.8 mgd (556 gallons per minute). Presently, SFPUC cannot meet this agreement because water from Thomas Shaft does not meet SWTR standards for *Giardia* inactivation. To meet SWTR requirements, and assist in meeting LT2ESWTR requirements, the treatment facility at Thomas Shaft would be upgraded by installation of a UV disinfection system. (Figure 4, Lawrence Livermore Supply Improvements.) This would be installed in a new approximately 300-square-foot building at the site, and consist of two UV reactors, each containing several UV lamp arrays, as well as a power supply and control panel.



Project Boundary

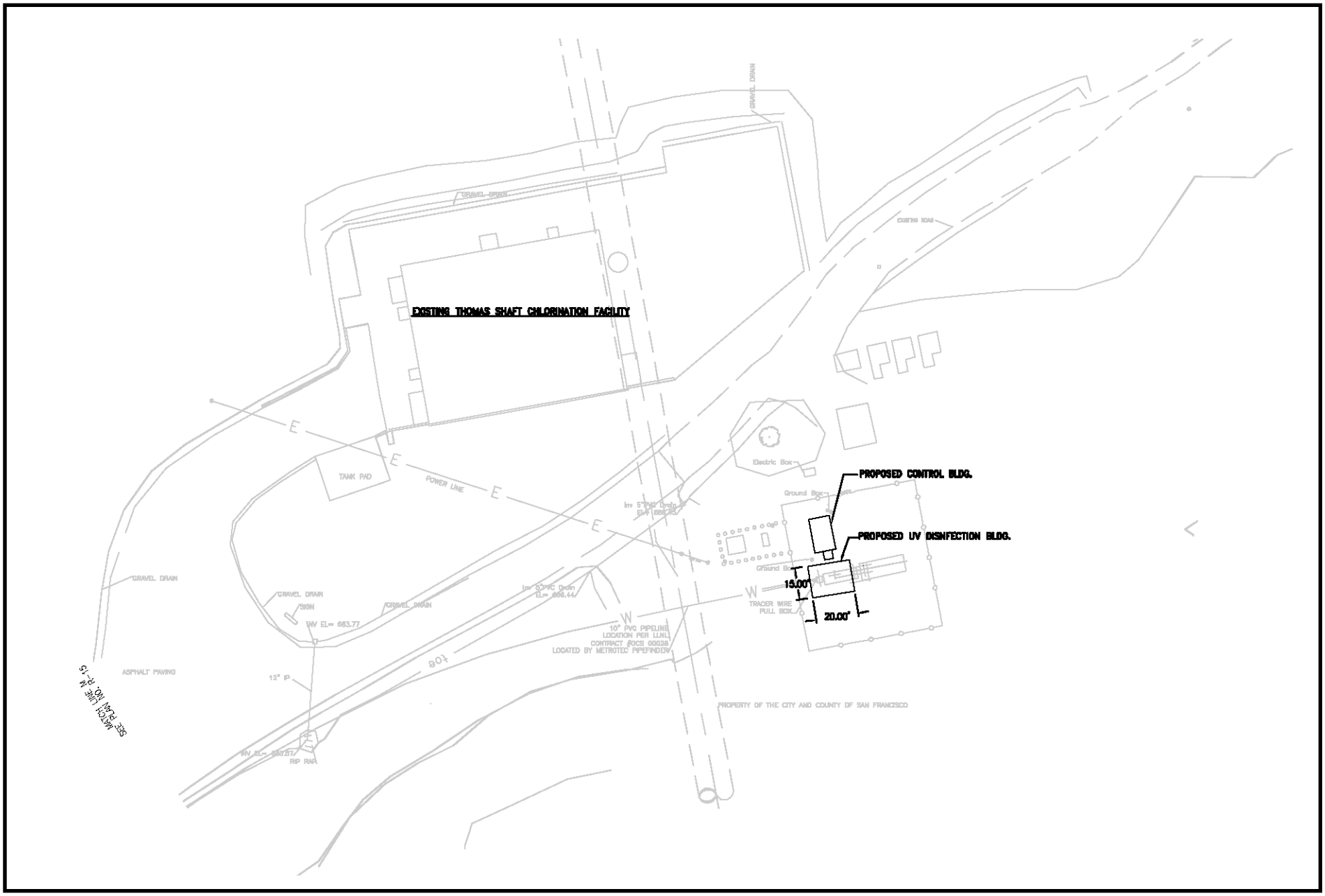
Limits of Staging Areas

Not To Scale

SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT

Tesla Portal Site Plan

Figure 3



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SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT

Lawrence Livermore Supply Improvements

Figure 4

The UV system likely would be installed partially on an existing graveled area across Thomas Shaft Road from the backup chlorination facility, and partially on grassland, which would be cleared and graded. Existing operations, which are minimal in any case, would not be interrupted as a result of the project. No new utility service from offsite sources would be required.

2.2 Project Goals and Objectives

The goals and objectives of the proposed project for each new project component are described below.

- Tesla Portal Disinfection Station. The objective of this facility is to have in place a chlorination facility at the Tesla Portal that would meet current seismic, safety/fire, and building code standards, which are not met by the existing facility. The new chlorination facility would also improve current water quality management capabilities.

- Advanced Disinfection Facility. The objective of this facility is to meet USEPA requirements for *Cryptosporidium* reduction in drinking water.

- LLNL Supply Improvements. The objective of this facility is to meet USEPA requirements for the inactivation of *Giardia*, assist in meeting USEPA *Cryptosporidium* requirements, and fulfill a contractual agreement between SFPUC and LLNL for supplying drinking water to LLNL Site 300.

2.3 Schedule

Tesla Portal Disinfection Station and Advanced Disinfection Facility. Construction of both facilities is anticipated to start in July 2009, and last for approximately 18 months to two years.

LLNL Supply Improvements. Construction is anticipated to start May 2010, and last for approximately one year.

Construction of the proposed project would be conducted on weekdays during daylight hours. No road closures are anticipated.

3.0 ENVIRONMENTAL ANALYSIS

3.1 Key Environmental Issues to be Addressed in the EIR

The EIR will address all environmental issue areas required under CEQA. The EIR will address both construction and operation activities and will propose mitigation measures for impacts considered to be

potentially significant adverse impacts. The following paragraphs describe the key environmental issues that the EIR will address.

Land Use, Agriculture and Recreation

The proposed project would not alter existing land uses and would not expand the boundaries of the Tesla Portal or Thomas Shaft sites, and it is anticipated that no significant land use impacts would result.

The proposed project would not reduce or otherwise affect agricultural land, and do not include construction of facilities that would result in additional population in the local area; thus, it is not anticipated to have any effects on agriculture and recreation. However, these topics also will be addressed in the EIR.

Employment, Population and Housing

A small number of permanent employees would be added at Tesla Portal as a result of the project. The construction activities would be short-term (anticipated maximum of two years), and construction workers are not anticipated to move permanently into the area as a result. While impacts of the project at both Tesla Portal and Thomas Shaft are anticipated to be less than significant, effects on employment, population, and housing will be addressed in the EIR.

Aesthetics

The installation of the new aboveground structures at the Tesla Portal site could result in visual impacts. Interstate 580, about one-half mile away, is a designated State Scenic Highway. The EIR will address the impacts of the proposed project on the aesthetic values of the proposed project area. Due to the remote location of the Thomas Shaft facility, the lack of any neighboring public roads or facilities, and the small scale of the proposed improvements, no aesthetic impacts are anticipated to occur from the LLNL Supply Improvements. However, the aesthetic impacts of the project will be addressed in the EIR.

Biological Resources

Construction of the proposed facilities could impact sensitive biological resources at both sites. The Tesla Portal site has a small wetland area which during site visits in fall 2006 was observed to have standing water and emergent vegetation. The water source for this area is runoff from sampling points at the existing Disinfection Station. Construction of the proposed facilities could affect this wetland if they were to, for example, cut off its source of water, discharge sediments or fill material to it, or remove wetland vegetation. Habitat suitable for several listed species, including San Joaquin kit fox and western burrowing owl, is present at Tesla Portal. No wetlands, creeks, or streams are present in the immediate vicinity of the Thomas Shaft site. However, several species, including San Joaquin kit fox and western

burrowing owl, could be adversely affected by the LLNL Supply Improvements. The EIR will address potential impacts on sensitive biological resources.

Cultural Resources

Historic resources are present at and/or are in the vicinity of both the Tesla Portal and Thomas Shaft sites. For example, as described earlier, several of the buildings at Tesla Portal are over 50 years old. Structures adjacent to the Thomas Shaft site were part of the original Hetch Hetchy Water System, which was completed in 1934. No prehistoric sites have been identified at either location; however, safeguards would be required if excavations uncovered archeological or paleontological resources. Although the project is not anticipated to adversely affect cultural resources (e.g., no structures at either site would be demolished), impacts on these resources will be addressed in the EIR.

Geology and Soils

A potentially active fault, the San Joaquin Fault, may be at or near the Tesla Portal site. No active faults have been mapped with the boundaries of the Thomas Shaft site. The project sites also may be subject to slope instability. Geologic hazards will be evaluated in the EIR.

Hydrology, Groundwater and Water Quality

Construction of the proposed project could affect surface water and groundwater resources (e.g., through erosion of soil resulting from construction activities, and from the creation of permanent impervious surfaces, affecting stormwater runoff). The EIR will evaluate the potential effects of erosion and any direct discharges into waterways during construction.

Hazards and Hazardous Materials

Neither project location is listed on state-maintained listings of sites with contaminated soil or groundwater, or that have hosted leaking underground storage tanks. However, hazardous materials have been used at both sites, and contaminated soils or contaminated groundwater might be encountered during construction. Additional hazardous materials would be stored and used in the future at the sites as a result of the proposed project. Hazardous building materials (e.g., asbestos) are not anticipated to be encountered during the project, as no building demolition would take place and project activities would not create situations where such materials would be encountered. However, the EIR will address potential environmental impacts from hazardous building materials and hazardous chemicals. In addition, both sites are in rural vegetated areas, and potential wildland fire impacts will be addressed.

Transportation, Circulation and Parking

Construction of the facilities would generate truck deliveries and worker trips, and operation of the facilities would generate new commuter trips and truck traffic (e.g., deliveries of disinfection chemicals) above baseline levels. No significant impacts upon circulation and parking are anticipated: parking of construction equipment and commuting personnel would take place entirely within SFPUC property, the volume and staging intervals of truck traffic is not expected to create significant effects upon intersection levels of service, and few additional commuter trips would be generated. However, the EIR will examine transportation impacts.

Air Quality

Air quality could be affected by emissions of dust and diesel exhaust during construction, and by longer-term operational air quality impacts. The project sites are within the jurisdiction of the San Joaquin Valley Air Pollution Control District. San Joaquin County is in nonattainment for the state ambient air quality standard for ozone (one hour) and PM^{10} (particulates 10 microns in diameter and smaller), and is in nonattainment for federal ambient air quality standards for ozone (eight hour), and $PM^{2.5}$ (2.5 microns in diameter and smaller). The EIR will evaluate air quality impacts of the proposed project.

Noise

Use of mechanical equipment and truck traffic associated with construction activities would generate noise and vibration levels typical of building construction, and post-construction operation of the facilities that would be installed under the project would generate noise. It is anticipated that due to the type of activities that would be conducted at both sites and their distance from residences (particularly in the case of Thomas Shaft), noise and vibration impacts would be less than significant. However, the EIR will address potential noise and vibration impacts in the proposed project areas.

Utilities and Public Services

The project would create potential new demands for utility services (e.g., electricity, wastewater, natural gas), and for public services such as police and fire. The EIR will address impacts of the project on utilities and public services.

Other Environmental Issues

The EIR will address other environmental issues, including potential growth-inducing and cumulative effects. The EIR will address the potential of the proposed project to remove an obstacle to growth, and if growth is projected, the EIR will evaluate any secondary impacts of growth. Note that the LLNL Supply Improvements would enable SFPUC to meet existing commitments to LLNL. In its own National

Environmental Policy Act Environmental Impact Statement (EIS) covering its future growth, LLNL anticipated and analyzed the impacts of the connection of Site 300 to the Hetch Hetchy system. No cumulative impacts to water availability for Site 300 and the vicinity were expected.[3]

The EIR will also address whether the proposed project could result in impacts that are significant when combined with the impacts of other SFPUC projects or other non-SFPUC projects occurring in the area at the same time or in the reasonably foreseeable future.

3.2 Alternatives

The EIR will describe and evaluate a reasonable range of alternatives to the proposed project, as required by CEQA. The alternatives would feasibly attain most of the project's basic objectives while simultaneously avoiding or substantially lessening any significant effects of the proposed project. CEQA also requires evaluation of the 'No Project' alternative.

[3] National Nuclear Security Administration, *Final Site-wide Environmental Impact Statement for Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic Environmental Impact Statement*, DOE/EIS-0348, DOE/EIS-0236-S3; March 2005, Volume I, p. 5.3-36.

Appendix B
Notice of Public Meeting

PROOF OF PUBLICATION
(2015.5 C.C.P.)

STATE OF CALIFORNIA
County of San Joaquin

I am a citizen of the United States and a resident of the County aforesaid; I am over the age of eighteen years, and not a part to or interested in the above entitled matter; I am the principal clerk of the printer of the Tracy Press, a newspaper of general circulation, printed and published five times a week on Tuesday, Wednesday, Thursday, Friday, and Saturday in the City of Tracy, California, County of San Joaquin, and which of newspaper has been adjudged a newspaper of general circulation by the Superior Court, Department 4, of the County of San Joaquin, State of California, under the date of June 30,1952, Case Number 53686; that the notice, of which the annexed is a printed copy (set in type not smaller than nonpareil), has been published in each regular and entire issue of said newspaper and no in any supplement thereof on the following dates, to-wit;

May 19

all in the year, 2007.

I certify (or declare) under penalty of perjury that the foregoing is true and correct.

Dated at Tracy, California, this 22nd

day of May 2007.

Signature

This space is for the County Clerk's Filing Stamp

Proof of Publication

Public Notice #0683

SRT Consultants

Notice of Preparation of EIR

S.J. Regional Water Quality Improvement

PUBLIC NOTICE

No. 0683

SAN FRANCISCO PLANNING DEPARTMENT NOTICE OF PREPARATION OF AN ENVIRONMENTAL IMPACT REPORT AND NOTICE OF PUBLIC SCOPING MEETING FOR THE SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT.

A Notice of Preparation (NOP) of an Environmental Impact Report (EIR) pursuant to the California Environmental Quality Act (CEQA) and a Notice of Public Scoping Meeting for the above-referenced project, described below, has been issued by the San Francisco Planning Department on May 17, 2007.

Project Description (Case No. 2007.0427E)

The San Francisco Public Utilities Commission (SFPUC) is proposing the San Joaquin Regional Water Quality Improvement Project to improve the disinfection capabilities of the Tesla Portal site and the Thomas Shaft site. Both of these sites are located in unincorporated San Joaquin County. The Tesla Portal Disinfection Station would be located at the Tesla Portal site and includes closing the existing Tesla Portal Hypochlorite Station and the construction and operation of replacement facilities. Also at the Tesla Portal site, the project would include the construction and operation of a new Advanced Disinfection Facility that would pass water by a series of ultraviolet light arrays. At the Thomas Shaft site, the Lawrence Livermore National Laboratory Supply Improvements would upgrade water treatment facilities. This project is part of the Water System Improvement Program,

at this meeting and until the close of business on **June 18, 2007**. Written comments should be sent to the San Francisco Planning Department, Attn: Paul Maltzer, Environmental Review Officer, San Joaquin Pipeline System Project EIR, 1650 Mission Street, Suite 400, San Francisco, CA, 94103-2479 or provided via email to jamie.dean@sfgov.org, or by fax to (415) 558-6409.

Publish: May 19, 2007

PROOF OF PU

PublicNotices

805 PUBLIC NOTICES

PUBLIC NOTICE

SAN FRANCISCO PLANNING DEPARTMENT NOTICE OF PREPARATION OF AN ENVIRONMENTAL IMPACT REPORT AND NOTICE OF PUBLIC SCOPING MEETING FOR THE SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT.

A Notice of Preparation (NOP) of an Environmental Impact Report (EIR) pursuant to the California Environmental Quality Act (CEQA) and a Notice of Public Scoping Meeting for the above-referenced project, described below, has been issued by the San Francisco Planning Department on May 17, 2007.

Project Description (Case No. 2007.0427E)
The San Francisco Public Utilities Commission (SFPUC) is proposing the San Joaquin Regional Water Quality Improvement Project to improve the disinfection capabilities of the Tesla Portal site and the Thomas Shaft site. Both of these sites are located in unincorporated San Joaquin County. The Tesla Portal Disinfection Station would be located at the Tesla Portal site and includes closing the existing Tesla Portal Hypochlorite Station and the construction and operation of replacement facilities. Also at the Tesla Portal site, the project would include the construction and operation of a new Advanced Disinfection Facility that would pass water by a series of ultraviolet light arrays. At the Thomas Shaft site, the Lawrence Livermore National Laboratory Supply Improvements would upgrade water treatment facilities. This project is part of the Water System Improvement Program, which has an overall objective of providing SFPUC customers with optimized solutions with respect to seismic and delivery reliability, cost, water quality, operational flexibility, and environmental impacts.

Public Scoping Meeting and Public Comments
The purpose of the EIR is to provide information about potentially significant adverse effects of the Project. The San Francisco Planning Department will hold a PUBLIC SCOPING MEETING on Wednesday, June 6, 2007 starting promptly at 6:30 PM at the Tracy Golf and Country Club, 35200 South Chrisman Road, Tracy, CA.

The purpose of this meeting is to receive oral comments to assist the San Francisco Planning Department in reviewing the scope and focus of the Project's environmental impact analysis and information to be contained in the EIR. Written comments will also be accepted at this meeting and until the close of business on June 18, 2007. Written comments should be sent to the San Francisco Planning Department, Attn: Paul Maltzer, Environmental Review Officer, San Joaquin Pipeline System Project EIR, 1650 Mission Street, Suite 400, San Francisco, CA, 94103-2479or provided via email to jamie.dean@sfgov.org, or by fax to (415) 558-6409.

805 PUBLIC NOTICES

Stanislaus County

Stanislaus County is seeking proposals for Inmate Telephone Equipment and Related Services. RFP # 07-17-TRS. Interested parties may obtain a proposal package by contacting the Stanislaus County General Services Agency, Purchasing Division, 1010 Tenth Street, Suite 5400, Modesto CA at (209) 525-6319. A mandatory pre-proposal conference will be held on May 30, 2007 at 10 am. Proposals must be received by the Purchasing Division no later than June 20, 2007, at 2:30 pm. EOE

810 PUBLIC NOTICES (NON-GOV.)

SUMMONS
CASE NO. CIV-455859
NOTICE TO CROSS-DEFENDANT:
Ananthram Kashyap and DOES 1-10
YOU ARE BEING SUED BY CROSS-COMPLAINANT:
Sherry McFarland

You have 30 CALENDAR DAYS after this summons and legal papers are served on you to file a written response at this court and have a copy served on the plaintiff. A letter or phone call will not protect you. Your written response must be in proper legal form if you want the court to hear your case. There may be a court form that you can use for your response. You can find these court forms and more information at the California Courts Online Self-Help Center (www.courtinfo.ca.gov/selfhelp), your county law library, or the courthouse nearest you. If you cannot pay the filing fee, ask the court clerk for a fee

Planning Department
City and County of San Francisco
1650 Mission Street, Suite 400
San Francisco, CA 94103

For More Information

About this **project environmental review**, contact:

Ms. Jamie Dean, *San Francisco Planning Department*
415.575.9028 or jamie.dean@sfgov.org

About the **San Joaquin Regional Water Quality Improvement Project**, please visit: **www.sfwater.org** or contact:

Mr. Jim Marks, *San Francisco Public Utilities Commission*
415.554.3237 or jmarks@sfwater.org

How To Get There

West: take I-580 E, take CA 132 exit towards Modesto, merge onto CA 132 E, take Chrisman Rd exit, turn right at S Chrisman Rd.

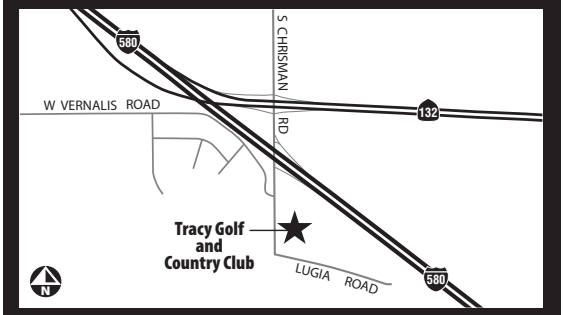
East: take CA 132 W, take the Chrisman Rd exit, turn left at Chrisman Rd.

North: take I-5 S, take exit 449 B and merge onto CA 132 W toward San Francisco, take Chrisman Rd exit, turn left at S Chrisman Rd.

South: take I-5 N, slight left onto I-580 N (towards I-580/Tracy/San Francisco), take Chrisman Rd exit towards CA 132/Tracy, sharp left at S Chrisman Rd.

Public Scoping Meeting

The San Francisco Planning Department will be holding a public scoping meeting to receive comments on the scope and focus of the environmental review for the proposed **San Joaquin Regional Water Quality Improvement Project.**



When: Wednesday, June 6, starting promptly at 6:30 PM

Where: Tracy Golf and Country Club
35200 South Chrisman Road, Tracy, CA 95377

To learn more about the environmental review for the proposed

San Joaquin Regional Water Quality Improvement Project,

and to provide comment on the scope and focus of the environmental review for the proposed project, please attend a

Public Scoping Meeting

Wednesday, June 6th • starting promptly at 6:30 PM

The **San Joaquin Regional Water Quality Improvement Project** is proposed to improve disinfection capabilities at the Tesla Portal and Thomas Shaft sites. At Tesla Portal, the existing Tesla Portal Hypochlorite Station would be closed and replaced with a new Disinfection Station. Also at this site, the new Advanced Disinfection Facility would be constructed and operated. At the Thomas Shaft site, the Lawrence Livermore National Laboratory Supply Improvements would upgrade water treatment facilities to provide potable water to the Lab's Site 300.

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Appendix C
Scoping Meeting Materials

SAN FRANCISCO PLANNING DEPARTMENT

Public Scoping Meeting

Proposed San Joaquin Regional Water Quality Improvement Project

Tracy, CA – June 6, 2007

SIGN-IN SHEET

(Please print)

NAME	AFFILIATION	ADDRESS	PHONE	EMAIL
KEITH F. GRAHAM	LAWRENCE LIVERMORE NATIONAL LAB, SITE 300	P.O. BOX 808 L-871 LIVERMORE, CA 94550	(925) 423-8971	graham6@LLNL.GOV
James W. Lopes	landowner	757 Orchard Rd. Vernalis CA 95385	209 839-0671	
PHIL GOVERNOR	TRACY GOLF CLUB		209-835-9320	
Charles Tapia	Homeowner	34521 Bernard Rd	209-833-7680	
Monica Cava	Homeowner Via Courtesy	34724 Bernard Rd Tracy CA	209-835-6889	
LARRY PAULKETT	LAWRENCE LIVERMORE NATIONAL LAB-SITE300	PO BOX 808, L-873 LIVERMORE CA. 94550	(925) 423-5316	PAULKETT1@LLNL.GOV
Linda Wihl	homeowner	34669 Bridella Ct. Tracy, CA 95377	836-3105	

SAN FRANCISCO PLANNING DEPARTMENT

Public Scoping Meeting

Proposed San Joaquin Regional Water Quality Improvement Project

Tracy, CA – June 6, 2007

SIGN-IN SHEET

(Please print)

NAME	AFFILIATION	ADDRESS	PHONE	EMAIL
CLOVIS WOO	LAND OWNER	7808 STEARMAN RD. TRACY CA 95377	510-909-2963	
Mark Wihl	Home Owner	34669 Brichetto Ct. Tracy CA 95377	(209) 836-3105	mjwihl@jps.net
RICH LEAL	Home Owner	7675 W STEARMAN Dr Tracy Ca 95377	(209) 835-8675	
NEIL FELDHEIM	LLNL	2576 PINE POINTE TRACY CA 95377	925-895-4127	
Linda L. Biscocho	Home Owner	7631 Stearman Drive Tracy, CA 95377	209.835.9748	
Amalie Koster	Home Owner.	35499 S. Koster R.	209-835-2493	
Brian Jackman	Home Owner	34868 Bernard Rd. Tracy	209-830-9231	brian.jackman@postfuture.com

SAN FRANCISCO PLANNING DEPARTMENT

Public Scoping Meeting

Proposed San Joaquin Regional Water Quality Improvement Project

Tracy, CA – June 6, 2007

SIGN-IN SHEET

(Please print)

NAME	AFFILIATION	ADDRESS	PHONE	EMAIL
CALEX BISCOCHO	HOMEOWNER	7631 STEARMAN DR. TRACY, CA 95377	(209) 835-9748	CALEXPECT-TRACY. CA.US

SAN FRANCISCO PLANNING DEPARTMENT

Public Scoping Meeting

Proposed San Joaquin Regional Water Quality Improvement Project

Tracy, CA – June 6, 2007

SPEAKER CARD

CONTACT INFORMATION

Name: Mark Wihl

Affiliation: Homeowner

Street Address: 34669 Brulette Ct.

City, State, Zip: Tracy CA 95377

Phone: (209) 836-3105

Email:

SAN FRANCISCO PLANNING DEPARTMENT

Public Scoping Meeting

Proposed San Joaquin Regional Water Quality Improvement Project

Tracy, CA – June 6, 2007

SPEAKER CARD

CONTACT INFORMATION

Name: Brian Jackman

Affiliation: Home Owner

Street Address: 34868 Bernard Rd.

City, State, Zip: Tracy, CA 95377

Phone: 209-830-9231

Email: brian.jackman@postfuture.com

SAN FRANCISCO PLANNING DEPARTMENT

Public Scoping Meeting

Proposed San Joaquin Regional Water Quality Improvement Project

Tracy, CA – June 6, 2007

SPEAKER CARD

CONTACT INFORMATION

Name: Charles Tapia

Affiliation: Home owner

Street Address: 34521 Bernard Rd

City, State, Zip: Tracy CA 95377

Phone: 833.2680

Email: Charlietap@MSN.C

SAN FRANCISCO PLANNING DEPARTMENT

Public Scoping Meeting

Proposed San Joaquin Regional Water Quality Improvement Project

Tracy, CA – June 6, 2007

SPEAKER CARD

CONTACT INFORMATION

Name: Linda L. Biscocho

Affiliation: Home Owner

Street Address: 7631 Stearman Drive

City, State, Zip: Tracy, CA 95377

Phone: 209. 835. 9748

Email: linda.biscocho@ci.tracy.ca.us

Tonight's San Joaquin Regional Water Quality Improvement Project Scoping Meeting

- Sign in at the table near the entrance
- Pick up copies of meeting materials
- If you would like to provide a comment tonight, fill out a speaker card
- To make written comments, pick up comment cards
  - ***Drop off at the end of the meeting***
  - ***Mail or fax later***
- Please hold all comments until the end of the presentation

Public Scoping Meeting

San Francisco Planning Department
Major Environmental Analysis Division

SCOPING MEETING

SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT
Environmental Impact Report

June 6, 2007

Tonight's San Joaquin Regional Water Quality Improvement Project Scoping Meeting

- Sign in at the table near the entrance
- Pick up copies of meeting materials
- If you would like to provide a comment tonight, fill out a speaker card
- To make written comments, pick up comment cards
  - ***Drop off at the end of the meeting***
  - ***Mail or fax later***
- Please hold all comments until the end of the presentation

Meeting Agenda

- Introductions
- Presentation
  - ***Overview of Environmental Review Process***
  - ***Overview of San Joaquin Regional Water Quality Improvement Project***
- Public Comments
- Closing Remarks

Project Team Introductions

San Francisco Planning Department

- ***Paul Maltzer, Environmental Review Officer***
- ***Jamie Dean, EIR Coordinator***

San Francisco Public Utilities Commission (SFPUC)

- ***Bijan Ahmadzadeh, Project Manager***
- ***Robin Breuer, Environmental Project Manager***
- ***Jim Marks, Communications***

ENVIRONMENTAL REVIEW PROCESS

California Environmental Quality Act

Projects require environmental review under the California Environmental Quality Act (CEQA) before they can be considered for approval

For SFPUC projects, CEQA is implemented by the San Francisco Planning Department

CEQA Objectives

- Present environmental impacts of proposed projects
- Identify ways to avoid or reduce environmental impacts
- Support the agency decision-making process
- Encourage public participation
- Enhance interagency coordination

What will the EIR do?

- Provide a detailed description of the project and the existing environment
- Identify potential environmental effects
- Identify ways to avoid or reduce significant environmental effects through mitigation or alternatives to the proposed project

Meeting Purpose

- Hear your comments on the proposed scope of environmental review of the San Joaquin Regional Water Quality Improvement Project
- Help identify the following to be analyzed in depth:
  - *Range of alternatives*
  - *Environmental effects*
  - *Methods of assessment*
  - *Mitigation measures*

PROPOSED SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT

SFPUC Hetch Hetchy Water System

Major Water System Facilities

- **280-plus miles of pipelines**
- **60-plus miles of tunnels**
- **11 reservoirs**
- **5 pump stations**
- **2 water treatment plants**

Water System Improvement Program (WSIP)

- Voter approved November 2002
- More than 70 projects to
  - *Repair, replace and seismically upgrade key water system facilities*
  - *Add new, redundant facilities to ensure system reliability*
  - *Maintain high-quality water*
- SJR Water Quality project one of many WSIP projects

Project Goals and Objectives

- Meet current seismic, safety/fire, and building code standards
- Improve current water quality management capabilities
- Meet United States Environmental Protection Agency's (USEPA's) requirements for reducing *Cryptosporidium* in drinking water
- Meet USEPA requirements for inactivation of *Giardia*
- Fulfill commitment to Lawrence Livermore National Laboratory (LLNL) to supply potable water to Site 300

Existing Tesla Site

Existing Tesla Site

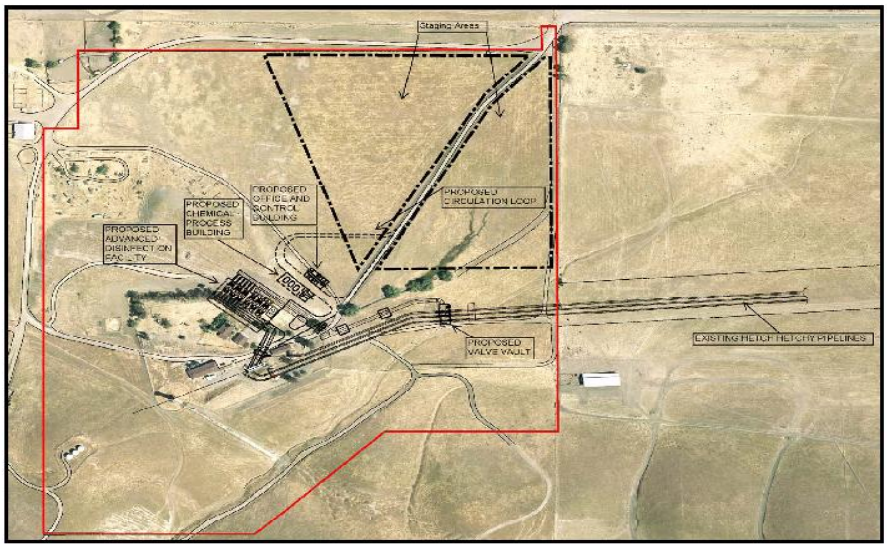
Existing Tesla Facility

- Primary disinfection point for the SFPUC water system
- Disinfectant : Sodium Hypochlorite
- Chemicals stored in two 13,000-gallon tanks and four 4,000-gallon tanks

Existing Tesla Facility (cont'd)

- Valve houses
- Pump house
- Three 20,000-gallon water tanks
- Watershed keeper's cottage
- Chemical delivery 6 loads/week at maximum flow

Proposed Improvements at Tesla



Not To Scale

Project Boundary
Limits of Staging Areas

SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT

Tesla Portal Site Plan

Figure 3

Typical Large UV Reactor System

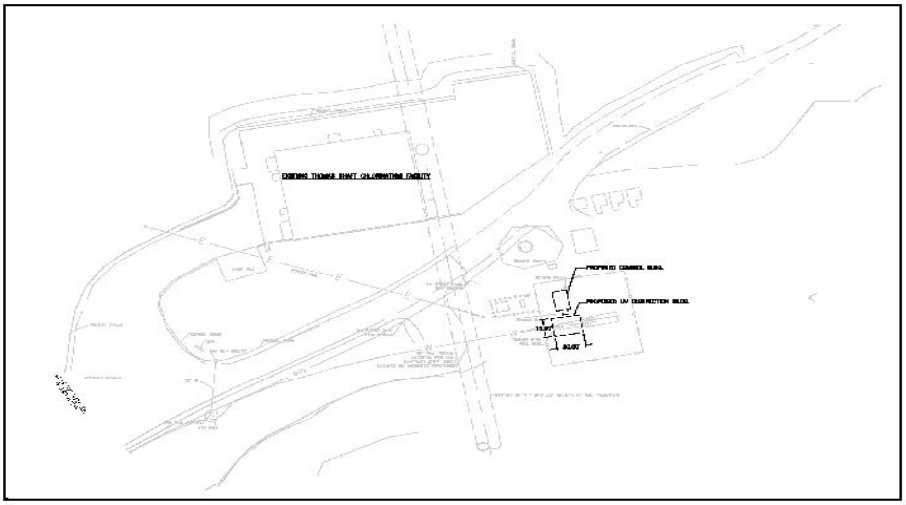
Existing Thomas Shaft – Water Supply Site to LLNL Site 300

Existing Thomas Shaft Facility

- Backup chlorination facility
- Chemical receiving and storage facility
- Three 6,000-gallon Sodium Hypochlorite Tanks

- Pumps
- Water quality analyzer
- Chemical delivery 5-6 loads/year

Proposed Improvements at Thomas Shaft



Not To Scale

SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT

Lawrence Livermore Supply Improvements

Figure 4

Typical Small UV Reactor System

Project Schedule

Environmental Review & Permitting: Thru Fall 2008

Improvements at Tesla

Project Design: Spring 2007 thru Summer 2009

Project Construction: Summer 2009 thru Spring 2011

Improvements at Thomas Shaft for LLNL Supply (Site 300)

Project Design: Spring 2008 thru Spring 2010

Project Construction: Spring 2010 thru Fall 2011

Environmental Review Schedule

- Notice of Preparation – May 17, 2007
- Public Scoping Meeting – June 6, 2007
- Scoping Period Ends – June 18, 2007
- Public Review of Draft EIR – 2008
- Release of Final EIR – 2008
- Certification of Final EIR – 2008

PUBLIC COMMENTS

Comment Session Ground Rules

- Submit speaker cards to speak
- Wait until your name is called
- Speak into the microphone and state your name
- Limit comments to 3 minutes
- Use comment forms for more extensive input

Where to Send Comments

- Scoping comments accepted through June 18, 2007
- Send by email to: jamie.dean@sfgov.org
- Send by fax to (415) 558-6409
- Send by U.S. mail to:

  San Francisco Planning Department
  Attn: Paul Maltzer, Environmental Review Officer
  1650 Mission Street, Suite 400
  San Francisco, Ca 94103-2479

For More Information

About the Environmental Review Process:

Jamie Dean, San Francisco Planning Department, Major Environmental Analysis Division

(415) 575-9028, jamie.dean@sfgov.org

The Notice of Preparation is available online at www.sfgov.org/planning/mea

About the San Joaquin Regional Water Quality Improvement Project

Jim Marks, SFPUC

(415) 554-3237, jmarks@sfwater.org

Appendix D
Transcript of Public Scoping Meeting

PLANNING SCOPING MEETING

CASE No. 2007.0427E

FOR THE SAN JOAQUIN REGIONAL WATER

QUALITY IMPROVEMENT PROJECT

Proposed By: The San Francisco Public Utilities Commission

JIM MARKS, San Francisco PUC

PAUL MALTZER, San Francisco Planning Department

BIJAN AHMADZADEH, Project Overview, SFPUC

OFFICIAL TRANSCRIPT

OF THE PLANNING SCOPING MEETING

TRACY, CALIFORNIA

JUNE 6, 2007

STAR REPORTING SERVICE

703 Market Street

San Francisco, California 94103

(415) 348-0050

REPORTED BY: VIRGINIA OREAR, CSR: 6475

A P P E A R A N C E S:

FOR THE SAN FRANCISCO PUBLIC UTILITIES COMMISSION
CITY AND COUNTY OF SAN FRANCISCO:
REGIONAL MANAGEMENT BUREAU
ROBIN BREUER, Regional Environmental Manager,
Bureau of Environmental Management
1145 Market Street, Suite 500
San Francisco, California 94103
(415) 551-2915

PROGRAM MANAGEMENT BUREAU:
BIJAN AHMADZADEH, P.E.
1155 Market Street, 4th Floor
San Francisco, California 94103
(415) 551-4532

FOR THE SAN FRANCISCO PLANNING DEPARTMENT:

BY: PAUL MALTZER, Environmental Review Officer
San Francisco Planning Department
1650 Mission Street, Suite 400
San Francisco, California 94103-2479
(415) 558-6378

The Planning Scoping Meeting was held at the Tracy Golf and Country Club, 35200 South Chrisman Road, Tracy, California, at 6:30 PM on the 6th day of June, 2007.

PLANNING SCOPING MEETING

BY MR. MALTZER:

Again, I'm Paul Maltzer with the Planning Department, in San Francisco. There are essentially two agencies here: The San Francisco Planning Department and the Public Utilities Commission. I'll introduce them in a moment.

This is a Scoping Meeting for The San Joaquin Regional Water Quality Improvement Project and the Environmental Impact Report that we are going to be preparing for the project, and again, I'm going to be describing to you in a little more detail what the purpose of this meeting is, but by and large, we are here to hear from you.

I'm going to try and give you a little bit of information our process. The PUC is going to give you a little information about the project, but mostly the purpose of this meeting is for us to hear from you. . I think we went through the general and accounts keeping. The agenda: I will be introducing some of the people here, and as I described, an overview of the Environmental Review process. I'm going to talk a little bit about what an EIR is all about.

The PUC will describe for you briefly what their project is that's being proposed and then we're going to move on to public comment where you will each have an

opportunity to tell us what you think we need to be addressing in the report that we are going to be producing. That's going to be the meeting tonight.

In terms of introductions, again, I'm Paul Maltzer, the Environmental Review Officer. In the Planning Department, one of our functions is to do the Environmental Review for the City,. There is an office that does that, the
Office of Environmental Review. I head up that office.

Jamie Dean works up that office. She is the staff person, the EIR coordinator. She is the person who is responsible for producing and directing the production of the EIR. We have a few members of the PUC, the Public Utilities Commission, here as well.

Bijan Ahmadzadeh, the Project Manager is here. Robin Breuer, the Environmental Project Manager, Jim Marks, the communications person for the PUC are all here tonight as well.

The Environmental Review process will be very brief. The state law requires that the before decisions are made on projects that we need to examine them for potential consequences, potential physical and environmental impacts as pursuant to the California Environmental Quality Act or CEQA.

You may hear the term CEQA. It stands for California

Environmental Quality Act. It gives us access to produce those reports. Those reports for San Francisco are produced by the Planning Department. That's our role. The Public Utilities Commission's role here is the project sponsor. They have a project they are proposing before the City, the Public Utilities Commission, the Board of Supervisors can take any action on it. The Planning Department needs to complete an Environmental Review, and as part of that Environmental Review process, we engage with the public and get public input.

That's the purpose of this meeting tonight.

The next line, the objectives of CEQA. The main objectives are to disclose potential environmental consequences of a project before decisions are made. It's to inform the decision making process, to look before you leap, essentially, and particularly with regard to physical and environmental impacts.

Another objective of a CEQA process is to identify impacts, to look up for ways that they can be reduced or avoided; typically referred to as mitigation measures. You may hear that term, to find impacts and ways that they can be mitigated.

That information is put together in written reports used by the agencies that make decision on the project.

It's not the only information that may be relevant to them, but is important information that they need to consider before they make the decision, but it is relevant information that they need to consider before they may make a decision. The CEQA process is to ensure that decisions are made out in public with the benefit of public input in conversations with the public.

So, public participation is a large part of the CEQA process and it ensures agency coordination, not just the PUC and the Planning Department, but other agencies that may be involved in the decision making process. It may be Fish and Game or Fish and Wildlife or Army Corps of Engineers or EPA, other agencies that may have decisions to make may also interact with us as we are producing these reports.

What will the EIR do? A project description. One of the key procedures of the EIR if to fully describe the project so that people know what is being proposed, to identify potential environmental effects, again, environmental effect? -- what does that mean? We typically what it means under CEQA law is physical and environmental impacts: Impacts on biology, on the land, air quality, transportation, noise, things of that nature -- information

that many people are interested in with regard to a project or analysis that they're interested in.

What the CEQA process does not report on are sociological or economic issues, but physical and environmental impacts are the focus of the Environmental Review, and to look at ways to avoid or reduce potential impacts that we have identified. That's the nuts and bolts of what an EIR is supposed to do.

The purpose of this meeting is to engage with the public to help us, the Planning Department and our consultants make sure that we are covering the scope of issues that are necessary and important and relevant for us to be discussing.

Although we have expertise in producing environmental documents, we're not necessarily experts on every project area that the neighbors and the public may be more familiar with and it's important to hear from the public what issues they have of concern that we may or may not be aware of to help us focus our study of the EIR.

In addition to that, EIR looks at alternatives to a project. If a project has potential impacts or consequences
are there other possible projects that may still accomplish the
main objectives and avoid the impacts and the EIR is

supposed to address alternatives to the project when there are impacts that we are trying to reduce or avoid.

Okay. Looking at environmental impact, methods of how we do our assessment and mitigation measures, these are in terms of what we are hoping to hear from you tonight would be directions to us or questions that you would like us to investigate in the EIR, that kind of falls under this umbrella, if you will:

The impacts of the project; the possible alternatives to the project; the analytical assessment, the methods that we're using to analyze impacts and what mitigation measures you think may be available.

So, to the extent that your comments are focused on the work we're doing, these are the kinds of comments or questions you should be thinking about in terms of what we would hear from you tonight. So, that's a real kind of brief summary of the CEQA process. So, after this meeting in the days or weeks to come, certainly myself and Jamie are available to answer questions you may have about that. Before I turn it over to the PUC, I just want to make sure you understand the PUC is going to, again, describe the project and then we're going to turn it over to you to hear comments from you.

The Hearing tonight we have a Court Reporter here to take your comments. The meeting tonight is not going to be a question and answer session. You'll be given an opportunity to give us your input which will help us do our EIR, which will help, but in terms of the formal scoping questions, do not have some questions and expect us to answer them tonight. We are going to transcribe all of your comments. Then we are going to be including that thinking in terms of the progress of the Environmental Impact Report.

At the end of your comments tonight, we're still going to be here if you have questions that you would like to talk to us about while we have a conversation, that would also be appropriate at the end of the formal scoping meeting. In terms of your comments, we'll give you about three minutes each to give us your comments. It's not going to be a question and answer session right now.

In order to help you understand what they're proposing, in order to help you understand what questions you may have about the project, the PUC is going to give you a description of what is being proposed.

BY MR. BIJAN AHMADZADEH:

My name is Bijan Ahmadzadeh. I am the Project Manager

for the Tesla Disinfection Site, the Tesla project. It's one project, but the other one is the Thomas Shaft project.

Here, first, I want to thank everyone for attending tonight's meeting on behalf of the project team here.

First of all, basically, I would talk about the Hetch Hetchy water system, about the facilities, the water system improvement program which is the bond measure, which was passed in 2002 and its goals, and the project goals of the San Joaquin Regional Water Project, the existing features of the site, the proposed improvements and then followed by the proposed schedule.

This line it's which is also the front of the building as you entered it, is our system map and the project we're talking about is these two stars here. This is Tesla Portal Disinfection Facility and the advanced Disinfection Facility and the supply line to Lawrence Livermore National Lab.

Next slide: The Hetch Hetchy Water System is comprised of over 200 plus miles of pipe line, 60 plus miles of tunnel resevoirs, pump station and two water treatment plants. The regional system was built over 104 years ago and the greater investments that we made have mostly been back in the twenties, thirties, sixties and seventies and so we haven't really had a major improvement program since

the seventies. So, the bond measure sort of helped us to achieve that goal. The water system improvement was a voter-approved in November 2002. It's comprised of more than seventy projects and its main objective is to repair, replace and seismically upgrade key water facilities, add new redundant facilities to ensure system reliability and maintain high quality water, and the SJR water quality project, which is the project we're talking about tonight, is one of the projects in the WSIP, and the bond measure was directed by the San Francisco Public Utilities Commission and the Board of Supervisors and San Francisco voters and it involves over 28 wholesale partners in Alameda, and
Santa Clara and San Mateo counties.

It has oversight from the State Legislature and also we have oversights from our resource agencies and regulatory agencies that oversee the permitting process for our project.

So, the project goals and objectives which are our goals and objectives for this project is basically meet current seismic, fire safety and building code standards for our current facility that's out there right now, improve the current water management capabilities and also as to meet the U.S. Environmental Protection Agency requirements for reducing Cryptosporidium in drinking

water. That's what they call the long term two enhanced surface water treatment rule, and also meet U.S. EPA requirements for inactivation of Giardia.

Cryptospordium and Giardia are parasites that are commonly found in river and lakes that can cause gastrointestinal diseases and basically our goal here is to provide clean, unfiltered water, again, originating from Hetch Hetchy water reservoir and also to continue to implement our water shed protection measure.

Okay, next slide: This is the existing Tesla site which is over here. It's all San Francisco PUC. It's about 64 acres and this is our primary disinfection facility and the correct use that it is.

Next slide: This is a closer view of the existing facility. We have the our close range tunnel, our existing hypochlorite station, our water keeper's cottage and some valves and pump stations.

Next slide: So, the existing Tesla facility which is right over here, right over past the golf course, this is the primary disinfection point from the San Francisco PUC water system.

The disinfectant that we use is sodium hypochlorite which is a liquid form for chlorine that we inject into the coast range tunnel. The chemical stored in these tanks,

these tanks that you see in this picture, we have two 13,000 gallon tanks and four 4,000 gallon tanks currently, and, basically, the goal of the disinfectant is to inactivate pathogens such as virus and Giardia in the drinking water.

Next slide: The existing facility also has some other features, we have valve houses, pump house, three 20,000 gallon water tanks up on the hill there, a water shed keepers's cottage and we deliver chemical there six loads a week at maximum flow.

Next slide: And the proposed improvements, you can probably get a better view over here is basically staying within the confines of the existing facility or existing right-of-way there.

We are proposing to build a new advanced disinfection facility which is the UV facility in here. We also plan to build a new chlorination facility because the existing building is not to building standard. It is old and it is not safe from seismic reliability and fire protection, and then we'll just have like a new administration building.

So, basically, we'll have the chemical process building, chemical feed equipment, office and control buildings. We'll have some emergency backup power supply. Most of the piping will be below grade. We'll have valve

and valve locks.

We'll have some security improvements of the current facility and we'll have some improvements to the existing road that's right there that leads to the new UV facility.

This is a typical large UV reactor system. Basically, they are like, basically, they are lamps. They consist of individual lamps of what happens with the primary mechanism of the UV disinfection involves light penetrating through the water column and it's basically to inactivate the microorganisms the pathogens, like the Cryptosporidium, the Giardia and it renders them unable to replicate.

The EPA or the USEPA has accepted UV technology to be a feasible treatment approach to disinfecting of drinking water.

The new long term two enhanced water treatment rule, which is what we need to comply with, requires that all unfiltered systems use at least two disinfectants in order to provide multiple barriers.

So, one of the measures would be the UV and the other measure would be the chlorination of the system that we're currently practicing and UV lighting, which we need to be in compliance by March of 2012. That's the new drinking rule.

The other treatment facility we have, which is the Thomas Shaft Facility, which is not too far from this

facility. It's four miles down. It's off of Corral Hollow road. This is the building that's there currently and it's basically --

Next slide: It's basically our backup chlorination facility in case, for some reason, Tesla goes down for some unknown reason, we have a backup facility currently in which we can disinfect our water. Basically, it's a chemical receiving and storage facility.

There's three 6,000 gallon sodium hypochlorite tanks at that facility. There's pumps and water quality analyzer and other appurtenances and we deliver chemical there five to six loads a year at that site.

Next slide: And the proposed improvements we plan to do here is in this little small area across the facility, there are pipes, pumps and they're, I think, Lawrence Livermore built a couple of years back. There's a 10-inch pipe line that leads down into Lawrence Livermore and basically what we're proposing to do here is to construct one duty and one redundant UV system about one point MGD.

We'll have some piping, power supplies and control panel and basically the intent of this project is to meet disinfection requirements to the current rule, which is the surface water treatment rule and the new rule, which is for Cryptosporidium. So, this project would also meet our obligation to Lawrence Livermore Lab to providing potable

water.

Next slide: And this would be a type of facility, this is a small UV facility. It's approximately maybe 300 square feet pad that we propose to put in our facility up there that will feed to the 10-inch water line that is currently existing.

The next slide: Basically, our project schedule is, our environmental review and permitting. We're going to complete that through fall of 2008 and our improvements at Tesla, which is both for the UV and the existing disinfection station, we're going to finish -- start. We've already started early design and we're going to finish in the summer of 2009 and construction is proposed the summer of 2009 through Spring of 2011, and then improvement at Thomas Shaft for the supply line at site 300, our project design schedule is starting at Spring of 08, through spring of 2010 through fall of 2011.

So, this is our baseline schedule. We are all planning to -- we are working on our WSIP schedule some. We might be expediting. This is what we are right now marching into.

Other than that, that pretty much describes very briefly some of the components and plans at both of the facilities.

BY MR. MALTZER:

We are almost at the point where we're going to listen to you. Just a couple of last points: The Environmental Review schedule, what you can anticipate coming from our office: First thing has already come out, this is probably the most important document that we have produced so far on this project and there are copies, if you haven't picked this up and looked at it.

This is Notices of Preparation. This is a description of the project together with our first cut at what we are already anticipating the EIR will be addressing. That latter part comes on the back end of the Notice of Preparation on pages twelve through 16 and let's you know what you will expect in looking at the EIR, but, again, we want to hear from you as well.

Public Scoping Meeting: This is the meeting that we are here today to help us hear from you to focus our opinion about what we need to analyze. The scoping period ends June eighteenth. In terms of written comment to us, you know, another 12 days to receive written comment from you as to what you believe should be in the EIR.

As a practical matter, if we receive comment from you thereafter that is really important that needs to be addressed in the EIR, we are going to have to grapple all that. In all likelihood, it will be included with the EIR, but we also need to get the document published and the

later we receive comment from you, the less attention we can give it. So, it's really important that you can get us your comments as soon as possible, so it's really important that you meet this June 18 deadline. At that point, beyond that date, we and our consultants are going to be busy working on the draft EIR.

So, any comment that we receive after that is going to be harder to address.

In terms of the Environmental Review process for an EIR, there are two key stages for that. The first document we would publish is called a draft EIR. We don't have an exact date for that. Hopefully it will be in 2008, but we're not sure. A draft EIR is our first cut of what we think are the impact of the project, mitigation measures, alternatives, significant impacts of the project.

It's called a draft EIR because it gets circulated for public review and comment in a formal way. There will be a 45-day review period typically and a public hearing at least for our Planning Commission to receive comment on the draft EIR.

You will have at least 45 days to review the draft EIR and to comment on what you think we got wrong, right or that we missed, and then in the EIR process, we're required to produce a second book, a book of comments and responses where we layout all the comments we receive and our

responses to them and any revisions that we have made to the EIR. Those are the two key pieces of the EIR, the draft EIR and the summary of comments and responses.

Once we have finished that, the book is ready to be certified as final. That's also hopefully sometime in 2008, we would be ready to take the EIR the draft and comment and responses to our Planning Commission to certify that we are done, that the City has the information necessary to make a decision about the project and then it would be in the hands of the PUC to make a decision.

So, that's our Environmental Review process and now we're up to the public comment. That's really what we are really here for tonight is to hear your comments about what you think we need to address in the EIR. So, we have public speaker cards. If you want to speak tonight and you haven't filled out a public speaker card, please raise your hand.

Is there anyone else here that either hasn't filled out a card or intends to make a comment here tonight? Okay.

Just the one? Okay.

AUDIENCE: So, can I ask my question now please?

MR. MALTZER: We have a Court Reporter. If you could please just clearly state your name and if you can speak clearly, we had intended to limit comments to three minutes

per speaker so that we wouldn't be here all night, I don't know that we have to strictly adhere to that if you are the only speaker, but again, we would like to hear your comments. Please state your name?

MS. BISCOCHO: My name is LINDA B-I-S-C-O-C-H-O, address 7631 Spearman Drive, Tracy, California 96377. This is my question: You are all from San Francisco Planning Department, right?

MR. MALTZER: Yes. This is not a question -- this is not a question and answer session.

A. Because I came in late.

MR. MALTZER: Yes?

A. So, I am not really kind of sure because it says here this is about the San Joaquin Regional Water Quality. So, this does not have to do with San Joaquin County and all that. It's just the fact of the project because it sits here in San Joaquin county; correct?

MR. MALTZER: Right.

A. That's one of my comments. Now, I have my question. I know this is not a question and answer thing. Is there any chance that we can have your water?

MR. MALTZER: Is that your comment? We are going to transcribe your comment and decide whether that needs to be addressed in the EIR. When this meeting is over, if you would like to have a conversation, you're welcome to do

that, but this is not the purpose of this part of the meeting.

A. I know. I just feel like there is this thing dangling in front of our faces and all we can do is just look at it. We can not even taste it. It's right under our noses, practically, because our house is just walking distance from the pipe that goes underneath my property and I want to know if we can at least, you know, have a chance at or a bid at the water that's passing through our property.

My house is just right across that Chrisman Road and so that is my comment, and this project that you're going to have, how will it impact me as a property owner very close to where this project is going to be? I am not very familiar with EIR, what is it? What are you going to have there? Are you going to have a lot of chlorine? Will it be dissipated in the air? Will it affect the air we breathe in that area there? That is one of the questions that, you know, I really don't know what's going to happen in that project.

MR. MALTZER: Well, again, at the end of this meeting we can have mower of a conversation about that.

A. Okay, thank you.

MR. MALTZER: Are there any other speakers who would

like to address the Board? If you could just state your name for the Court Reporter, thank you

A. Brian Jackman, J-A-C-K-M-A-N. I live right next to the pipe line. So, my question is: Is there any of the pipe lines going to be replaced or is it just specifically the two sites that you're going to be working?

MR. AHMADZADEH: Well, this project is inside your property?

MR. JACKMAN: Through our property, which is where we live in that subdivision. Is there a replacement of the pipe that's going to happen?

MR. AHMADZADEH: No. This project is just the upgrades to the facility within the compound of the Tesla site. There is another project.

MR. JACKMAN: So, this is a separate project from the other one?

MR. MALTZER: Yes.

MR. JACKMAN: There is another one about the pipe lines, itself?

MR. MALTZER: Yes, and then after this meeting, the project manager from that meeting is here, so you can ask him some questions about that if you have some questions about the pipe line.

MR. JACKMAN: Okay. Thank you.

MR. MALTZER: But, this is basically our facility

which we are upgrading in order to meet the USEPA requirements for drinking water, the new rule which has to be complied with by 2012 . Yes, please?

A. My name is Mark Wihl, home owner in Park Country as well. Just two things that I would like to see addressed in the EIR is, you know, dust and traffic impact on the residents in Park Country during construction, since the wind blows directly over our place from where the site would be worked on, and also, we have lived here for 20 years and I don't know if there should be any special evacuation drills or sirens or things if anything went wrong at that plant, but in all the years that I have been here, I haven't heard anything about that, but during that time, what are the hazards to the whole population and how can those hazards be mitigated in the case of a problem?

MR. MR. MALZTER: Thank you. Are there any other comments? Yes, please?

A. See if I can turn my question into a comment. Concern about the overall appearance of this facility, is the new facility going to be taller, bigger, wider, painted bright red? Whatever? Is it going to be to enhance the appearance of our community or is it going to take away from the community?

Is the facility going to be landscaped or things like that? That's my comment and question. The other thing is

tagging on to --

MR. AHMADZADEH: I didn't catch your name.

A. -- concern about the road, because my house is right next to that road. Although, I am moving, I hope, one of these days, but for right now, will the facility be pumping more water and if it's pumping more water will it require more chlorine, and if it requires more chlorine, does that mean more traffic down Vernalis, because I hear those trucks go down all the time and of course I have the concern about the possible spill of chlorine into the air and things like that. So, those are my questions and comments. Charlie Tapia, T-A-P-I-A, 34521 Bernard Road.

MR. MALTZER: Are there any other people who have comments that they would like to make?

I'll just move on, then. Again, I will be here and the PUC will be here to answer questions, if you have some or you would like to have more of a conversation tonight. I would like to remind people that in terms of a formal written comment period, in terms of scoping comments, if at all possible, we would like to receive your comments by June eighteenth and then you can put up the next slide.

You can send comments, you can send comments here to Jamie Dean at SFGOV.ORG or you can send them by fax to our office 415-558-6409, that's the Planning Department, or by U.S. Mail to my attention, Paul Maltzer at the Planning

Department as well, and with that, again, I would also like to repeat Bijan, thank you very much for coming. I'm also pleasantly surprised at how many people do participate in the process and is very helpful to us. I know it's hard for people to take time for their busy days and lives to help us come and do this work, but I appreciate your comments, and again, if you have any interest in receiving the draft EIR, in particular, please make sure that you provide us with the name and an address so that we can send that to you. Thank you very much and with that, I think we're in terms of the formal session, we are done.

(The record was closed at 7:07 PM.)

STATE OF CALIFORNIA)
) ss
COUNTY OF CONTRA COSTA)

I, VIRGINIA OREAR, CERTIFIED SHORTHAND REPORTER duly qualified in and for the STATE OF CALIFORNIA, do hereby certify that the foregoing proceedings were stenographically reported and thereafter put into writing by me.

I further certify that the foregoing transcript (Pages 1 through 23 inclusive) is a true and correct transcript of my original stenographic notes.

I further certify that I am neither Attorney or Counsel for, nor related to or employed by any of the parties to the action in which this matter is before the Public; and furthermore, that I am not a relative or employee of any attorney or Counsel employed by the parties hereto or financially interested in the action.

IN WITNESS WHEREOF, I have hereunto set my hand this 8th day of June, 2007.

VIRGINIA ANN OREAR, CSR: 6475

Appendix E
Written Comments on the Notice of Preparation

SAN FRANCISCO PLANNING DEPARTMENT

Public Scoping Meeting

Proposed San Joaquin Regional Water Quality Improvement Project

Tracy, CA – June 6, 2007

COMMENTS

Thank you for participating in tonight's Public Scoping Meeting on the SFPUC's Proposed San Joaquin Regional Water Quality Improvement Project. Your comments on the scope and focus of the environmental review are encouraged.

Name (please print): CLETUS WOO

Affiliation (if applicable): NEARBY LANDOWNER

Phone: 510-909-2963 Email: LINQUEINTL@YAHOO.COM

Address: 7808 STEARMAN RD.

City, State, Zip: TRACY CA 95377

COMMENTS

WITHIN THE ENVIRONMENTAL IMPACT REPORT, IF APPLICABLE, PLEASE ADDRESS: ASBESTOS ABATEMENT, DUST/DEBRIS ABATEMENT, DEMOLITION/CONSTRUCTION NOISE ABATEMENT, VERNALIS ROAD USAGE INCREASE, DEBRIS REMOVAL PROCEDURES AND IF ANY MATERIAL LOGISTICS INVOLVE CLOSURE(S) OR TEMPORARY ROAD BLOCKS/DETOUR(S) THROUGH SURROUNDING NEIGHBORHOOD(S).

Mail comments to: Paul Maltzer, San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, CA 94103-2479
Fax: (415) 558-6409 Email: jamie.dean@sfgov.org
For more information on SFPUC's San Joaquin Regional Water Quality Improvement Project, Contact: Jim Marks, SFPUC Communications Division
Phone: (415) 554-3237 Email: jmarks@sfwater.org

SAN FRANCISCO PLANNING DEPARTMENT

Public Scoping Meeting

Proposed San Joaquin Regional Water Quality Improvement Project

Tracy, CA – June 6, 2007

COMMENTS

Thank you for participating in tonight's Public Scoping Meeting on the SFPUC's Proposed San Joaquin Regional Water Quality Improvement Project. Your comments on the scope and focus of the environmental review are encouraged.

Name (please print): Keith F. Graham, Deputy Manager, Site 300

Affiliation (if applicable): Lawrence Livermore National Laboratory

Phone: (925) 423-8971 Email: graham6@llnl.gov

Address: L-871; P.O. Box 808

City, State, Zip: Livermore, CA 94550

COMMENTS

The Proposed Project (listed as three separate projects in the WSIP NOP) is supported by Lawrence Livermore National Laboratory's Site 300 Experimental Test Facility in fulfillment of the existing contract between the Department of Energy and the City and County of San Francisco for water service supplied at the Thomas Shaft. Each of these three projects promotes the ability to secure water following a 20 year hiatus for the service anticipated. Improvements were installed more than 17 years ago to assist in water delivery to Site 300 pending final regulatory approvals. In the interim, the Site continues to rely on onsite water wells which present administrative and infrastructure challenges to maintain indefinitely. The early or as-scheduled completion of all interrelated projects portends sufficient and high quality water for the Site's population and multifarious operations. The perceived environmental consequences of this phased undertaking can only be viewed as positive for Site 300. Please continue to progress these related projects expeditiously in meeting the legal obligation established by contract.

Mail comments to: Paul Maltzer, San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, CA 94103-2479
Fax: (415) 558-6409 Email: jamie.dean@sfgov.org
For more information on SFPUC's San Joaquin Regional Water Quality Improvement Project, Contact: Jim Marks, SFPUC Communications Division
Phone: (415) 554-3237 Email: jmarks@sfwater.org

BAWSCA

Bay Area Water Supply & Conservation Agency

June 15, 2007

Mr. Paul Maltzer
Environmental Review Officer
San Joaquin Regional Water Quality Improvement Project EIR
San Francisco Planning Department
1650 Mission Street, Suite 400
San Francisco, CA 94103-2479

Subject: Case No. 2007.0427E – San Joaquin Regional Water Quality Improvement Project; Notice of Preparation of an Environmental Impact Report and Notice of Public Scoping Meeting

Dear Mr. Maltzer,

Thank you for the opportunity to provide the following comments from the Bay Area Water Supply & Conservation Agency (BAWSCA). BAWSCA represents the interests of 25 cities and water districts, and two private utilities, that purchase water wholesale from the San Francisco regional water system. These entities provide water to 1.7 million people, businesses and community organizations in Alameda, Santa Clara and San Mateo counties. The BAWSCA agencies are highly dependent on the SFPUC Regional Water System to provide potable drinking water critical to the health and safety of water customers in the region.

These comments are in response to the Notice of Preparation of an Environmental Impact Report (EIR) dated May 17, 2007 for the San Joaquin Regional Water Quality Improvement Project.

Specific Comments

Section 2.1.2 – Project Components

1. The description of the Advanced Disinfection Facility would be more understandable to the general public if a brief statement were added to define what *Cryptosporidium* is and its regulatory significance.

2. The description of the LLNL Supply Improvements should clarify that *Giardia* inactivation is needed to comply with Surface Water Treatment Rule standards and reducing *Cryptosporidium* is required to comply with Long Term-2 Enhanced Surface Water Treatment Rule standards.

3. The description of the LLNL Supply Improvements would be more understandable to the general public if a brief statement were added to define what *Giardia* is and its regulatory significance.

155 Bovet Road, Suite 302 • San Mateo, CA 94402 • *ph* 650 349 3000 • *fx* 650 349 8395 • www.bawsca.org

4. How big is the proposed control building (shown adjacent to the proposed UV disinfection building) in Figure 4?

5. The LLNL Supply Improvements description should note that electrical consumption will increase with the operation of the UV system. The EIR should examine if electrical upgrades (either onsite or offsite) would be required to support this increase.

Section 2.2 – Project Goal and Objectives

6. The objective for the Advanced Disinfection Facility should emphasize that the project is to comply with federal and state drinking water regulations to meet more stringent regulations. It should be stated that the project is mandatory and to not build it would lead to a violation of the Long Term-2 Enhanced Surface Water Treatment Rule.

7. The objective for the LLNL Supply Improvements should clarify that *Giardia* inactivation is needed to comply with Surface Water Treatment Rule standards and reducing *Cryptosporidium* is to comply with Long Term-2 Enhanced Surface Water Treatment Rule standards.

Section 3.1 – Key Environmental Issues to be Addressed in the EIR

8. The discussion of other environmental issues refers to potential growth-inducing and cumulative effects. This section of the EIR must be consistent with the analysis done for the WSIP Program Environmental Impact Report (PEIR) currently in preparation. Also, information developed in the WSIP PEIR that is used in this EIR should be appropriately referenced.

Thank you for the opportunity to provide these comments on the EIR scoping for the San Joaquin Regional Water Quality Improvement project.

Sincerely,

Nicole Sandkulla

Nicole M. Sandkulla, P.E.
Senior Water Resources Engineer

cc: Board of Directors
Ray McDevitt, Hanson Bridgett
Dale Newkirk, Newkirk Environmental

Linda S. Adams
Secretary for Environmental Protection

California Regional Water Quality Control Board
Central Valley Region

Karl E. Longley, ScD, PE, Chair

Arnold Schwarzenegger
Governor

Sacramento Main Office
11020 Sun Center Drive #200, Rancho Cordova, California 95670-6114
Phone (916) 464-3291 • FAX (916) 464-4645
http://www.waterboards.ca.gov/centralvalley

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PLANNING DEPARTMENT
MEA

25 May 2007

San Francisco Planning Department
Attn.: Mr. Paul Maltzer
Environmental Review Officer
1660 Mission Street, Suite 500
San Francisco, CA 94103-2414

COMMENTS ON NOTICE OF PREPARATION OF AN ENVIRONMENTAL IMPACT REPORT FOR THE SAN JOAQUIN REGIONAL WATER QUALITY IMPROVEMENT PROJECT SCH NO. 2007.0427E

Dear Mr. Maltzer:

We have reviewed the Notice of Preparation (NOP) of an environmental impact report (EIR) for the above referenced project. The proposed project consists of the following three components:

- **Tesla Portal Disinfection Station:** This component includes replacement and upgrade of the existing disinfection facilities at the Tesla Hypochlorite Station;
- **Advanced Disinfection Station:** This component includes installing an ultraviolet (UV) disinfection system into a newly constructed water treatment facility at the Tesla Portal; and,
- **Lawrence Livermore National Laboratory (LLNL) Supply Improvements:** This component includes installing an ultraviolet (UV) disinfection system into a newly constructed water treatment facility at the Thomas Shaft.

The proposed project also includes road improvements, installation of valves and valve vaults, installation of two back up generators, and security upgrades that will benefit the Tesla Portal Disinfection Station and Advanced Disinfection Station facilities.

The objectives for each component of the proposed project include the following:

- **Tesla Portal Disinfection Station:** Replace the outdated chlorination facility at the Tesla Portal with a chlorination facility that will meet current seismic, safety/fire, and building code standards;

- **Advanced Disinfection Station:** Provide a facility that will meet U.S. Environmental Protection Agency (USEPA) requirements for *Cryptosporidium* reduction in drinking water; and,

- **LLNL Supply Improvements:** Provide a facility that will meet USEPA requirements for *Giardia* inactivation, *Cryptosporidium* reduction, so the SFPUC can fulfill a contractual agreement to provide drinking water to LLNL Site 300.

Based on the information provided in the NOP, we offer the following comments. These comments are intended to advise the SFPUC of our concerns, so they may be incorporated into the planning and design process at an early date.

COMMENTS ON BIOLOGICAL RESOURCES

In the NOP, the Biological Resources Subsection of Section 3.1 indicates that there are potential impacts to a wetland at the Tesla Portal Site and that the water source for this wetland is runoff from sampling points at the existing Tesla Portal Disinfection Station. However, there is no indication that a wetland would not occur at the site in the absence of runoff from sampling points. As a result, the wetland should be delineated to determine whether it is part of waters of the U.S under the Clean Water Act (CWA) and/or part of waters of the State under the California Porter-Cologne Water Quality Act. Please note that waters of the State under the Porter-Cologne Act include waters outside federal jurisdiction (e.g. isolated waters under the Supreme Court's SWANCC decision). If the wetland is considered part of waters of the U.S., both a CWA Section 401 water quality certification and a CWA Section 404 Permit from the U.S. Army Corps of Engineers will be necessary. If the wetland is part of the waters of the State but not waters of the U.S., Waste Discharge Requirements will need to be issued. Under either scenario, direct impacts should be avoided to the maximum extent practicable.

Cumulative and indirect impacts of wetlands must also be prevented. Indirect impacts include deposition of sediments; erosion of substratum; additional water (flooding); reduced water supply or flows from natural sources creating a condition of pollution; shading; and watershed degradation.

COMMENTS ON HYDROLOGY, GROUNDWATER AND WATER QUALITY

In the NOP, the Hydrology, Groundwater and Water Quality Subsection of Section 3.1 indicates that the proposed project may affect surface water and groundwater quality through construction activities and creation of permanent impervious surfaces. Recommendations for avoiding impacts to water quality are provided below.

Construction Activities

The proposed project will disturb more than one acre of land during construction. As a result, it must be covered under the State NPDES General Permit for Discharges of Storm Water Associated with Construction Activity (General Permit). This can be accomplished by filing a Notice of Intent (NOI) with the State Water Resources Control Board, Division of Water Quality. Copies of the General Permit and NOI can be obtained from the State

Board's web page, http://www.waterboards.ca.gov/stormwtr/construction.html. The project sponsor must propose and implement control measures that are consistent with the General Permit and with the recommendations and policies of the local agency and the Water Board.

Impervious Surfaces

This project would increase the amount of impervious surfaces and as a result increase the amount of storm water runoff from the site. Central Valley Regional Water Quality Control Board (Water Board) staff recommends the development and implementation of a long term Storm Water Management Plan (SWMP) to protect water quality after construction. Post-construction storm water concerns may include significant changes in the hydrograph of the receiving waters caused by storm water runoff, or discharge of pollution, such as fertilizers, pesticides, petroleum products and animal waste to a waterway. We encourage the use of innovative site designs that reduce impermeable surfaces and incorporate Best Management Practices (BMPs) to protect and treat storm water. These considerations should be incorporated into project design as early in the planning phase as possible.

COMMENTS ON HAZARDS AND HAZARDOUS MATERIALS

In the NOP, the Hazards and Hazardous Materials Subsection of Section 3.1 indicates that the proposed project may encounter contaminated soils and/or groundwater because hazardous materials have been used at both sites in the past. As a result, the EIR should discuss whether there is soil and/or groundwater contamination at the site. If the SFPUC does not know whether soils and/or groundwater are contaminated at the site, a preconstruction site investigation may be necessary to evaluate whether contamination is present at the sites. Any contamination found at the sites should be reported to the Water Board and other responsible agencies and remedied to state and local standards.

The EIR should also include an evaluation of the depth of groundwater and whether groundwater is expected to be encountered. If contact with groundwater is anticipated as a part of the project, the EIR should evaluate how groundwater dewatering will be accomplished. This evaluation should address whether dewatering discharges may be contaminated and whether water quality objectives are exceeded in the groundwater. Poor quality or contaminated water should be discharged to the sanitary sewer, assuming approval can be obtained from the sanitary sewer agency. If approval to discharge to the sanitary sewer cannot be obtained and the water cannot be otherwise disposed to land (e.g., as dust control or irrigation for water that has minimal contamination), then the SFPUC should determine whether the discharge could be covered under the Board's Low Threat General NPDES dewatering permit. The discharger will need to submit the requisite sampling, analysis, treatment plans, etc. as a part of their permit application. Sufficient time for preparation of the plan, applying for the permit, and obtaining coverage should be considered before beginning the project.

The discharger should implement best management practices including sediment and suspended solids removal to ensure that groundwater meets water quality objectives prior to discharge to the storm drain. The discharger should also check with the local municipality to ensure that the discharge will not cause localized flooding or other problems associated with the increased flow.

CONCLUSION

Please contact Xavier Fernandez at 510-622-5685 xafernandez@waterboards.ca.gov at the San Francisco Bay Regional Board office or me at (916) 474-4742 if you have any questions.

Greg Vaughn
Senior Engineer
Stormwater and Water Quality Certification Unit

cc: State Clearinghouse
Xavier Fernandez, San Francisco Bay Regional Board, Oakland

STATE OF CALIFORNIA—BUSINESS, TRANSPORTATION AND HOUSING AGENCY ARNOLD SCHWARZENEGGER, Governor

DEPARTMENT OF TRANSPORTATION
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June 11, 2007

10-SJ-132 –PM .67
SCH# 2007052109
San Joaquin Regional Water Quality Improvement Project

Jamie Dean
San Francisco Planning Department
1650 Mission Street, Suite 400
San Francisco, CA 94103-2479

Dear Ms. Dean:

The California Department of Transportation (Department) appreciates the opportunity to have reviewed the Notice of Preparation (NOP) of an Environmental Impact Report (EIR) for the proposed San Joaquin Regional Water Quality Improvement Project to be located at the Tesla Portal Site and the Thomas Shaft Site west of the SR-132/I-580 Interchange.

The Department has no comments at this time. When complete, please forward the environmental document for review and comment.

If you have any questions or would like to discuss our comments in more detail, please contact Annette Clark at (209) 948-3909 (e-mail: annette_clark@dot.ca.gov) or me at (209) 941-1921.

Sincerely,

Annette Clark

TOM DUMAS, Chief
Office of Intermodal Planning

c: SMorgan CA Office of Planning and Research

MID Modesto Irrigation District
Water and Power

1231 Eleventh St.
P.O. Box 4060
Modesto, CA 95352
(209) 526-7373

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PLANNING DEPARTMENT
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June 7, 2007

San Francisco Planning Department
Att: Paul Maltzer, Environmental Review Officer
San Joaquin Regional Water Quality Improvement Projects EIR
1650 Mission Street, Suite 400
San Francisco, CA 94103-2479

RE: NOP of an EIR and Notice Of Public Scooping
Tesla Portal – San Joaquin County

Dear Mr. Maltzer:

Thank you for allowing the District to comment on this referral. Following are the recommendations from our Risk & Property, Electrical, Irrigation and Domestic Water Divisions:

Irrigation/ Domestic Water

- No comments at this time.

Risk & Property

- No comments at this time.

Electrical

- The proposed project is located outside the Modesto Irrigation District's electric service area. Therefore the Electrical Division has no specific requirements to the proposed project at this time.

The Modesto Irrigation District reserves its future rights to utilize its property, including its canal and electrical easements and rights-of-way, in a manner it deems necessary for the installation and maintenance of electric, irrigation, agricultural and urban drainage, domestic water and telecommunication facilities. These needs, which have not yet been determined, may consist of poles, crossarms, wires, cables, braces, insulators, transformers, service lines, open channels, pipelines, control structures and any necessary appurtenances, as may, in District's opinion, be necessary or desirable.

If you have any questions, please contact me at 526-7433.

Sincerely,

Celia Aceves
Risk & Property Analyst

Copy: File

San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

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JUN 22 2007

CITY & COUNTY OF S.F.
PLANNING DEPARTMENT
MEA

June 19, 2007

Jamie Dean
City and County of San Francisco
Planning Department
1650 Mission Street, Suite 400
San Francisco, CA 94103-2479

Project: San Joaquin Regional Water Quality Improvement Project
Case No. 2007.0427E

Subject: CEQA comments regarding the Notice of Preparation for improvements under the Water System Improvement Program that include: closing the existing Tesla Portal Disinfection Station and the construction of replacement facilities at 9000 W. Vernalis Road and the upgrade of water treatment facilities on Thomas Shaft Road (San Joaquin County APNs 253-160-02, 251-330-10 and 251-170-03)

District Reference No: 200701035

Dear Ms. Dean:

The San Joaquin Valley Unified Air Pollution Control District (District) has reviewed the project referenced above and offers the following comments:

The San Joaquin Valley Air Basin is currently designated as serious non-attainment for Ozone and non-attainment (no classification) for PM2.5. On October 30, 2006, the US EPA found that the San Joaquin Valley had attained the PM10 standard. The US EPA based its determination upon monitoring data demonstrating that the ambient air quality had met the requirements for attainment. The US EPA's finding does not change the District's classification as a serious PM10 non-attainment to attainment area. However, re-designation from serious non-attainment to attainment requires additional documentation and will occur at some future date.

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www.valleyair.org

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This project would contribute to the overall decline in air quality due to construction activities in preparation of the site, and ongoing traffic and other operational emissions. The District recommends that the air quality section of the EIR have four main components:

1. **A description of the regulatory environment and existing air quality conditions impacting the area.** This section should be concise and contain information that is pertinent to analysis of the project. The District has several sources of information available to assist with the existing air quality and regulatory environment section of the EIR. The District's "*Guide for Assessing and Mitigating Air Quality Impacts, 2002 Revision*" (GAMAQI) contains discussions regarding the existing air quality conditions and trends of the San Joaquin Valley Air Basin (SJVAB), including those pollutants of particular concern: ozone, PM10, and carbon monoxide. In addition, it provides an overview of the regulatory environment governing air quality at the federal, state, and regional levels. The GAMAQI provides air monitoring data and other relevant information for PM-10 and other pollutants. The current GAMAQI can be found at www.valleyair.org/transportation/ceqa_guidance_documents.htm. The most recent air quality data for the District is Available on the California Air Resources Board (ARB) website at http://www.arb.ca.gov/html/aqe&m.htm. The air quality section of EPA's Region 9 (which includes information on the SJVAB) can be found at http://www.epa.gov/ region09/air/index.html.

2. **Estimates of existing emissions and projected pollutant emissions related to the increase in project source emissions and vehicle use, along with an analysis of the effects of these increases.** The EIR should include the methodology, model assumptions, inputs and results for pollutant emissions. The cumulative impact analyses should consider current existing and planned development both within the project area and in surrounding areas. The EIR needs to address the short term and long term local and regional adverse air quality impacts associated with the operation of construction equipment (ROG, NOx, carbon monoxide [CO], and PM10) and emission generated from stationary and mobile sources. The EIR should identify the components and phases of the project. The EIR should provide emissions projections for the project at the build out of each phase (including ongoing emissions from each previous phase). The most current URBEMIS program may be used to quantify these emissions.

   Ozone Precursors – The District recommends using the regional transportation model to quantify mobile source emissions, but in some cases it may be possible to use the most current URBEMIS program to calculate project area and operational emissions. San Joaquin COG may be able to provide assistance with the regional transportation model. The District recommends using the most current URBEMIS program to calculate project area and operational emissions and to identify mitigation measures that reduce impacts. URBEMIS can be downloaded from http://www.urbemis.com/ or the South Coast Air Quality Management District's website at http://www.aqmd.gov/ceqa/urbemis.html. If the analysis reveals that the emissions generated by this project will exceed the District's thresholds (10 tons per

year for ROG and NOx), this project may significantly impact the ambient air quality if not sufficiently mitigated. The project applicant or consultant is encouraged to consult with District staff for assistance in determining appropriate methodology and model inputs.

Toxic Air Pollutants – The air analysis should discuss District and State regulations for identifying and reducing toxic air pollutants and should describe any potential toxic emissions that would be generated by the project. Potential sources that emit toxic pollutants include project operations, and vehicles (the ARB has designated diesel particulate emissions as a toxic air contaminant). If the project is near existing or planned sensitive receptors, the District should be contacted to determine if the project developer should perform a Health Risk Assessment (HRA). An HRA should include a discussion of the toxic risk associated with the proposed project, including project equipment, operations, and vehicles. The GAMAQI defines the significance levels for toxic impacts as a cancer risk greater than 10 in a million and/or a hazard index (HI) of 1.0 or greater for chronic non-carcinogenic or acute risks.

HRA guidelines promulgated by the California Office of Environmental Health Hazard Assessment (OEHHA) and OEHHA toxicity criteria must be used. In addition, the applicant should also refer to the "*Guidance for Air Dispersion Modeling*" document found on the District's web page for additional guidance. This document can be found at http://www.valleyair.org/busind/pto/Tox_Resources/AirQualityMonitoring.htm.

The District recommends use of the latest version of the Hot Spots Analysis and Reporting Program (HARP) released by ARB for an HRA because it is the only software that is compliant with the OEHHA guidelines.

The project consultant should contact the District to review the proposed modeling approach before modeling begins. For more information on HAPs analyses, please contact Mr. Leland Villalvazo, Supervising Air Quality Specialist, at (559) 230-6000 or hramodeler@valleyair.org.

Carbon Monoxide Hotspot Analysis – Results of the traffic study should be used to identify intersections and corridors with high levels of congestion that may result in a CO hot spot. CO hot spots should be screened using a protocol developed by the Institute of Transportation Studies at University of California Davis entitled Transportation Project-Level Carbon Monoxide Protocol. Locations that are predicted by the CO Protocol to experience high levels of CO should be modeled using the most current CALINE dispersion model. The procedure for using the current EMFAC model to calculate emission factors to be used in the CALINE modeling can be downloaded at the Caltrans Division of Environmental Analysis site http://www.dot.ca.gov/hq/env/air/pages/calinesw.htm.

Odor Analysis – The proposed project should be analyzed to see if it is considered near a location of sensitive receptors (including residences) and if odor is a concern. The procedure outlined in the GAMAQI includes the following:

- Identify the location of sensitive receptors (including residences).
- Compare the distance to the nearest sensitive receptor to the distances in Table 4.2 of the GAMAQI. If the sensitive receptors are further away than the distances given in Table 4.2, no further analysis is required. The results should be documented in the EIR.
- Obtain any odor complaints against the facility or similar facilities from the local District office and the county's environmental health department.
- Review the complaints to determine the location of complainants relative to the facility.
- Identify any sensitive receptors at similar distances.
- Determine if emissions of odoriferous compounds will increase or decrease with implementation of the project.
- Draw any reasonable conclusions as to the probability that the project will generate odor complaints based on this analysis of complaint history.

Note that the emission of odiferous compounds should be mitigated as much as feasible if it is anticipated that the project will have a significant impact. For more information on odor impact analyses, please contact Mr. Leland Villalvazo, Supervising Air Quality Specialist, at (559) 230-6000, or hramodeler@valleyair.org.

3. **Identify and discuss all existing District regulations that apply to the project.** The EIR should identify and discuss all existing District regulations that apply to the project. It would be appropriate to discuss proposed rules that are being developed that would apply to the proposed project. Current rules and regulations are available on the District's website at http://www.valleyair.org/rules/1ruleslist.htm. District rules and regulations are periodically revised, and new regulations are promulgated. The District strongly advises the City of San Francisco to contact the District for any rule updates and new rules when the project development begins. Current District rules and regulations applicable to the proposed project are requirements. Based on the information provided, the project will be subject to the following District rules:

Regulation VIII (Fugitive PM10 Prohibitions) Rules 8011-8081 are designed to reduce PM10 emissions (predominantly dust/dirt) generated by human activity, including construction and demolition activities, road construction, bulk materials storage, paved and unpaved roads, carryout and track out, landfill operations, etc. The District's compliance assistance bulletin for construction sites can be found at www.valleyair.org/busind/comply/PM10/Reg VIII CAB.pdf.

Rule 2201 (New and Modified Stationary Source Review Rule) This rule applies to all new stationary sources and all modifications of existing stationary sources that are subject to the District permit requirements and after construction emit or may emit one or more affected pollutant. For more information regarding the District's permitting process, and to determine if an Authority to Construct (ATC) and Permit to

Operate (PTO) are necessary, the applicant should contact the District's Small Business Assistance Office at (209) 557-6446.

Rule 4002 (National Emission Standards for Hazardous Air Pollutants) In the event that any portion of an existing building will be renovated, partially demolished or removed, the project will be subject to District Rule 4002. Prior to any demolition activity, an asbestos survey of existing structures on the project site may be required to identify the presence of any asbestos containing building material (ACBM). In accordance with CAL-OSHA requirements, a certified asbestos contractor must remove any identified ACBM having the potential for disturbance. If you have any questions concerning asbestos related requirements, please contact the District's Compliance Division at (209) 557-6400 or contact CAL-OSHA at (559) 454-1295. The District's Asbestos Requirements Bulletin can be found online at http://valleyair.org/busind/comply/asbestosbultn.htm.

Rule 4102 (Nuisance) This rule applies to any source operation that emits or may emit air contaminants or other materials. In the event that the project or construction of the project creates a public nuisance, it could be in violation and be subject to District enforcement action.

Rule 4601 (Architectural Coatings) This rule limits volatile organic compounds from architectural coatings by specifying architectural coatings storage, clean up and labeling requirements and applies to any person who supplies, sells, offers for sale, applies, or solicits the application of any architectural coating.

Rule 4623 (Storage of Organic Liquids) This rule limits VOC emissions from tanks used to store organic liquids and applies to any tank with a capacity of 1,100 gallons or greater in which any organic liquid is placed, held, or stored.

Rule 4702 (Internal Combustion Engines – Phase 2) This rule applies to any internal combustion engine with a rated brake horsepower greater than 50 horsepower (for example, a standby generator fueled by diesel).

4. **Identify and discuss all feasible measures that will reduce air quality impacts generated by the project.** "Feasible" means "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors: (California Code of Regulations (CCR § 15364)). CEQA requires that EIRs "describe measures which could minimize significant adverse impacts" (CCR §15126(c)). Additionally, the CCR requires that "a public agency should not approve a project as proposed if there are feasible alternatives or mitigation measures that would substantially lessen any significant effects that the project would have on the environment " (CCR § 15021(a)(2)). For each potential adverse impact, mitigation measures should be identified to reduce impacts below air quality threshold levels of significance. Therefore, the EIR should identify which mitigation measures will be included in the project, and how each mitigation measure will be implemented. The reduction of air

quality impacts from implementation of mitigation measures should be quantified to the extent possible. If a measure cannot be quantified a qualitative discussion should be provided explaining the benefits of the proposed mitigation measure. The EIR should discuss how project design modifications could reduce project impacts

District staff is available to meet with you and/or the applicant to further discuss the regulatory requirements that are associated with this project. If you have any questions or require further information, please call Jessica Willis at (559) 230-5818 and provide the reference number at the top of this letter.

Sincerely,

David Warner
Director of Permits Services

Jessica R. Willis

for Arnaud Marjollet
Permit Services Manager

DW:jw

cc: File

TUOLUMNE ME-WUK TRIBAL COUNCIL

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JUL 09 2007

CITY & COUNTY OF S.F.
PLANNING DEPARTMENT
M E A

Cultural Resources Department

~~01 March 2007~~
(5 July 2007)

Jamie Dean
San Francisco Planning Department
1650 Mission Street, Suite 400
San Francisco, CA 94103-2479

RE: Notice of Preparation of EIR
San Joaquin Regional Water Quality Improvement Project

Dear Mr/Ms. Dean,

The Tuolumne Band of Me-Wuk Indians would like to provide written comments for the scoping for the City and County of San Francisco's San Joaquin Regional Water Quality Improvement Project. The project has the potential to affect cultural resources, including archaeological sites, burial areas, and plant gathering areas. We know of human remains near the area, along with other important resources. Further, there is some potential for buried cultural deposits, not obvious on the surface, and we suggest you may need to hire a cultural resources firm who conducts archaeological research as well as ethnographic research and geoarchaeology. We request that said qualified firm conduct a cultural resources survey of the impact area, and that they contact us for discussion and further

Sincerely,

Stanley R Cox

Stanley Robert Cox
Cultural Resources Director

Appendix F
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Government Publications Dept. - San Francisco State University Library
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Hastings College of the Law - Library
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Institute of Government Studies - University of California
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Stanford University Libraries - Jonsson Library of Government Documents
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3904 SEMALLON DR
MODESTO, CA 95356

JOHN B GROHL JR
235 SCHOOL AVE
OAKDALE, CA 95361

MARTIN GLENN GRUVER
2317 NORTHRIDGE DR
MODESTO, CA 95350

SALVATORE R GUARDINO
1031 WALNUT AVE
FREMONT, CA 94536

TOM L & SHARON A HAGGARD
P O BOX 531
ESCALON, CA 95320

LUCILLE HAMMER
1821 EDGEBROOK DR #A
MODESTO, CA 95354

TORYANDUST E & SHELLEY HANIBLE
2109 CLAYMONT DR
MODESTO, CA 95350

DONALD & BARBARA HARNDEN
3804 PAN AM DR
MODESTO, CA 95350

LANE H & CHRISTINA HARREWYN
3312 MINNIEAR AVE
MODESTO, CA 95357

JOSEPH M & LUCILLE A HASLEGO
3649 MINNEAR RD
MODESTO, CA 95355

JAMES N & JANET A HAYDN-MYER
10807 WARNERVILLE RD
OAKDALE, CA 95361

LARRY D & BETH R HAZLEWOOD
3342 MINNIEAR AVE
MODESTO, CA 95357

OWEN E & MARYELLEN HEINRICH
2037 FISHER AVE
MODESTO, CA 95351

RANDALL LEVI & SHERI ANN HEINRICH
6406 SHOEMAKE AVE
MODESTO, CA 95358

JAMES L & ROSIE M HENDERSON
1600 CARLISLE AVE
MODESTO, CA 95356

NORMAN H & NONA O HENDERSON
1700 W MONTE VISTA AVE
MODESTO, CA 95358

HENRY BETTENCOURT ET AL
542 CENTER RD
VERNALIS, CA 95385

ROBERT L & KATHY L HESTER
2025 MENDOCINO WAY
MODESTO, CA 95350

BERNARR W & KATHRYN A HEYNE
1526 VELLA WAY
MODESTO, CA 95357

DOUGLAS K HIGHIET
P O BOX 1597
MODESTO, CA 95353

VALENTINO & LUPE M HIRALEZ
1509 WAKEBRIDGE DR
MODESTO, CA 95356

EDMON & HANNA JENAN HIRMIZ
1508 CARLISLE AVE
MODESTO, CA 95356

HOANG CUC
6020 W EVANA PL
LAKEWOOD, CO 80227

WILLIAM HOEKSTRA
10836 HWY 120
OAKDALE, CA 95361

HOUSING AUTHORITY CO OF STAN
P O BOX 581918
MODESTO, CA 95358

VERDIA M HOWARD
2036 GAINSBORO PL
MODESTO, CA 95355

MARLEN L & DONNA J HOWRY
805 MASSERA WAY
MODESTO, CA 95356

SANDRO & BARBARA HUIZAR
3813 TAHITI LN
MODESTO, CA 95356

NORMAN & L HUNTER
700 E BUTTERFIELD RD #250
LOMBARD, IL 60148

VICTOR H & GAIL L IRONS
1608 CARLISLE AVE
MODESTO, CA 95356

JAMC
9812 STANISLAUS RIVER DR
OAKDALE, CA 95361

A ARANAS H & YOLANDA Z JAMES
2053 MENDOCINO WAY
MODESTO, CA 95350

SUKH D JIT
1604 CARLISLE AVE
MODESTO, CA 95356

JOHN WILLMS RANCH INC
8028 ARROYO WAY
STOCKTON, CA 95209

HERMAN W JONES
P O BOX 65
SNELLING, CA 95369

CYNTHIA A & CHARLES R JOYCE
P O BOX 1609
TRACY, CA 95376

WERNER JOSEPH & ALLISON JEAN KAISER
2425 VAN LAYDEN WAY
MODESTO, CA 95356

KC PROPCO LLC
650 NE HOLIADAY ST #1400
PORTLAND, OR 97232

PRAMOD & HEMIATA KHATRI
2241 NORTHRIDGE DR
MODESTO, CA 95350

FRED D & COLLEEN KILLION
22021 MONTGOMERY RD
SONORA, CA 95370

DICK S KIRK
7830 KIERNAN AVE
MODESTO, CA 95358

RAJESH & RESHAM KLAIR
1121 CHATEAUGAY DR
MODESTO, CA 95356

LINDA L KONG
621 COTTONWOOD DR
MODESTO, CA 95356

CLIFFORD & ONALEE KOSTER
505 W WHITTIER AVE
TRACY, CA 95376

CLIFFORD W KOSTER
35499 S KOSTER RD
TRACY, CA 95304

ONALEE JANE KOSTER
35499 S KOSTER RD
TRACY, CA 95304

FRANCIS DORMAN KOSTER
787 CROUCH AV
CHICO, CA 95928

DIANE GALE KOSTER
505 W WHITTIER AVE
TRACY, CA 95304

MICHAEL W KUMMER
P O BOX 502
RIVERBANK, CA 95367

SHUI & SURJAN LAL
1528 CARLISLE AVE
MODESTO, CA 95356

DAVID K & SUSAN M LANGDON
P O BOX 287
VERNALIS, CA 95385

HAROLD E LATIMER
1808 CHOCTAW WAY
MODESTO, CA 95356

DAVID L & ARLENE C LAWSON
1804 ALPINE ST
CARSON CITY, NV 89703

MIKE H & SHAWN L LAWSON
1133 CHATEAUGAY DR
MODESTO, CA 95356

LCL ELLIS FAMILY LIMITED PARTNERSHIP
3021 SUNDANCE LAKE DR
MODESTO, CA 95354

JICK G & ALICE NG LEONG
2605 BAROLA LN
MODESTO, CA 95356

PAUL & NATALIE LEOPOLDO
34776 BRICHETTO CT
TRACY, CA 95377

DOROTHY K LINDER
253 PINKSTON AVE
OAKDALE, CA 95361

LONESTAR CALIFORNIA INC
PO BOX 5252
PLEASANTON, CA 94566

HERBERT T & ALLEEN M LONG
3409 MANSFIELD LN
MODESTO, CA 95350

JAMES W & JOAN D LOPES
757 ORCHARD RD
VERNALIS, CA 95385

ALFRED D & CAROLYN E LOPEZ
11237 WILLMS RD
OAKDALE, CA 95361

WILLIAM T LORETELLI
1529 ROOSEVELT AVE
MODESTO, CA 95350

DELFINA ALMA LUDDEN
34779 BRICHETTO CT
TRACY, CA 95377

RICHARD W LUNDBERG
821 MASSERA WAY
MODESTO, CA 95356

JIM LYON
18078 ROB-RIC DR
SONORA, CA 95370

LYONS LAND MANAGEMENT
10555 MAZE BLVD
MODESTO, CA 95358

ANTHONY E & MARY E MACIEL
1742 WELTY RD
VERNALIS, CA 95385

YVONNE & BAILEY HAROLD MACINTOSH
3608 LONGBRIDGE DR
MODESTO, CA 95356

ROBERT & SHANNON GAIL MADRID
5201 EQUINE CT
RIVERBANK, CA 95367

ARTURO C & RITA S MANRIQUEZ
1218 HWY 33
VERNALIS, CA 95385

MAPE'S RANCH
10555 MAZE BLVD
MODESTO, CA 95358

LELAND K & LORETTA E MARCIEL
1529 WAKEBRIDGE DR
MODESTO, CA 95356

LAURA MARCILLE
2209 NORTHRIDGE DR
MODESTO, CA 95350

EDWARD MARGOLIS
13124 MUIR DR
GIG HARBOR, WA 98335

JAMES R & LORENE V MARTIN
1516 CARLISLE AVE
MODESTO, CA 95356

MARTIN FAMILY HOLDINGS LLC
1480 MORAGA RD #I
MORAGA, CA 94556

JAVIER MARTINEZ
2800 BRIDLE CT
RIVERBANK, CA 95367

MARY T MORRIS RANCH LTD
3101 S RIVER RD
VERNALIS, CA 95385

CELINA G MATA
1328 SILVERADO DR
MODESTO, CA 95356

MARK & JANET MATTFELD
1504 CARLISLE AVE
MODESTO, CA 95356

ELMER R MAZZUCCHI
3821 WESSON RANCH RD
MODESTO, CA 95356

WILLIAM W MC COMBS
352 KINROSS DR
WALNUT CREEK, CA 94598

CAROL E MC FEETERS
1104 TASMANIA WAY
MODESTO, CA 95356

MC HENRY MOBILE MANOR LLC
6374 PARK
ANDERSON, CA 96007

MARION MEILY
1861 STONE AVE
MODESTO, CA 95351

TONY RAMOS & MARY ROCHA MEIRINHO
PO BOX 580010
MODESTO, CA 95358

ROMEO A MEJIA
3701 MERRIFIELD AVE
MODESTO, CA 95356

JOSE MENDEZ & EVELIA MENDOZA
5203 HARNESS CT
RIVERBANK, CA 95367

HERSHEL CLAY MILLER
1125 CHATEAGAY WAY
MODESTO, CA 95356

LLOYD B & MARY E MILLER
3824 BECKWITH RD
MODESTO, CA 95358

MILLER A B & SONS
7925 BLUE GUM AVE
MODESTO, CA 95358

CAROLINE M MITTON
1120 TASMANIA WAY
MODESTO, CA 95356

MODESTO IRRIG DIST
P O BOX 4060
MODESTO, CA 95352

MODESTO RTMT RES LTD PTNSHP
P O BOX 167928
IRVING, TX 75016

ARIAN MONGEON
2370 WARBURTON AVE
SANTA CLARA, CA 95050

CONCETTA MONTEMURRO
525 CLARATINA AVE
MODESTO, CA 95356

DAVID MONTOYA
2345 NORTHRIDGE DR
MODESTO, CA 95350

JOSE G & ALICIA MONTOYA
3854 VAN DUSEN AVE
RIVERBANK, CA 95367

DOUGLAS A & PATRICIA L MOORE
617 COTTONWOOD DR
MODESTO, CA 95356

LISA A MOORE
6760 PANORAMA DR
RIVERBANK, CA 95367

HUGO MORALES
2233 NORTHRIDGE DR
MODESTO, CA 95350

EMILLO MORAN
289 MINERVA
SAN FRANCISCO, CA 94112

MARTIN MORENO
1501 WAKEBRIDGE DR
MODESTO, CA 95355

LENORE MARJORIE MOREY
2029 MENDOCINO WAY
MODESTO, CA 95350

ESTELLA MORFIN
5202 HARNESS CT
RIVERBANK, CA 95367

BRAD A & MYRA K MORRIS
2141 CLAYMONT DR
MODESTO, CA 95350

MANUEL J & MARY C MORRIS
3513 SHILOH RD
MODESTO, CA 95358

THOMAS C & DEBORAH D MORRIS
P O BOX 184
WESTLEY, CA 95387

DAVID P MOSER
809 MASSERA WAY
MODESTO, CA 95356

STEVE C SR MOTHERSELL
1920 STANDIFORD AVE #1
MODESTO, CA 95350

RAMONA D MOUNT
3830 FIJI CT
MODESTO, CA 95356

JANYCE MULHERN
1800 CHOCTAW WAY
MODESTO, CA 95356

GERARDO & MARIA VICTORIA MUNOZ
5201 SULKY CT
RIVERBANK, CA 95367

ANNETTE LUCIA MYLES
1533 WAKEBRIDGE DR
MODESTO, CA 95356

STEVE M & JENNIFER NAPOLITAN
34417 S KOSTER RD
TRACY, CA 95304

UDAY & GYAN WATI NARAYAN
1101 CHATEAUGAY DR
MODESTO, CA 95356

JOSE L & MARIA DEL ROCIO NAVIA
4017 RANCHO MESA CT
MODESTO, CA 95356

JASON NEIBAUER
3817 WESSON RANCH RD
MODESTO, CA 95356

STEVE & DE ANNE NELSON
34757 BRICHETTO CT
TRACY, CA 95377

BARBARA NETO
1190 CEDAR TREE WAY
SACRAMENTO, CA 95831

MARK & DIANNA NORMAN
34672 BERNARD DR
TRACY, CA 95304

NORTHGATE FARMS A CA CORP
8711 SHOEMAKE AVE
MODESTO, CA 95358

NORTHWOOD PLACE LLC
P O BOX 167928
IRVING, TX 75016

OAKDALE COMMERCIAL FEED YARDS
P O BOX 276
OAKDALE, CA 95361

OAKDALE IRRIGATION DISTRICT
1205 EAST F ST.
OAKLAND, CA 95361

OAKDALE RURAL FIRE PROT DIST
1398 E F ST
OAKDALE, CA 95361

JOHN A & CYNTHIA S ONKEN
7583 PATTERSON RD
OAKDALE, CA 95361

GARY L OOSTERKAMP
5325 SHOEMAKE AVE
MODESTO, CA 95358

FLOYD E & VERTRILLA T OVERHOLTZER
3204 BECKWITH CT
MODESTO, CA 95358

PAC AM LAND ENTERPRISES LLC
298 9TH ST
SAN FRANCISCO, CA 94103

BERNARD R PANELLA
P O BOX 386
CERES, CA 95307

ROBERT L & MAGGIE P PARRA
2017 MENDOCINO WAY
MODESTO, CA 95350

LORRAINE PATRINO
5200 SULKY CT
RIVERBANK, CA 95367

BILLIE J PATTERSON
2337 NORTHRIDGE DR
MODESTO, CA 95350

ERNEST W PENROSE
1100 TASMANIA WAY
MODESTO, CA 95356

TOMMY G & SYLVIA PERALTA
900 GUAVA DR
MODESTO, CA 95356

JOHN T & REBECCA L PERRY
7546 W VERNALIS RD
TRACY, CA 95377

PAULA PERSANO
2225 NORTHRIDGE DR
MODESTO, CA 95350

CASEY & ROCHELLE PHILLIPS
5200 STABLE WAY
RIVERBANK, CA 95367

PHOENIX FAMILY LP
3719 TULLY RD
MODESTO, CA 95356

PATRICK A & DONNA J PICONE
2105 CLAYMONT DR
MODESTO, CA 95350

EDWARD R POLLARD
3932 CROCUS DR
MODESTO, CA 95356

PPC THE GABLES LLC
P O BOX 576489
MODESTO, CA 95357

VISHNU & LAL SHAILENI S PRAKASH
1521 WAKEBRIDGE DR
MODESTO, CA 95356

DEVENDRA D & SATRUBA PRASAD
2125 CLAYMONT DR
MODESTO, CA 95350

VIJMA W PRASAD
1612 CARLISLE AVE
MODESTO, CA 95356

PROTEIN ENTERPRISES
P O BOX 457
LIVINGSTON, CA 95334

RAM & LA LEETA RAJORI
3812 WARMERDAM LN
MODESTO, CA 95356

JOHN C RAMIREZ
1108 TASMANIA WAY
MODESTO, CA 95356

RUTH RAMIREZ
1716 CHOCTAW WAY
MODESTO, CA 95356

DOREEN R RAMOS
4116 HERITAGE OAK CT
MODESTO, CA 95356

MIKE RANDO
1324 SILVERADO DR
MODESTO, CA 95356

RON RATLIFF
5200 SIRE CT
RIVERBANK, CA 95367

PETE & CHARLEEN REECE
30421 S KOSTER RD
TRACY, CA 95304

LISA & BRUCE REGO
2009 MENDOCINO WAY
MODESTO, CA 95350

GLENN & CYNTHIA REIFSCHNEIDER
4655 HEYER AVE
CASTRO VALLEY, CA 94546

RENATA ENTERPRISES INC
3719 TULLY RD #A
MODESTO, CA 95356

RUBEN & GONZALES ANGELINA REYNA
2045 MENDOCINO WAY
MODESTO, CA 95350

RAM & RAM SNEH PRABHA RISHI
1505 WAKEBRIDGE
MODESTO, CA 95356

CITY OF RIVERBANK
6707 3RD ST
RIVERBANK, CA 95367

RIVERSIDE BUILDERS INC
3237 RIVERSIDE DR
RIVERBANK, CA 95367

JOEL R & MARY K ROBERTSON
463 ANN CT
LIVERMORE, CA 94550

ANTE & FLORENCE RODIN
2727 GOUGH ST
SAN FRANCISCO, CA 94123

ANTHONY & FRANCES E RODIN
1518 MORENE WAY
MODESTO, CA 95355

ERIK O ROEN
P O BOX 467
LE GRAND, CA 95333

JESSE D ROGERS
5643 CLAUS RD
RIVERBANK, CA 95367

NATHAN P ROSASCO
15550 HWY 108
JAMESTOWN, CA 95327

NATHAN P ROSASCO
16002 HWY 108
JAMESTOWN, CA 95327

JEREMY D ROSS
1112 TASMANIA WAY
MODESTO, CA 95356

MARK E & MARY LOU ROYER
2619 FINNEY RD
MODESTO, CA 95358

RRP INC
6303 BECKWITH RD
MODESTO, CA 95358

HAROLD S RUBIDGE
1142 HWY 33
VERNALIS, CA 95385

JOSEPH P JR & L RUBINO
402 E BLEWETT RD
TRACY, CA 95304

BRETT L & BRENDA I RUSSELL
2049 MENDOCINO
MODESTO, CA 95350

ANDREW H RUSTAN
603 CRITCHETT RD
TRACY, CA 95304

FLOYD H & EVA D L RYDALCH
5713 SHOEMAKE AVE
MODESTO, CA 95358

LANE SAARLOOS
2305 PRIDMORE AVE
MODESTO, CA 95355

MUNIR SABBAGH
1616 CARLISLE AVE
MODESTO, CA 95356

GOMATI SAHAI
2333 NORTHRIDGE DR
MODESTO, CA 95350

JERROLD D SALEL
7522 W VERNALIS RD
TRACY, CA 95377

County Clerk
SAN JOAQUIN COUNTY
COURTHOUSE
STOCKTON, CA 95202

OCTAVIO & ISELA SANCHEZ
3605 LONGBRIDGE DR
MODESTO, CA 95356

SANDERS PROPERTIES
1031 15TH ST #3
MODESTO, CA 95354

GEORGE & DEBRA A
SANTILLANES
7601 PATTERSON RD
OAKDALE, CA 95361

RONALD SANTISTEBAN
2061 MENDOCINO WAY
MODESTO, CA 95350

ERIC R SANTOS
5206 EQUINE CT
RIVERBANK, CA 95367

MICHAEL P SARDELLA
13775 A MONO WAY #192
SONORA, CA 95370

NAOHARU SATAKE
2600 EL CAMINO REAL #603
PALO ALTO, CA 94306

JUNE ANNA SCHAEFFER
PO BOX 262
VERNALIS, CA 95385

PATRICIA M & HOLLOWAY
RICHARD H SCHMIDT
1632 CARLISLE AVE
MODESTO, CA 95356

PAUL P SENG
2600 DARDANELLE DR
MODESTO, CA 95355

MAUREEN G SERRANO
677 HURON AVE
SAN FRANCISCO, CA 94112

LYDIA SESSUMS
5512 TERMINAL AVE
RIVERBANK, CA 95367

LYDIA SESSUMS
P O BOX 705
RIVERBANK, CA 95367

SHADOWBROOK PROPERTIES
P O BOX 167928
IRVING, 75016

JERRY L & PAMELA G SILVA
2157 CLAYMONT
MODESTO, CA 95350

BALJINDER SINGH
1708 CHOCTAW WAY
MODESTO, CA 95356

JAGENDER & JAGINDAR K SINGH
404 ENGLEWOOD LN
MODESTO, CA 95356

RASHAM SINGH
1141 YALE AVE
MODESTO, CA 95350

SISK RECYCLING CO INC
4506 S COMMONS RD
TURLOCK, CA 95380

JAMAN JAMES & PATRICIA ANN SMITH
3831 FIJI CT
MODESTO, CA 95356

MAYNARD C SMITH
701 CLARATINA AVE
MODESTO, CA 95356

SCOTT M SMITH
701 CLARATINA AVE
MODESTO, CA 95356

AARON SNYDER
2113 CLAYMONT DR
MODESTO, CA 95350

ROBERT & KATHLEEN SOARES
6218 SHOEMAKE AVE
MODESTO, CA 95358

DEBORAH A SORENSON
5845 VIRMAR AVE
OAKLAND, CA 94618

CAROL A SOUZA
1344 SILVERADO DR
MODESTO, CA 95356

ROLAND E SPILKER
2413 NORTHRIDGE DR
MODESTO, CA 95350

STANISLAUS UNION SCHOOL DIST
3601 CARVER RD
MODESTO, CA 95356

SHAWN STODDARD
1205 CHATEAUGAY DR
MODESTO, CA 95356

STUEVE BROS FARMS
671 W ARROW HWY
CLAREMONT, CA 91711

SUNDANCE DEVELOPMENT INC
3021 SUNDANCE LAKE DR
MODESTO, CA 95355

SUTTER FAMILY CORP
P O BOX 3520
MODESTO, CA 95352

FLORENCIO L & ROSELA C TANICALA
2005 MENDOCINO WAY
MODESTO, CA 95350

CHARLES S & MARY ANN TAPIA
34521 S BERNARD DR
TRACY, CA 95377

TAVA DEVELOPMENT CO
2431 BAY SHORE DR
NEWPORT BEACH, CA 92663

THE LCL ELLIS FAMILY LIMITED PARTNERSHIP
3021 SUNDANCE LAKE DR
MODESTO, CA 95355

CAROL L & STEPHEN D THOMAS
2229 NORTHRIDGE DR
MODESTO, CA 95350

THOMING AGGREGATES LIMITED PTP
33600 KOSTER RD
TRACY, CA 95304

ERIC & LISA THOMPSON
3861 SEMALLON DR
MODESTO, CA 95356

KENNETH J & PAULETTE THOMSEN
1929 W DURHAM FERRY RD
TRACY, CA 95304

THOMSEN FARMS INC
2365 DURHAM FERRY RD
TRACY, CA 95304

JOE DEAN TIDWELL
3513 BRENTWOOD WAY
MODESTO, CA 95356

ROBERT S & MARY TIMMERMEYER
1712 CHOCTAW WAY
MODESTO, CA 95356

PATRICK TITTLE
1912 STANDIFORD AVE #1
MODESTO, CA 95350

TRACY GOLF & COUNTRY CLUB
35200 S CHRISMAN RD
TRACY, CA 95304

LEVIO W TRAINA
2055 MARQUES AVE
SAN JOSE, CA 95125

PHU TRAN
1835 NATALIE PL
OXNARD, CA 93030

WESLEY T & JOANNE B TRANA
4854 NORTH AVE
MODESTO, CA 95358

TREEO INC
6303 BECKWITH RD
MODESTO, CA 95358

TRIANGLE PROPERTIES INC
PO BOX 15002
SACRAMENTO, CA 95851

TRIANGLE PROPERTIES INC
3500 AMERICAN RIVER DR
SACRAMENTO, CA 95864

HELEN A TROMBETTA
7109 HILLCREST DR
MODESTO, CA 95356

DAVID R & KRISTIE L TURNER
40590 ENCANTO WAY
FREMONT, CA 94539

USA- USACE
2233 WATT AVE #375
SACRAMENTO, CA 95825

BHOPENDRA CHAND & VENUS VANDANA UMA
1733 MARK MEAD LN
MODESTO, CA 95356

CHET C & SANDY N UMA
2408 BOSCH LN
MODESTO, CA 95356

UNION PACIFIC RAILROAD COMPANY
1416 DODGE ST ROOM 830
OMAHA, NE 68179

VALLEY HAY SAN JOAQUIN
P O BOX 1127
TRACY, CA 95378

KENNETH L & ROBERTA E VAN DYKE
P O BOX 648
OAKDALE, CA 95361

ROGER L & CHERYL A VAN HORN
5130 ROSELLE AVE
MODESTO, CA 95357

DAVID VANDER WALL
837 CLARATINA AVE
MODESTO, CA 95356

CARLOS A VARGAS
3806 VAN DUSEN RD
RIVERBANK, CA 95367

JORGE VARGAS
3617 LONGBRIDGE DR
MODESTO, CA 95356

MICHAEL VAWTER
3900 TEA LEAF DR
MODESTO, CA 95356

FRANK J & CAROL VELOTTA
35150 WELTY RD
VERNALIS, CA 95385

JUAN & PATRICIA VENEGAS
3748 VAN DUSEN AVE
RIVERBANK, CA 95367

JANIS A VENIOT
1444 CARLISLE AVE
MODESTO, CA 95356

JAVIER VERA
5201 STABLE WAY
RIVERBANK, CA 95367

VERNALIS PATNERS LTD
33909 S BIRD RD
TRACY, CA 95304

JOHN J & ELEANOR L VIERRA
5350 FIG AVE
MANTECA, CA 95337

VINEWOOD APARTMENTS
P O BOX 167928
IRVING, TX 75016

CECIL W & CYNTHIA WALKER
3772 VAN DUSEN RD
RIVERBANK, CA 95367

EDWIN C WALKER
1304 SILVERADO DR
MODESTO, CA 95356

RANDELL E & MARILYN T WALKER
4444 COFFEE RD
MODESTO, CA 95357

VERENA R WALTHER
6749 BLUE GUM AVE
MODESTO, CA 95358

LES P & LINDA L WEIDMAN
18467 HIDDEN HILLS CT
HICKMAN, CA 95323

CAMILLA A WELLS
P O BOX 303
WESTLEY, CA 95387

KENNETH B & BETTY LEE WENGER
4342 BECKWITH RD
MODESTO, CA 95358

PAUL J & DEBORAH L WENGER
4267 BECKWITH RD
MODESTO, CA 95358

BARRY & KATHY WEST
1532 CARLISLE AVE
MODESTO, CA 95356

FREDERICK & JENNIFER WEST
613 MC CRACKEN RD
VERNALIS, CA 95385

DONALD A & ELSIE C WESTBROOK
1267 GATES RD
MODESTO, CA 95358

WESTERN FARM SERVICE INC
PO BOX 1168
FRESNO, CA 93715

RALPH A & DEBORAH LYNN WESTLAKE
3824 CAIRNS WAY
MODESTO, CA 95356

MARILYN I WHITE
2133 CLAYMONT DR
MODESTO, CA 95350

MICHAEL T & NANCY C WHITE
2648 DAKOTA AVE
MODESTO, CA 95358

BRUCE D & JANET WICKSTROM
709 COTTONWOOD CT
MODESTO, CA 95356

BRIAN E WILKES
3830 GUAVA CT
MODESTO, CA 95356

FRANKLIN G & VIVIAN J WILLIAM
1936 CHURTON AVE
LOS ALTOS, CA 94024

WILLIAM J COFFILL ET AL
P O BOX 1117
SONORA, CA 95370

JAMES S WILLITS
2973 CASTRO VALLEY BLVD
CASTRO VALLEY, CA 94546

WILLMS RANCH LLC
11707 BLUE OAK DR
OAKDALE, CA 95361

WILLOWS MANCHESTER LTD PAR
P O BOX 167928
IRVING, TX 75016

MICHAEL C & SUSAN K WINGET
3730 VAN DUSEN
RIVERBANK, CA 95367

MAUREEN WIREN
1109 CHATEAUGAY DR
MODESTO, CA 95356

WILLIAM A & RUTH M WISE
4037 BECKWITH RD
MODESTO, CA 95358

SO HAN WONG-LAI
2217 NORTHRIDGE DR
MODESTO, CA 95350

CLETUS & SHERRY H WOO
7808 STEARMAN DR
TRACY, CA 95377

WILLIAM J & MARILYN J WOODARD
3916 LINDENWOOD CT
MODESTO, CA 95356

DARLENE M WRIGHT
6200 JACKSON ST
RIVERBANK, CA 95367

YING LI YANG
1513 RIVER OAKS DR
MODESTO, CA 95356

DANIEL S J & ZITA C YI
7437 BLUE GUM AVE
MODESTO, CA 95358

NOBELLA YOUSEF
2057 MENDOCINO WAY
MODESTO, CA 95350

CARLOS & LOURDES ZARATE
5203 SIRE CT
RIVERBANK, CA 95367

MONICA RAE ZORN
2037 MENDOCINO WAY
MODESTO, CA 95350

KARENA A ZORNOW
3845 EMPEROR LN
MODESTO, CA 95356

BRIAN J & REBECCA A JACKMAN
34868 BERNARD RD
TRACY CA 95377-9356

MIKE J & PAM S BARTOLOMEI
34855 BERNARD RD
TRACY CA 95377-9356

GARY & CAROL KINST
34735 BERNARD RD
TRACY CA 95377-9356

PATRICIA FREEMAN
34703 BERNARD RD
TRACY CA 95377-9356

STEVAN R & C A CURTISS
34641 BERNARD RD
TRACY CA 95377-9356

EDWARD S & MARIANNE C JESSOP
34619 BERNARD RD
TRACY CA 95377-9356

GERALD T & JANET F NELSON
34553 BERNARD RD
TRACY CA 95377-9356

CHARLES S & MARY ANN TAPIA
34521 BERNARD RD
TRACY CA 95377-9356

BILL G & LUCILLE A HOLLOWAY
34532 BERNARD RD
TRACY CA 95377-9356

NAFASGULE S AIMAQUE AIMAQUE
7843 STEARMAN RD
TRACY CA 95377-9358

MARILYN C BONGIOVANNI
7821 STEARMAN RD
TRACY CA 95377-9358

EUGENE E & CAROLYN M SIMPSON
7781 STEARMAN RD
TRACY CA 95377-9358

TIMOTHY & V I HENDERSON
7759 STEARMAN RD
TRACY CA 95377-9358

RICHARD & MARGIE PERUGI
7737 STEARMAN RD
TRACY CA 95377-9358

JOHN & ORINDA T NAJERA
7725 STEARMAN RD
TRACY CA 95377-9358

RICHARD & JANET LEAL
7675 STEARMAN RD
TRACY CA 95377-9358

RICHARD JOHNSON
7653 STEARMAN RD
TRACY CA 95377-9358

CALIXTO & ERLINDA BISCOCHO
7631 STEARMAN RD
TRACY CA 95377-9358

JERROLD D SALEL
7522 W VERNALIS RD
TRACY CA 95377-9365

MICHAEL W & K EELLS
34726 STEARMAN CT
TRACY CA 95377-9359

BRIAN & KAREN M BENTLEY
34760 STEARMAN CT
TRACY CA 95377-9359

GARRY L & C DE WOLF
34755 STEARMAN CT
TRACY CA 95377-9359

LOUIS R & MARIA S PANTANO
34723 STEARMAN CT
TRACY CA 95377-9359

MICHAEL & KAREN WISELOGEL
34678 BRICHETTO CT
TRACY CA 95377-9357

PAUL & NATALIE LEOPOLDO
34776 BRICHETTO CT
TRACY CA 95377-9357

DELFINA ALMA LUDDEN
34779 BRICHETTO CT
TRACY CA 95377-9357

STEVE & DE ANNE NELSON
34757 BRICHETTO CT
TRACY CA 95377-9357

MARK & LINDA WIHL
34669 BRICHETTO CT
TRACY CA 95377-9357

CLETUS & SHERRY H WOO
7808 STEARMAN RD
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JOHN & KATHERINE FISHER
34650 BERNARD RD
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MARK & DIANNA NORMAN
34672 BERNARD RD
TRACY CA 95377-9356

MONICA CAVA
34724 BERNARD RD
TRACY CA 95377-9356

JOSEPH R & VICTORIA S GEIBIG
34746 BERNARD RD
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JACK & SHEILA ADAMS
34877 BERNARD RD
TRACY CA 95377-9356

JOHN T & REBECCA L PERRY
7546 W VERNALIS RD
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FRANK & S L DOMNICK
34704 STEARMAN CT
TRACY CA 95377-9359

Joan Shea
34442 MacCarthur Dr.
Tracy, CA 95377

Joan Shea
1601 W. Lincold Rd.
Stockton, CA 95208

Manuel Silva
35005 S. Chrisman Rd.
Tracy, CA 95376

Manuel Silva
8900 W. Vernalis Rd.
Tracy, CA 95376

Connolly Ranch, Inc.
15220 W. Corral Hollow Rd.
Tracy, CA 95376

Connolly Ranch, Inc.
P.O. Box 1122
Tracy, CA 95378

Corral Hollow Ranch LP
15350 W. Corral Hollow Rd.
Tracy, CA 95376

Corral Hollow Ranch LP
P.O. Box 1130
Modesto, CA 95353

City & Co. of San Francisco
15110 W. Corral Hollow Rd.
Tracy, CA 95376

Union Livestock Inc.
P.O. Box 811
Tracy, CA 95378

RESIDENT
7653 STEARMAN RD
TRACY, CA 95377-9358

RESIDENT
7675 STEARMAN RD
TRACY, CA 95377-9358

RESIDENT
7715 STEARMAN RD
TRACY, CA 95377-9358

RESIDENT
7737 STEARMAN RD
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7759 STEARMAN RD
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7787 STEARMAN RD
TRACY, CA 95377-9358

RESIDENT
7843 STEARMAN RD
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RESIDENT
9000 W VERNALIS RD
TRACY, CA 95377-9363

RESIDENT
8900 W VERNALIS RD
TRACY, CA 95377-9300

RESIDENT
34845 BERNARD RD
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34855 BERNARD RD
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34669 BRICHETTO CT
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34204 STEARMAN CT
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RESIDENT
7588 W VERNALIS RD
TRACY, CA 95377-9365

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RESIDENT
35151 S CHRISMAN RD
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36200 S CHRISMAN RD
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7151 W SAINT ANDREWS LN
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7133 W SAINT ANDREWS LN
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RESIDENT
7095 W SAINT ANDREWS LN
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RESIDENT
7011 W SAINT ANDREWS LN
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6993 W SAINT ANDREWS LN
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6935 W SAINT ANDREWS LN
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6893 W SAINT ANDREWS LN
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7653 STEARMAN RD
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7588 W VERNALIS RD
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6893 W SAINT ANDREWS LN
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SAN JOAQUIN COUNTY
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ANDREW CHESLEY
SAN JOAQUIN COUNCIL OF GOVERNMENTS
555 E. WEBER AVE.
STOCKTON, CA 95202

STEVEN GUTIERREZ
SAN JOAQUIN COUNTY
COUNTY COURTHOUSE, RM 701,
222 E. WEBER AVE.
STOCKTON, CA 95202

VICTOR MOW
SAN JOAQUIN COUNTY
COUNTY COURTHOUSE, RM 701,
222 E. WEBER AVE.
STOCKTON, CA 95202

LEROY ORNELLAS
SAN JOAQUIN COUNTY
COUNTY COURTHOUSE, RM 701
222 E. WEBER AVE.
STOCKTON, CA 95202

LARRY RUHSTALLER
SAN JOAQUIN COUNTY
COUNTY COURTHOUSE, RM 701,
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SJCC DEVELOPMENT DEPT.
1810 E. HAZELTON AVE.
STOCKTON, CA 95205

KEN VOGEL
SJCC COURTHOUSE, RM 701
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STOCKTON, CA 95202

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SAN FRANCISCO, CA 94103

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STOCKTON, CA 95207

TOM BERRYHILL
CA STATE
1912 STANDIFORD AVE., STE 4
MODESTO, CA 95350

DAVE COGDILL
CA STATE
1308 W. MAIN STREET, SUITE C
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1231 - 8TH STREET, STE 175
MODESTO, CA 95354

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CA STATE
31 E. CHANNEL STREET, STE 306
STOCKTON, CA 95202

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1635 CHESTNUT STREET, STE A
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MIKE MACHADO
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31 E. CHANNEL STREET, STE 440
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CITY OF TRACY
325 EAST 10TH STREET
TRACY, CA 95376

SANDRA EVANS
CITY OF TRACY
325 EAST 10TH STREET
TRACY, CA 95376

DANIEL HOBBS
CITY OF TRACY
325 EAST 10TH STREET
TRACY, CA 95376

BRENT IVES
CITY OF TRACY
325 EAST 10TH STREET
TRACY, CA 95376

ANDREW MALIK
CITY OF TRACY
520 TRACY BLVD.
TRACY, CA 95376

RAYMOND MCCRAY
CITY OF TRACY
325 EAST 10TH STREET
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IRENE SUNDBERG
CITY OF TRACY
325 EAST 10TH STREET
TRACY, CA 95376

EVELYN TOLBERT
CITY OF TRACY
325 EAST 10TH STREET
TRACY, CA 95376

SUZANNE TUCKER
CITY OF TRACY
325 EAST 10TH STREET
TRACY, CA 95376

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520 TRACY BOULEVARD
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KEITH CARSON
ALAMEDA COUNTY
1221 OAK STREET, #536
OAKLAND, CA 94612

SCOTT HAGGERTY
ALAMEDA COUNTY
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ADMINISTRATION BUILDING,
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GAIL STEELE
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1221 OAK STREET, #536
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RESIDENT
7631 STEARMAN RD
TRACY, CA 95377-9358

RESIDENT
7653 STEARMAN RD
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7675 STEARMAN RD
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RESIDENT
7715 STEARMAN RD
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7737 STEARMAN RD
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RESIDENT
7759 STEARMAN RD
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7843 STEARMAN RD
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9000 W VERNALIS RD
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34845 BERNARD RD
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34855 BERNARD RD
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34724 BERNARD RD
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RESIDENT
34650 BERNARD RD
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RESIDENT
7808 STEARMAN RD
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RESIDENT
34669 BRICHETTO CT
TRACY, CA 95377-9357

RESIDENT
34757 BRICHETTO CT
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RESIDENT
34745 BRICHETTO CT
TRACY, CA 95377-9357

RESIDENT
34678 BRICHETTO CT
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RESIDENT
34723 STEARMAN CT
TRACY, CA 95377-9359

RESIDENT
34760 STEARMAN CT
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RESIDENT
34726 STEARMAN CT
TRACY, CA 95377-9359

RESIDENT
34204 STEARMAN CT
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RESIDENT
7588 W VERNALIS RD
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RESIDENT
35151 S CHRISMAN RD
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RESIDENT
7071 W SAINT ANDREWS LN
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RESIDENT
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6993 W SAINT ANDREWS LN
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6935 W SAINT ANDREWS LN
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6957 W SAINT ANDREWS LN
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RESIDENT
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RESIDENT
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RESIDENT
6893 W SAINT ANDREWS LN
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RESIDENT
6855 W SAINT ANDREWS LN
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A L GILBERT CO INC
P O BOX 38
OAKDALE, CA 95361

JACK & SHEILA ADAMS
34877 S BERNARD DR
TRACY, CA 95304

BEN M & VIRGINIA LADRIANO
2117 CLAYMONT DR
MODESTO, CA 95350

BETTY LAKARD
3834 FIJI CT
MODESTO, CA 95356

ALEX LIAKOS ET AL
P O BOX 814
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DAVID R & BENICIA LALFARO
2137 CLAYMONT DR
MODESTO, CA 95350

DAVID ALLEM
1419 CARLISLE AVE
MODESTO, CA 95356

SEAN AAMIN
2320 BANGS AVE
MODESTO, CA 95356

MICHELLE ANDERSON
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ROSALIO O & TERRIARCOS
9624 ST
OAKDALE, CA 95361

RICHARD BARDIS
PO BOX 1927
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JOE V & LUCIA VAREIAS
5732 PATTERSON RD
OAKDALE, CA 95361

RONALD EARNOLD
12553 WARNERVILLE RD
OAKDALE, CA 95361

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1300 SILVERADO DR
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BRUCE C & JANIS
KASCHENBRENNER
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5200 YEARLING CT
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1812 CHOCTAW WAY
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MANUEL & ADELINE AZEVEDO
1619 SANDALWOOD DR
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SABBA HAZIZ
904 GUAVA DR
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7012 EDSEL LN
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TOMMY R & SHARON KBALL
2806 BRIDLE CT
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BALOCH FAMILY INDUST/COMM LAND TRUST
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SANTA CLARA, CA 95050

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212 CRAWFORD RD
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6610 W DURHAM FERRY RD
TRACY, CA 95304

THELMA M BENNETT
35454 S KOSTER RD
TRACY, CA 95304

BRIAN & KAREN BENTLEY
34760 STEARMAN CT
TRACY, CA 95377

BERBERIAN PROPERTIES LLC
515 LYELL DR #100
MODESTO, CA 95356

BETHANY CHRISTIAN SERVICES
901 EASTERN AVE
GRAND RAPIDS, MI 49503

FRANK BETTENCOURT
585 RIVER RD
VERNALIS, CA 95385

TIM BETTENCOURT
2020 STANDIFORD #D-1
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HENRY BETTENCOURT
542 CENTER RD
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2505 BRIDLE PATH LN
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5330 ROSELLE AVE
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213 RIVER RD
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3624 BECKWITH RD
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BLUE TREE FARMS CORP
PO BOX 13308
SACRAMENTO, CA 95813

HANS MARK & BARBARA JEANETTE BOEGE
4719 NORTH AVE
MODESTO, CA 95358

JOHN III & MARCIA BOER
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MICHAEL BOGETTI
PO BOX 273
VERNALIS, CA 95385

ALBERT M & DOROTHY BOGETTI
855 MC CRACKEN RD
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MICHAEL & LAURIE BOGETTI
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VERNALIS, CA 95385

MICHAEL BOGETTI
31300 S KOSTER RD
TRACY, CA 95304

PAULETTE BOGETTI
PO BOX 273
VERNALIS, CA 95385

PAULETTE BOGETTI
464 MC CRACKEN RD
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ALBERT BOGETTI JR
PO BOX 273
VERNALIS, CA 95385

BOGETTIS ORCHARD INC
P O BOX 705
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LYNETTE BRAWLEY
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JOHN P & JACQUELINE BRICHETTO
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OAKDALE, CA 95361

LOUIS BRICHETTO
P O BOX 548
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CANDAS BROCK
142 N 9TH ST #14
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PATRICIA & LEE BROOKS
9668 ROCK RIVER RD
JAMESTOWN, CA 95327

JEFFREY BROOME
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MODESTO, CA 95358

RANDALL BROUGHTON
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LEONARD BROWN
5106 USTICK RD
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TRACY, CA 95304

HUBERT BRUBAKER
3254 BECKWITH CT
MODESTO, CA 95358

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MODESTO, CA 95356

KAY BRYANT
1129 CHATEAUGAY DR
MODESTO, CA 95356

JAMES & ANITA BUDDE
5206 SULKY CT
RIVERBANK, CA 95367

KENNTH A & LORI BUEHNER
19112 PARADISE AVE
PATTERSON, CA 95363

OSVALDO & SONIA BUGARIN
2401 NORTHRIDGE DR
MODESTO, CA 95350

BURCHELL NURSERY INC
12000 HWY 120
OAKDALE, CA 95361

ROGELIO & DOMITILA CARLOS
2405 NORTHRIDGE DR
MODESTO, CA 95350

JOSE & SUSANA CASTELLANOS
3429 CLAUS RD
MODESTO, CA 95356

RAYMOND & WANDA CASTELLO
1790 S WINCHESTER BL #1
CAMPBELL, CA 95008

JOSEPH CASTELLO
1790 S WINCHESTER BLVD #1
CAMPBELL, CA 95008

MONICA CAVA
34724 BERNARD DR
TRACY, CA 95377

CH ADVENTIST CCC 7TH DAY
P O BOX 770
CLOVIS, CA 93613

CH BAPTIST LIB LANDMARK MISS
341 CLARATINA AVE
MODESTO, CA 95356

CH BAPTIST OLD GERMAN
2872 VENEMAN AVE
MODESTO, CA 95356

GERMAN & ATRA MARIA CHAVEZ
P O BOX 1339
SALIDA, CA 95368

MARTHA CHAVEZ
5209 PROSPECTORS PKWY
RIVERBANK, CA 95367

CHEVRON USA INC
P O BOX 285
HOUSTON, TX 77001

EUGENE & FRANCIE CHIARA
3807 MINNEAR AVE
MODESTO, CA 95354

DWIGHT & SMALLEY PENNY CLARK
3305 WOODCLIFF WAY
MODESTO, CA 95350

ROBERT CLARK
1340 SILVERADO DR
MODESTO, CA 95356

ALLEN & SHARON CLAYTON
1704 CHOCTAW WAY
MODESTO, CA 95356

JAY & SHIRLEY COATES
2121 CLAYMONT DR
MODESTO, CA 95350

LOUIS J & THELMA COELHO
1843 N HART RD
MODESTO, CA 95358

RICHARD COFFEE
5372 LITT RD
MODESTO, CA 95357

BETTY COLLIER
1440 CARLISLE AVE
MODESTO, CA 95356

ROYCE CONWAY
29621 SCOTT RD
MENIFFE, CA 92584

RICHARD & SANDRA CORNEJO
817 MASSERA WAY
MODESTO, CA 95356

JESSICA & FRANCISCO CORRAL
3324 BROOKTREE LN
MODESTO, CA 95350

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TRACY, CA 95376

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3837 EMPEROR LN
MODESTO, CA 95356

VALENTINO & MYRA CRUZ
787 FLEMING AVE
SAN JOSE, CA 95127

EDWARD & KATHY CUNNINGHAM
2325 NORTHRIDGE DR
MODESTO, CA 95350

MARY CURCI
1307 CENTRAL AVE
SAN JOSE, CA 95128

JAMES & BEVERLY CURTONI
P O BOX 1214
OAKDALE, CA 95361

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9825 WARNERVILLE RD
OAKDALE, CA 95361

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1901 SHELL CT
MODESTO, CA 95356

JAMES & CARLA DE METRIS
2067 SULLIVAN AVE
SAN MATEO, CA 94403

ANTONIA DE PALMA
18666 E HWY
RIPON, CA 95366

PAT & APOLLONIA DE PALMA
18666 E HWY
RIPON, CA 95366

GREGORY DE VALLE
45404 COYOTE RD
FREMONT, CA 94539

ABRAHAM & CYNTHIA DE VISSER
4500 ALBERS RD
OAKDALE, CA 95361

ELENE DELGADILLO
9133 INTERNATIONAL BLVD
OAKLAND, CA 94603

FRANK JR & LUCILLE DENIZ
5307 ELEANOR AVE
OAKDALE, CA 95361

GARRY & CHRISTINE DEWOLF
34755 STEARMAN CT
TRACY, CA 95377

LUIS DIAZ
2205 NORTHRIDGE DR
MODESTO, CA 95350

ROBERTO & JOSEFINA DIAZ
1701 CHOCTAW
MODESTO, CA 95356

THIET & NGO UYEN DO
4208 KINDRED CT
MODESTO, CA 95356

E L & C DOTSON
793 S TRACY BLVD #285
TRACY, CA 95376

ROBERT & SHARON DRIVER
PO BOX 188
SALIDA, CA 95368

ANGELA DUMLAO
754 MC CRACKEN
VERNALIS, CA 95385

JOSEPH DUTY
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MODESTO, CA 95356

E F CASH DUDLE
1608 F ST
MODESTO, CA 95354

WAYNE & RUTH EBLE
1217 CHATEAUGAY DR
MODESTO, CA 95356

ALFRED & CHARLOTTE MARIE EGLIOTTO
1137 MOUNTAIN VIEW RD
HUGHSON, CA 95326

JEFF C & STEPHANIE EISENHAUER
3824 AUCKLAND CT
MODESTO, CA 95356

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VERNALIS, CA 95385

MIKE ERCEG
33969 S KOSTER RD
TRACY, CA 95304

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1213 CHATEAUGAY DR
MODESTO, CA 95356

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MODESTO, CA 95355

FBO SANDERS IRENE
1031 15TH ST #3
MODESTO, CA 95354

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MODESTO, CA 95350

WERNER H III & TAMI LYNN FELDHAUS
2021 MENDOCINO WAY
MODESTO, CA 95350

KENNETH FERGUSON
3774 VAN DUSEN AVE
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RIVERBANK, CA 95367

JEFFREY ALLEN FERRARI
2260 MABLE AVE
MODESTO, CA 95357

PAULA FINTON
33969 S KOSTER RD
TRACY, CA 95304

STUART & CAROLYN FISHER
1980 FISHER RD
MODESTO, CA 95358

JOHN & KATHERINE FISHER
34650 BERNARD DR
TRACY, CA 95377

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5201 YEARLING CT
RIVERBANK, CA 95367

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1720 CHOCTAW WAY
MODESTO, CA 95356

NYLA FORNACIARI
3327 COVE CIR
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HERMISTON, OR 97838

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PATTERSON, CA 95363

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5230 ROSELLE AVE
MODESTO, CA 95357

RONALD & REID PORTIA GAINES
3100 MINNIEAR AVE
MODESTO, CA 95357

ERNEST & ANN GAMMA
128 PRESTON DR
MOUNTAIN VIEW, CA 94040

PARBHUBHAI & SUSHILABEN GANDHI
2313 NORTHRIDGE DR
MODESTO, CA 95350

CAROLYN GANNON
3800 PAN AM DR
MODESTO, CA 95356

MERLYN & BETTY GARBER
7848 SHACKELFORD RD
MODESTO, CA 95358

DOLORES GARCIA
1116 TASMANIA WAY
MODESTO, CA 95356

JUAN GABRIEL & MINERVA JUDITH GARCIA
3409 MELGREN AVE
MODESTO, CA 95356

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P O BOX 304
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2041 MENDOCINO WAY
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P O BOX 1867
MODESTO, CA 95354

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MODESTO, CA 95354

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P O BOX 593330
ORLANDO, FL 32859

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3531 CARVER RD
MODESTO, CA 95356

PHILLIP GIAMBANCO
3531 CARVER RD
MODESTO, CA 95356

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1128 TASMANIA WAY
MODESTO, CA 95356

JIMMIE & KATHLEEN GILBERT
7011 PATTERSON RD
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JOHN & NYDIA GLETNE
713 COTTONWOOD CT
MODESTO, CA 95356

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2001 MENDOCINO WAY
MODESTO, CA 95350

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2161 CLAYMONT DR
MODESTO, CA 95350

RAVI & HARJIT GOGNA
407 CLARATINA AVE
MODESTO, CA 95356

RAVI & HARJIT GOGNA
7417 SPY GLASS DR
MODESTO, CA 95356

GOLF & COUNTRY CLUB TRACY
35200 S CHRISMAN RD
TRACY, CA 95377

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3608 DAYSTAR DR
MODESTO, CA 95355

GRANITE CONSTRUCTION CO CORP
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WATSONVILLE, CA 95077

GRANITE CONSTRUCTION CO CORP
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OAKDALE, CA 95361

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1821 EDGEBROOK DR #A
MODESTO, CA 95354

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MODESTO, CA 95350

DONALD & BARBARA HARNDEN
3804 PAN AM DR
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MODESTO, CA 95356

NORMAN H & NONA HENDERSON
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2025 MENDOCINO WAY
MODESTO, CA 95350

BERNARR & KATHRYN HEYNE
1526 VELLA WAY
MODESTO, CA 95357

DOUGLAS HIGHIET
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1509 WAKEBRIDGE DR
MODESTO, CA 95356

EDMON & HANNA JENAN HIRMIZ
1508 CARLISLE AVE
MODESTO, CA 95356

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6020 W EVANA PL
LAKEWOOD, CO 80227

WILLIAM HOEKSTRA
10836 HWY 120
OAKDALE, CA 95361

HOUSING AUTHORITY CO OF STAN
P O BOX 581918
MODESTO, CA 95358

VERDIA HOWARD
2036 GAINSBORO PL
MODESTO, CA 95355

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805 MASSERA WAY
MODESTO, CA 95356

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3813 TAHITI LN
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700 E BUTTERFIELD RD #250
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A ARANAS & YOLANDA JAMES
2053 MENDOCINO WAY
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SUKH D JIT
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TRACY, CA 95376

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2425 VAN LAYDEN WAY
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PRAMOD & HEMIATA KHATRI
2241 NORTHRIDGE DR
MODESTO, CA 95350

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22021 MONTGOMERY RD
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MODESTO, CA 95356

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MODESTO, CA 95356

CLIFFORD & ONALEE KOSTER
505 W WHITTIER AVE
TRACY, CA 95376

CLIFFORD KOSTER
35499 S KOSTER RD
TRACY, CA 95304

ONALEE JANE KOSTER
35499 S KOSTER RD
TRACY, CA 95304

FRANCIS DORMAN KOSTER
787 CROUCH AV
CHICO, CA 95928

DIANE GALE KOSTER
505 W WHITTIER AVE
TRACY, CA 95304

MICHAEL KUMMER
P O BOX 502
RIVERBANK, CA 95367

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1528 CARLISLE AVE
MODESTO, CA 95356

DAVID K & SUSAN LANGDON
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HAROLD LATIMER
1808 CHOCTAW WAY
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DAVID L & ARLENE LAWSON
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CARSON CITY, NV 89703

MIKE H & SHAWN LAWSON
1133 CHATEAUGAY DR
MODESTO, CA 95356

LCL ELLIS FAMILY LIMITED PARTNERSHIP
3021 SUNDANCE LAKE DR
MODESTO, CA 95354

JICK & ALICE LEONG
2605 BAROLA LN
MODESTO, CA 95356

PAUL & NATALIE LEOPOLDO
34776 BRICHETTO CT
TRACY, CA 95377

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253 PINKSTON AVE
OAKDALE, CA 95361

LONESTAR CALIFORNIA INC
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PLEASANTON, CA 94566

HERBERT T & ALLEEN LONG
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757 ORCHARD RD
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11237 WILLMS RD
OAKDALE, CA 95361

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34779 BRICHETTO CT
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821 MASSERA WAY
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18078 ROB-RIC DR
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LYONS LAND MANAGEMENT
10555 MAZE BLVD
MODESTO, CA 95358

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1742 WELTY RD
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YVONNE & BAILEY HAROLD MACINTOSH
3608 LONGBRIDGE DR
MODESTO, CA 95356

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1529 WAKEBRIDGE DR
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2209 NORTHRIDGE DR
MODESTO, CA 95350

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13124 MUIR DR
GIG HARBOR, WA 98335

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1516 CARLISLE AVE
MODESTO, CA 95356

MARTIN FAMILY HOLDINGS LLC
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3101 S RIVER RD
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1328 SILVERADO DR
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WILLIAM WMC COMBS
352 KINROSS DR
WALNUT CREEK, CA 94598

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6374 PARK
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MODESTO, CA 95358

ROMEO AMEJIA
3701 MERRIFIELD AVE
MODESTO, CA 95356

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5203 HARNESS CT
RIVERBANK, CA 95367

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LLOYD B & MARY MILLER
3824 BECKWITH RD
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7925 BLUE GUM AVE
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MODESTO, CA 95356

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MODESTO, CA 95353

MODESTO IRRIG DIST
P O BOX 4060
MODESTO, CA 95352

MODESTO RTMT RES LTD PTNSHP
P O BOX 167928
IRVING, TX 75016

ARIAN MONGEON
2370 WARBURTON AVE
SANTA CLARA, CA 95050

CONCETTAMONTE MURRO
525 CLARATINA AVE
MODESTO, CA 95356

DAVID MONTOYA
2345 NORTHRIDGE DR
MODESTO, CA 95350

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MODESTO, CA 95356

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2233 NORTHRIDGE DR
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EMILLO MORAN
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SAN FRANCISCO, CA 94112

MARTIN MORENO
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MODESTO, CA 95355

LENORE MARJORIE MOREY
2029 MENDOCINO WAY
MODESTO, CA 95350

ESTELLA MORFIN
5202 HARNESS CT
RIVERBANK, CA 95367

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2141 CLAYMONT DR
MODESTO, CA 95350

MANUEL & MARY MORRIS
3513 SHILOH RD
MODESTO, CA 95358

THOMAS & DEBORAH MORRIS
P O BOX 184
WESTLEY, CA 95387

DAVID MOSER
809 MASSERA WAY
MODESTO, CA 95356

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1920 STANDIFORD AVE #1
MODESTO, CA 95350

RAMONA MOUNT
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MODESTO, CA 95356

JANYCE MULHERN
1800 CHOCTAW WAY
MODESTO, CA 95356

GERARDO & MARIA VICTORIA MUNOZ
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RIVERBANK, CA 95367

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MODESTO, CA 95356

STEVE & JENNIFER NAPOLITAN
34417 S KOSTER RD
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MODESTO, CA 95356

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MODESTO, CA 95356

JASON NEIBAUER
3817 WESSON RANCH RD
MODESTO, CA 95356

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SACRAMENTO, CA 95831

MARK & DIAN NANORMAN
34672 BERNARD DR
TRACY, CA 95304

NORTHGATE FARMS A CA CORP
8711 SHOEMAKE AVE
MODESTO, CA 95358

NORTHWOOD PLACE LLC
P O BOX 167928
IRVING, TX 75016

OAKDALE COMMERCIAL FEED YARDS
P O BOX 276
OAKDALE, CA 95361

OAKDALE IRRIGATION DISTRICT
1205 EAST F ST.
OAKLAND, CA 95361

OAKDALE RURAL FIRE PROT DIST
1398 E F ST
OAKDALE, CA 95361

JOHN & CYNTHIA SONKEN
7583 PATTERSON RD
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5325 SHOEMAKE AVE
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MODESTO, CA 95358

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PAC AM LAND ENTERPRISES LLC
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SAN FRANCISCO, CA 94103

BERNARD PANELLA
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CERES, CA 95307

ROBERT & MAGGIE PARRA
2017 MENDOCINO WAY
MODESTO, CA 95350

LORRAINE PATRINO
5200 SULKY CT
RIVERBANK, CA 95367

BILLIE PATTERSON
2337 NORTHRIDGE DR
MODESTO, CA 95350

ERNEST PENROSE
1100 TASMANIA WAY
MODESTO, CA 95356

TOMMY & SYLVIA PERALTA
900 GUAVA DR
MODESTO, CA 95356

JOHN & REBECCA PERRY
7546 W VERNALIS RD
TRACY, CA 95377

PAULA PERSANO
2225 NORTHRIDGE DR
MODESTO, CA 95350

CASEY & ROCHELLE PHILLIPS
5200 STABLE WAY
RIVERBANK, CA 95367

PHOENIX FAMILY LP
3719 TULLY RD
MODESTO, CA 95356

PATRICK & DONNA PICONE
2105 CLAYMONT DR
MODESTO, CA 95350

EDWARD POLLARD
3932 CROCUS DR
MODESTO, CA 95356

PPC THE GABLES LLC
P O BOX 576489
MODESTO, CA 95357

VISHNU & LAL SHAILENI PRAKASH
1521 WAKEBRIDGE DR
MODESTO, CA 95356

DEVENDRA & SATRUBA PRASAD
2125 CLAYMONT DR
MODESTO, CA 95350

VIJMA PRASAD
1612 CARLISLE AVE
MODESTO, CA 95356

PROTEIN ENTERPRISES
P O BOX 457
LIVINGSTON, CA 95334

RAM & LA LEETA RAJORI
3812 WARMERDAM LN
MODESTO, CA 95356

JOHN RAMIREZ
1108 TASMANIA WAY
MODESTO, CA 95356

RUTH RAMIREZ
1716 CHOCTAW WAY
MODESTO, CA 95356

DOREEN RAMOS
4116 HERITAGE OAK CT
MODESTO, CA 95356

MIKE RANDO
1324 SILVERADO DR
MODESTO, CA 95356

RON RATLIFF
5200 SIRE CT
RIVERBANK, CA 95367

PETE & CHARLEEN REECE
30421 S KOSTER RD
TRACY, CA 95304

LISA & BRUCE REGO
2009 MENDOCINO WAY
MODESTO, CA 95350

GLENN & CYNTHIA REIFSCHNEIDER
4655 HEYER AVE
CASTRO VALLEY, CA 94546

RENATA ENTERPRISES INC
3719 TULLY RD #A
MODESTO, CA 95356

RUBEN & GONZALES ANGELINA REYNA
2045 MENDOCINO WAY
MODESTO, CA 95350

RAM & RAM SNEH PRABHA RISHI
1505 WAKEBRIDGE
MODESTO, CA 95356

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RIVERBANK, CA 95367

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3237 RIVERSIDE DR
RIVERBANK, CA 95367

JOEL & MARY ROBERTSON
463 ANN CT
LIVERMORE, CA 94550

ANTE & FLORENCE RODIN
2727 GOUGH ST
SAN FRANCISCO, CA 94123

ANTHONY & FRANCES RODIN
1518 MORENE WAY
MODESTO, CA 95355

ERIK ROEN
P O BOX 467
LE GRAND, CA 95333

JESSE ROGERS
5643 CLAUS RD
RIVERBANK, CA 95367

NATHAN ROSASCO
15550 HWY 108
JAMESTOWN, CA 95327

NATHAN ROSASCO
16002 HWY 108
JAMESTOWN, CA 95327

JEREMY ROSS
1112 TASMANIA WAY
MODESTO, CA 95356

MARK & MARY LOU ROYER
2619 FINNEY RD
MODESTO, CA 95358

RRP INC
6303 BECKWITH RD
MODESTO, CA 95358

HAROLD RUBIDGE
1142 HWY 33
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APPENDIX B

WSIP PEIR Reference Chapters

Overview and Introduction

As discussed in this Environmental Impact Report (EIR), the proposed project is part of the San Francisco Public Utilities Commission's (SFPUC) Water System Improvement Program (WSIP). The San Francisco Planning Department prepared a Draft Program Environmental Impact Report (PEIR) on the WSIP, which was published on June 29, 2007. After responding to public comments on the Draft PEIR, the Final PEIR was certified by the San Francisco Planning Commission on October 30, 2008 (Motion No. 17734). On that same day, the revised WSIP (known as the "Phased WSIP Variant" in the Final PEIR) was adopted by the SFPUC (Resolution 08-0200).

Because the proposed project is a component of the WSIP, it would contribute to the impacts that would occur with implementation of the WSIP's water supply strategy, including its growth-inducement impacts. These impacts are summarized in the main body of this EIR in the Executive Summary and in Section 4.1, Approach to Analysis, of this EIR. This appendix supplements the WSIP impact summaries by including the actual text from the Draft and Final PEIR on the WSIP's water supply impacts.

Due to the timing of publication of this EIR, certification of the Final PEIR, and adoption of the WSIP, this appendix was assembled to present information on the impacts of the WSIP's water supply strategy and also to correct some of this information in response to comments on the Draft PEIR, as set forth in the Final PEIR. Specifically, this appendix includes the actual text in the Draft and Final PEIR on the originally proposed and the revised, adopted WSIP along with other information and text changes from the Final PEIR relevant to the WSIP's water supply strategy as it relates to the proposed project.

Contents of this Appendix

Text from the Draft PEIR on the WSIP

This appendix contains the following text on the WSIP's water supply impacts from the Draft PEIR:

- **Chapter 5 (Volume 3 of the PEIR):** This chapter evaluates the potential environmental impacts of the WSIP's water supply strategy and regional water system operations. The impact discussion is organized by watershed and related drainages and reservoirs.

- **Chapter 7 (Volume 4 of the PEIR):** This chapter analyzes the WSIP's growth inducement potential and associated secondary effects of growth impacts.

- **Chapter 9 (Volume 4 of the PEIR):** This chapter presents and evaluates the alternatives to the originally proposed WSIP. In particular, it evaluates alternative water supply strategies that could meet most of the basic objectives of the WSIP.

- **Appendix E (Volume 5 of the PEIR):** This appendix supplements the information contained in Chapter 7 of the Draft PEIR on growth inducement impacts.

Text from the Final PEIR on the WSIP

In response to comments on the Draft PEIR, the SFPUC proposed several changes to the WSIP. These changes are detailed in the Final PEIR along with the environmental effects of the revised program. Therefore, this appendix also contains the following text from the Final PEIR on the WSIP:

- **Sections 13.2, 13.3, and 13.4 (Chapter 13, Volume 7a of the PEIR):** These sections describe changes in the WSIP that have been proposed by the SFPUC since publication of the Draft PEIR. The SFPUC has proposed revisions to the WSIP in three areas, either in response to comments received on the Draft PEIR or as part of its ongoing system operations and planning. These revisions include: (1) changes in the project descriptions of two WSIP facility improvement projects (both of which help reduce impacts associated with the projects as originally proposed) which affect overall system operations; (2) updated water system assumptions and corresponding updates in the system modeling and results; and (3) development of the Phased WSIP Variant, a "hybrid" program that is a combination of the proposed program and one of the alternatives analyzed in the Draft PEIR. The environmental impacts of the revised WSIP are also described.

Master responses provide comprehensive discussions to respond to select sets of issues that received multiple comments. The following master responses are included in this appendix to clarify the description of the WSIP and its impacts:

- 14.3 – Master Response on Proposed Dry-Year Water Transfer (Chapter 14, Volume 7a of the PEIR): This master response explains the dry-year transfer component of the adopted WSIP.

- 14.5 – Master Response on Water Resources Modeling and Appendix O (Chapter 14, Volume 7a of the PEIR): This master response addresses questions about the water resources model used for the impact analysis of WSIP. It references "Appendix O," which is also included as part of this appendix.

- 14.9 – Master Response on Alameda Creek Fishery Issues (Chapter 14, Volume 7a of the PEIR): This master response addresses comments on the adequacy of the impact analysis and mitigations with respect to the WSIP's effects on the steelhead fishery in Alameda Creek. It describes in detail the changes that were incorporated into two WSIP facility improvement projects: the Calaveras Dam Replacement Project and the Alameda Creek Fishery Enhancement Project.

- 14.10 – Master Response on Modified WSIP Alternative (Chapter 14, Volume 7a of the PEIR): This master response addresses the issues commenters raised on the Modified WSIP Alternative, which was identified in the Draft PEIR as the environmentally superior alternative.

- 14.11 – Master Response on Climate Change (Chapter 14, Volume 7a of the PEIR): This master response addresses issues raised by commenters concerning the impacts of the WSIP on climate change and global warming.

Chapters 5, 7, and 9 of the Draft PEIR on the WSIP are included in this appendix as described above. Several changes were made to these chapters in the Final PEIR. This section details these changes.

- **16 – Staff-initiated Text Changes for Chapters 5, 7, and 9 (Volume 7b of the PEIR):** This section contains text changes to the Draft PEIR that resulted from: (1) changes made in response to comments received on the Draft PEIR; (2) changes that reflect the WSIP revisions; or (3) changes to correct errors or to clarify information presented in the Draft PEIR. Where a response to a comment includes a change to the text of the Draft PEIR, the text changes are shown in underline for additions and ~~strikethrough~~ for deletions.

The Draft and Final PEIR on the WSIP may be reviewed in its entirety at the offices of the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, CA 94103.

June 2007

Draft
Program Environmental Impact Report
Volume 3 of 5

For the
San Francisco Public Utilities Commission's
WATER SYSTEM IMPROVEMENT PROGRAM

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Draft PEIR Public Comment Period: June 29, 2007 through October 1, 2007

City and County of San Francisco
San Francisco Planning Department

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CHAPTER 5
WSIP Water Supply and System Operations – Setting and Impacts

Chapter 5 Sections

5.1 Overview

5.2 Plans and Policies

5.3 Tuolumne River System and Downstream Water Bodies

5.4 Alameda Creek Watershed Streams and Reservoirs

5.5 San Francisco Peninsula Streams and Reservoirs

5.6 Westside Basin Groundwater Resources

5.7 Cumulative Projects and Impacts Related to WSIP Water Supply and System Operations

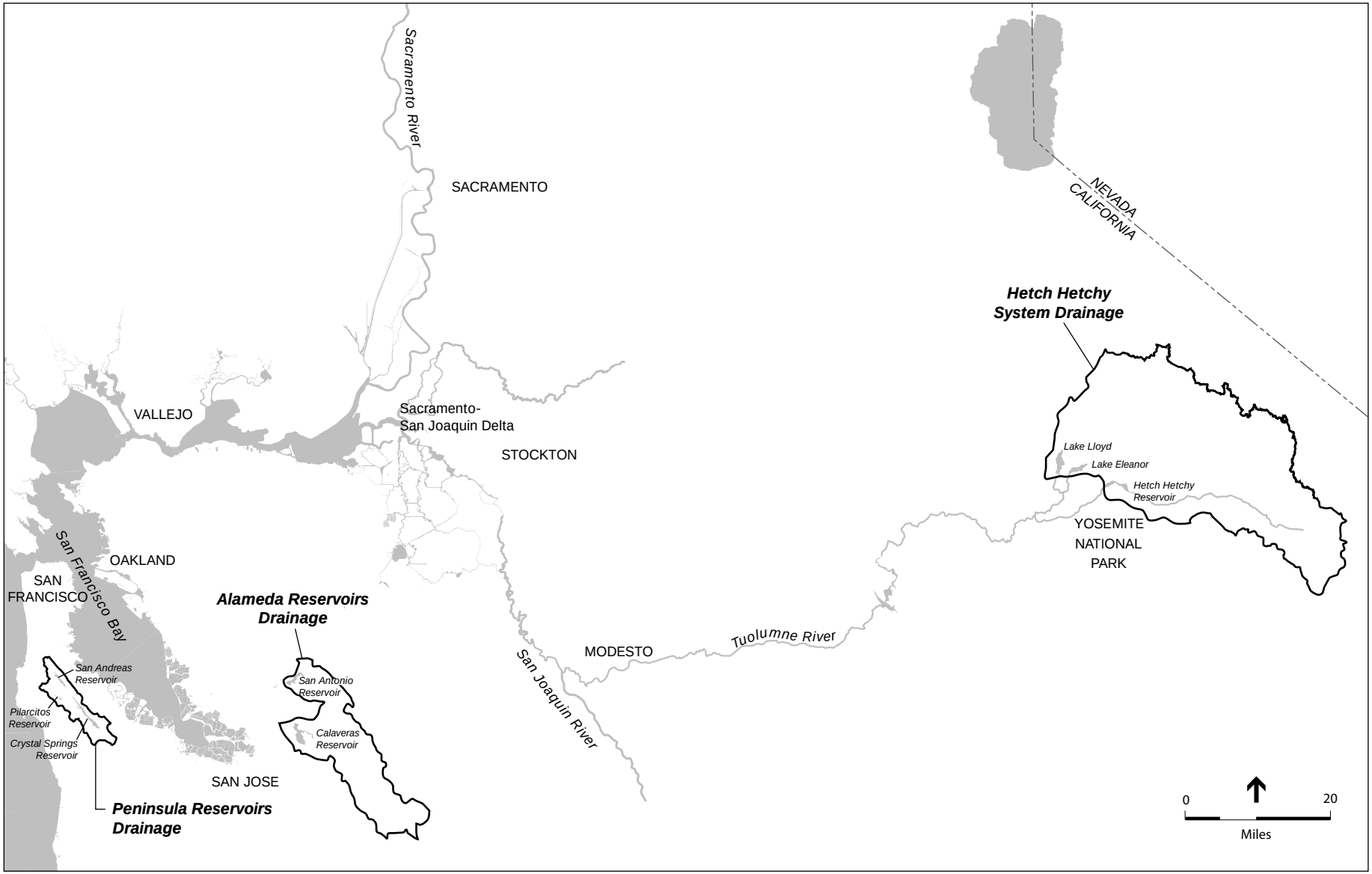
(References included under each section)

5.1 Overview

5.1.1 Introduction

This chapter addresses the water supply and system operations aspects of the Water System Improvement Program (WSIP) and evaluates the potential environmental impacts of the proposed changes in water supply sources and regional water system operations. These impacts are generally distinct from the impacts associated with proposed construction and operation of the WSIP facility improvement projects described in Chapter 4, although there are some areas of overlap, which are described where appropriate. Together, Chapters 4 and 5 of this Program Environmental Impact Report (PEIR) present the impacts associated with implementation of the San Francisco Public Utilities Commission's (SFPUC) proposed program.

The impact discussions in Chapter 5 are organized by watershed and related drainages and reservoirs, rather than by environmental resource topics as in Chapter 4. This is because the water supply and system impacts are dependent on the local characteristics of each watershed and related resources. In this chapter, each watershed or water resource is discussed as a whole. There are three watershed areas of interest along the SFPUC's regional system: the Tuolumne River system, the Alameda Creek system, and the Peninsula system (including Pilarcitos Creek) (see **Figure 5.1-1**). In addition, the Westside Groundwater Basin is analyzed as a separate resource area only with respect to WSIP impacts on the groundwater resources, since the facilities-related



SOURCE: ESA + Orion

SFPUC Water System Improvement Program . 203287

Figure 5.1-1
Overview of Water Supply Watersheds
in the SFPUC Regional Water System

effects of construction and operation of the WSIP groundwater projects are evaluated in Chapter 4. Together, these watersheds and related water resources constitute the "program area" affected by the proposed water supply and system operations of the WSIP (Chapter 4, Section 4.1 defines the "study area," which encompasses the areas affected by proposed WSIP facilities).

For each watershed and related drainage area, this chapter addresses impacts on all environmental resources that could be affected by the proposed water supply option and system operations included in the proposed program: surface water hydrology, geomorphology, water quality, groundwater, fisheries and aquatic resources, riparian resources, recreational and visual resources, and, where applicable, water supplies and energy. Other resource topic areas analyzed in Chapter 4—land use, geology/soils/seismicity, cultural resources, traffic/transportation/ circulation, air quality, noise/vibration, public services and utilities, agricultural resources, and hazards—are not addressed in Chapter 5, since these resource areas would not be affected by changes in water supply and system operations (see Appendix B for more discussion).

Chapter 5 provides a *project-level* impact analysis of implementing: (1) the proposed WSIP water supply option to serve the projected 2030 average annual customer water purchase requests of 300 million gallons per day (mgd), and (2) the future regional system operations associated with meeting the WSIP's water supply and delivery reliability level of service objectives. Specifically, Chapter 5 provides a detailed analysis of the effects of increasing the average annual diversion from the Tuolumne River to serve customer purchase requests during both nondrought and drought periods through 2030. The project-level analysis evaluates the effects on the hydrology and related resources in the Tuolumne River, Alameda Creek, and Peninsula watersheds. Project-level mitigation measures have been identified, where appropriate, to address potentially significant impacts.

This detailed analysis is intended to fully address the effects of implementing the proposed WSIP water supply option through 2030 without the need for additional environmental review, with one exception. The exception that will require additional CEQA review is associated with the effects of the WSIP facility improvement project, Groundwater Projects (SF-2), on groundwater resources. The analyses in Sections 5.3 through 5.5 include the project-level impacts of taking additional water from the Tuolumne River to provide potable water from the regional system during nondrought years to serve those customers in San Mateo County that currently use groundwater from the Westside Basin; however, Chapter 5 does not evaluate the project-level impacts on the Westside Groundwater Basin of extracting the water from the basin during drought years. Section 5.6 analyzes the effects of the proposed conjunctive-use program and local groundwater projects on groundwater resources at a program-level, and subsequent project-level impact analysis of the proposed groundwater extraction activities on groundwater resources will be required, as appropriate, as specific well facilities are proposed under the WSIP facility improvement project for Groundwater Projects (SF-2).[1]

[1] Chapter 4 analyzes the program-level effects of implementing facilities needed for the Groundwater Projects (SF-2) and Recycled Water Projects (SF-3), and separate, project-level CEQA review on those facilities will be required. The project-level analysis of the proposed water supply option in Chapter 5 includes the effects of incorporating recycled water into systemwide operations.

5.1.2 Chapter Organization

Chapter 5 is organized as follows. Section 5.1 provides a description of the WSIP water supply option and system operations analyzed in this chapter as well as a general discussion of the approach to the analysis and rationale used in the impact evaluation for all watersheds. It describes the modeling tool used in the analysis and the chief assumptions made regarding system operations in the future. Specific differences in approach that are unique to each watershed are described in the individual sections. In addition, this overview section presents the definitions of significance determinations used throughout the chapter.

Section 5.2 presents a review of the plans, policies, and regulatory framework as they apply to relevant water supply issues as well as to watershed management of affected resources. In addition, the general regulatory framework for water and biological resources is included in this section, and specific details applicable to each watershed are provided in subsequent sections.

Section 5.3 covers the Tuolumne River drainage from Hetch Hetchy Reservoir to the river's confluence with the San Joaquin River and, as appropriate, also discusses the Delta.

Section 5.4 addresses the portion of the Alameda Creek watershed and major tributaries where it would be affected by the regional water system.

Section 5.5 encompasses drainage areas within the SFPUC Peninsula watershed, including the watersheds of San Mateo, Pilarcitos, and San Andreas Creeks and associated reservoirs.

Section 5.6 discusses the Westside Groundwater Basin resources that could be affected by the proposed WSIP groundwater projects, including both the local project in San Francisco as well as the regional projects proposed as part of the conjunctive-use program.

Section 5.7 presents an analysis of cumulative effects associated with the water supply sources and related resources. The section describes other past, present, and reasonably foreseeable future projects that could affect the same water resources and related environmental resources as the WSIP (as described in Sections 5.3 through 5.6) and evaluates the potential cumulative effects of implementing the WSIP in combination with those projects.

5.1.3 Proposed Water Supply Option and System Operations

This section reiterates the description of the proposed water supply option, as presented in Chapter 3.0, since it is the focus of the Chapter 5 impact analysis. The proposed water supply option addresses both the delivery reliability and water supply levels of service proposed under the WSIP, which are both associated with the projected increase in customer purchase requests (demand) through the year 2030. The proposed delivery reliability level of service is to increase the reliability of the regional system to serve average day customer demand of 300 mgd under a range of operating conditions, including providing for local reservoir replenishment and during planned maintenance, unplanned outages, and loss of water from any one water source. The proposed water supply levels of service are as follows: (1) to fully meet customer purchase

requests in nondrought years through the planning year 2030, estimated to be 300-mgd average annual delivery, and (2) to provide drought-year delivery with a maximum systemwide cutback of 20 percent in any one year of a drought.

Although no major changes are proposed under the WSIP with respect to regional system operations, there would be some operational refinements (described in Chapter 3, Section 3.7). The proposed facility improvements would upgrade and in some cases expand the system, allowing changes in operations that provide increased flexibility as well as increased delivery reliability. In particular, local Bay Area reservoirs would be maintained at higher water levels for longer periods of time under the WSIP than under the existing condition. By keeping water stored in local reservoirs, geographically close to the customers' demand, the SFPUC would be able to respond to service needs during a drought or other emergency, such as an unplanned facility outage.

Proposed Nondrought-Year Water Supplies

During nondrought conditions, the SFPUC proposes to serve the increased 35 mgd in average annual purchase requests through a combination of conservation, water recycling, and groundwater supply programs in San Francisco supplemented with increased diversions from the Tuolumne River. Under the proposed water supply option, the SFPUC would implement conservation, water recycling, and groundwater supply programs in the SFPUC retail service area to achieve the equivalent of 10 mgd of supply in all years (drought and nondrought).

The SFPUC proposes to serve the increase in customer purchase requests that are not served by conservation, water recycling, and groundwater supply programs through increased use of Tuolumne River water under its existing water rights and additional management of the local watershed resources with the restoration of the storage capacity of Calaveras and Crystal Springs Reservoirs. The regional system would continue to maximize its use of local watershed water supplies. This increased diversions from the Tuolumne River include additional diversions needed to serve 2030 purchase requests as well as maintaining local storage for supply reliability and implementation of Westside Basin conjunctive-use program.

Proposed Drought-Year Water Supplies

During drought years under the WSIP, the SFPUC would continue to use the nondrought-year water supplies described above and would make use of the following additional resources and measures to meet the 2030 needs:

- *Water transfers*. Obtain up to an equivalent of 23 mgd of supplemental Tuolumne River water through water transfer agreements with TID and MID such that water would be available for diversion in drought years.

- *Groundwater conjunctive-use program in the Westside Basin, San Mateo County*. Utilize the extraction component of a groundwater conjunctive-use program in the Westside Groundwater Basin in northern San Mateo County to provide the equivalent of approximately 6 mgd of water during prolonged drought to groundwater pumpers. This

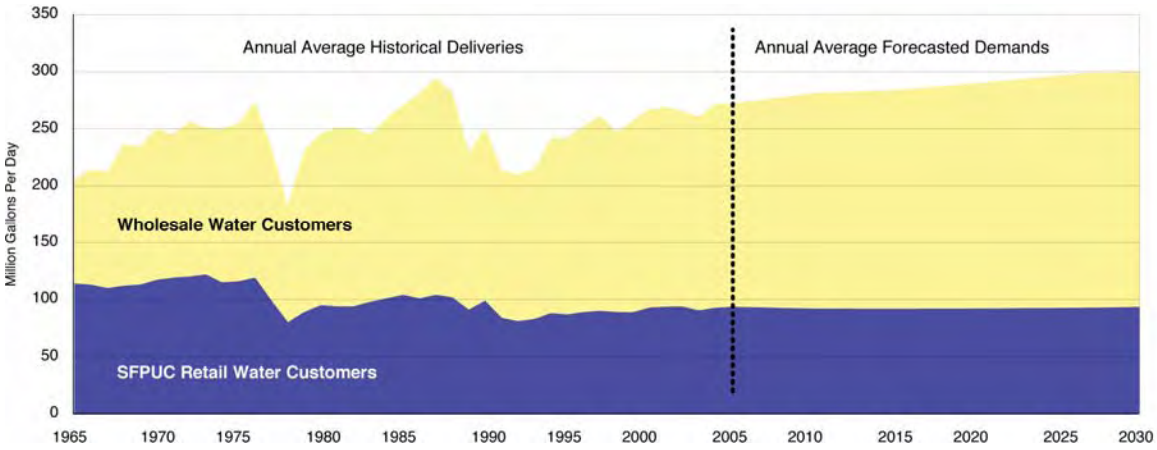
includes providing potable water to groundwater pumpers and in-lieu groundwater recharge during nondrought years in return for reduced groundwater pumping during drought years.

- *Restoration of Calaveras and Crystal Springs Reservoir capacities*. Restore the historical operating storage capacities at Calaveras Reservoir to provide an equivalent of 7 mgd of additional water supply and at Crystal Springs Reservoir to provide an equivalent of 1 mgd of additional supply.

- *Rationing*. Implement up to 20 percent systemwide rationing if necessary in combination with use of the above supplemental water supplies.

To ensure that the water supplies would be available by 2030, the SFPUC is currently in the planning phase of the design and construction of needed facilities and is pursuing required agreements with other agencies. The SFPUC would secure these water supplies in phases as required to meet the increased customer demand between now and 2030, as reflected in **Figure 5.1-2**. Figure 5.1-2 shows the average annual historical customer deliveries as well as the projected future average annual demand. The figure indicates that between 2005 and 2030, the total customer purchase requests are estimated to increase by 35 mgd (annual average), from an annual average of 265 mgd to an annual average of 300 mgd. Retail customer demand would increase by about 1 mgd,[2] and the remaining increase would be from wholesale customers (see also Chapter 3, Table 3.4). Half of this increased demand is expected to occur before 2020, and the remaining by 2030.

This chapter evaluates the effects of implementing this proposed combination of actions and supplemental supplies to meet water supply and delivery needs and performance objectives through 2030.



SFPUC Water System Improvement Program ▪ 203287

SOURCE: SFPUC, 2007b

Figure 5.1-2
Annual Average Historical and
Projected Future Customer Purchase Requests

2 The SFPUC retail service area high-range purchase estimate of 91 mgd assumes that San Francisco groundwater supply would be part of the regional water system supply.

5.1.4 Approach to the Analysis

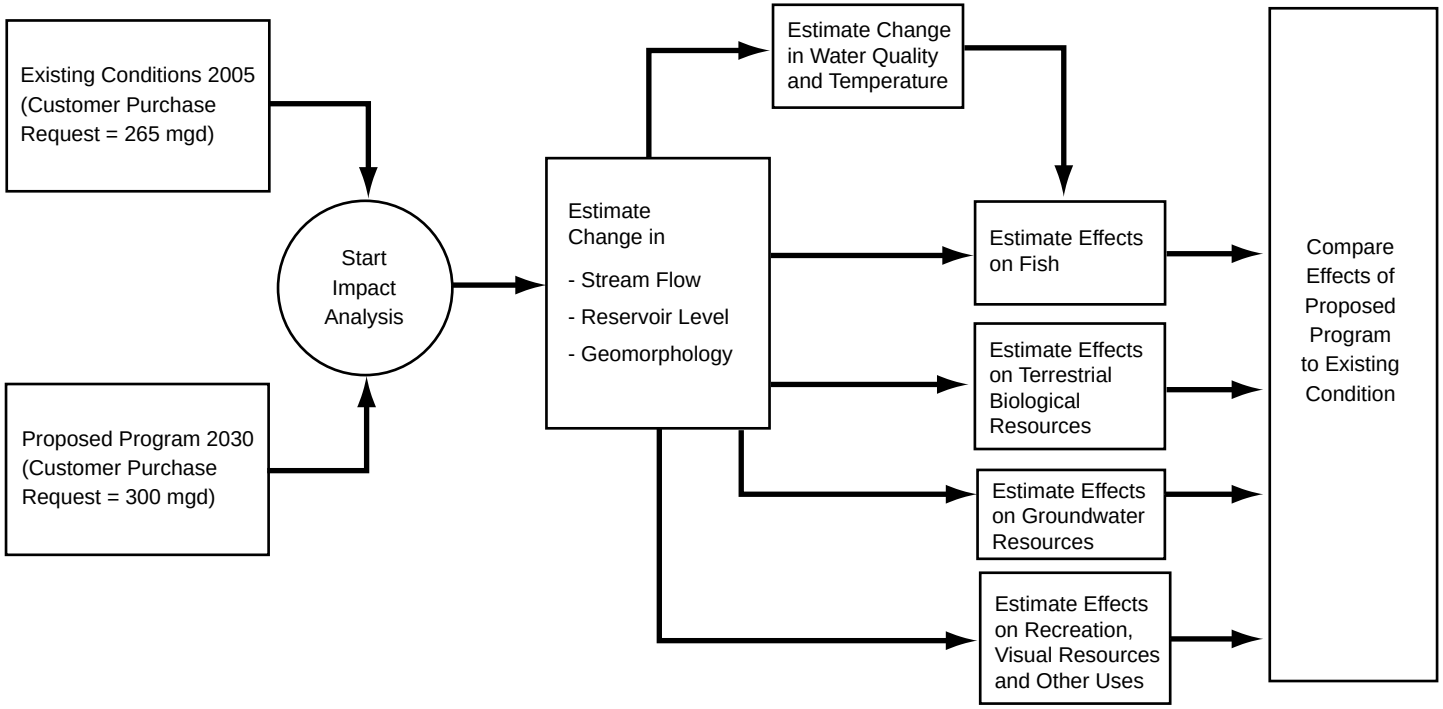
As part of WSIP implementation, additional water would be diverted from the Tuolumne River above the current average annual diversion levels in order to serve customer water delivery requirements and the other level of service goals established for the regional system through 2030. The analyses presented in Sections 5.3, 5.4, and 5.5 focus on the effects of this additional water diversion and of the related system operations needed to store and move that water from the Tuolumne River through the regional system of reservoirs and conveyance facilities to customers in the Bay Area. The analysis considers future system operations following implementation of all proposed WSIP projects in order to determine the effects that any adjustments in operations might have on the hydrology and related environmental resources in the three affected watersheds—the Tuolumne River, Alameda Creek, and Peninsula watersheds.

Relationship of Affected Resources

The basic approach to determining the potential impacts on water and related resources was the same for the three affected watersheds. First, changes in flow in the rivers and/or creeks and changes in water levels in each of the reservoirs were evaluated. These are the primary physical environmental changes that could occur with implementation of the water supply component of the WSIP, and these changes provide the basis for evaluating the potential related effects on other environmental resources. **Figure 5.1-3** depicts the interrelationships between, and among, changes in stream flow and reservoir storage levels and the potentially affected environmental resources.

Changes in stream flow under to the WSIP, which would primarily result from changes in the timing and quantity of water released from system reservoirs, were used to assess changes in the geomorphic processes for local streams (i.e., the sediment transport and channel-forming properties that define the nature of a stream course and its associated habitats). Stream flow and reservoir water level changes were then used to estimate changes in water quality. The chief water quality parameters that could be affected by changes in stream flow and reservoir levels are temperature and dissolved oxygen, and these parameters are the focus of the water quality analysis. The combination of changes in flow, reservoir levels, and water quality was then used to determine potential impacts on fisheries resources. Changes in flow and reservoir levels were also used to identify potential impacts on riparian habitat and related terrestrial biological resources. Finally, changes in flow and reservoir levels were used to identify potential impacts on water-related recreation, including whitewater rafting, boating, and fishing, and water-related visual resources. For the Tuolumne River watershed, the changes in flow and reservoir levels were also used to identify potential effects on downstream users and on energy supplies due to potential changes in hydropower generation.

The SFPUC operates and manages the regional water system (including the Tuolumne River system, the Alameda Creek system, and the Peninsula watershed system) in accordance with a complex and dynamic set of operational procedures that respond to changing climatic and hydrologic conditions, legal and regulatory requirements, water supply demands, and needs for maintenance, repair, and replacement of system facilities. In order to assess the changes to these systems that could occur under the WSIP, it was necessary to employ a computer modeling tool



SOURCE: ESA + Orion

Figure 5.1-3
Approach to Impact Analysis on Water Resources

with the capability of addressing the many factors involved in system operations and management and thus enabling a comparison of the "before" and "after" program conditions. The modeling tool and approach used for analysis are described in the following section.

Hetch Hetchy/Local Simulation Model

The amount of water available to the SFPUC varies from year-to-year depending on meteorological conditions, water rights, and statutory and contractual obligations, including the Raker Act. The SFPUC operates its water system to meet customer water demand as fully and efficiently as it can, despite the fact that the amount of water available to it varies from year-to-year. The operations of the water system are complex, involving numerous reservoirs, pipelines, and pumping plants. The SFPUC utilizes a computerized mathematical model to assist in the evaluation of its water systems operations—the Hetch Hetchy/Local Simulation Model (HH/LSM), a water supply planning model (SFPUC, 2007a). This model is the best available tool for depicting the overall regional water system operations under a range of conditions and is similar to the models used by other water purveyors in the United States to depict their water system operations and to plan for system improvements.

A general overview of this modeling tool and the basic assumptions about the system included in the model are described in this section. **Appendix H1** provides a more detailed description of the model and how it was used for the PEIR water supply and system operations impact analysis; **Appendix H2** provides supporting details and an explanation of raw data output from the model.

Representation of the Regional System in the Model

The HH/LSM incorporates detailed information about key aspects of the SFPUC regional water system, including facilities (i.e., reservoir and conveyance capacities) and operating procedures and "rules" that determine how and when water is moved through the system to customers. The operating procedures include responses to seasonal variation in demand, allocation of demand to customer groups, and procedures to maximize the use of local watershed supplies, while the rules include responses to regulatory requirements for instream flows and compliance with Raker Act obligations. As described in Chapters 2 and 3, water system operations can be generally delineated between rules and strategies affecting the operation of the Bay Area water system and rules and strategies affecting the operation of the Hetch Hetchy system. Although generally discussed separately, the two systems are integrally linked and are interdependent on each other in order to maximize water availability and quality.

For the Hetch Hetchy system, the HH/LSM integrates operations at SFPUC's three major reservoirs in the Tuolumne River watershed—Hetch Hetchy Reservoir, Lake Lloyd, and Lake Eleanor—with the operation of TID/MID's Don Pedro Reservoir, due to the SFPUC's water bank account in Don Pedro Reservoir (described in Chapter 2, Section 2.5.2). The operation of these reservoirs and the water bank account is guided by two primary objectives: (1) to conserve reservoir storage so as to optimize supply to SFPUC customers, and (2) to fulfill San Francisco's Raker Act obligation to bypass Tuolumne River flow to TID and MID. Underlying the operations at the SFPUC's reservoirs are the minimum fishery release requirements prescribed for Hetch

Hetchy Reservoir, Lake Lloyd, and Lake Eleanor. Water that is released from San Francisco's reservoirs and not diverted to SFPUC customers, together with runoff that originates below San Francisco's reservoirs, flows to Don Pedro Reservoir. The HH/LSM simulates TID/MID's operation of Don Pedro Reservoir, including simulation of canal diversions, flood control operations, and releases to meet fishery release requirements below La Grange Dam. The model also simulates the accounting for the SFPUC's water bank account.

The model uses a watershed runoff forecasting routine (for snowmelt and rainfall) that projects the amount of runoff that can be expected to flow into each reservoir for a particular time period. Once the amount of runoff is projected, this amount is compared to the availability of reservoir storage and the anticipated releases required from the reservoir to meet downstream flow requirements and the diversions needed for water deliveries to SFPUC customers. If a reservoir is projected to spill, the model incorporates discretionary releases that the SFPUC manages to enhance hydropower generation. The model uses a monthly time step. This forecasting and decision process occurs sequentially each month of the period being modeled.

For the local Bay area system, the model depicts the regional system as a linked series of inflows, reservoirs, conveyance routes, and areas of water demand. Numerous operational constraints are incorporated, including considerations for downstream channel conveyance capacity, treatment plant capacity, and water transmission capacity. The Bay Area system is operated to maximize the efficient use of local Bay Area watershed runoff and supplemented with Tuolumne River water resources. The model establishes optimal storage levels for each Bay Area reservoir by season; this relates to how the SFPUC manages reservoir storage levels to lower reservoir storage space prior to the rainy season and then to raise the level through the dry season. In San Antonio, Crystal Springs, and San Andreas Reservoirs, the model assumes that reservoir space is filled first with Bay Area watershed runoff and then supplemented with Tuolumne River water by late spring in order to ensure maximum local reservoir storage through the summer season.

Simulation of System Operations

Simulation Period

The model simulates system operations over the course of an 82-year sequential hydrologic period from July 1920 through September 2002. The model includes actual, measured historical information about the hydrology (the amount of runoff estimated from either snowmelt and/or rainfall) that occurred in each year over the 82-year record for each of the three watershed areas under consideration: the Tuolumne River system, the Alameda Creek system, and the Peninsula watershed system. This 82-year period includes many different types and sequences of actual hydrological events, ranging from flood events to droughts of different magnitude and duration. Because natural surface water systems are dynamic and runoff and flow vary each year, and as it is not possible to predict future precipitation, it is a necessary and standard industry practice to use a long-term historical record to represent the range of hydrologic conditions that can be expected in the future. The long-term 82-year historical record is used in the model to represent

the range of hydrologic conditions that could occur in the future[3] and to assess both how the system would perform in terms of meeting the WSIP level of service objectives and what types of impacts the program might have under a range of conditions.

The modeling tool uses information on actual historical hydrology but does not "predict" or necessarily precisely depict the past, historical operation of the system. The historical operation of the system in an actual year will differ from the operations simulated by the model for that year as a result of day-to-day adjustments made by the system operators, who constantly modify operations throughout the year to respond to changing conditions related to weather, demand, water quality, or facilities conditions (e.g., maintenance or unplanned facilities outages). While many of these factors are built into the model, the model cannot account for all the actual operations and adjustments made throughout each year. The objective of using the modeling tool is to assess the effect of system changes on future operations over a broad range of realistic hydrologic conditions.

Hydrologic Year Definitions

As described in detail in Appendix H1, all years in the 82 years of historical hydrology were ranked and grouped into hydrologic year types according to river and creek flow. Five hydrologic categories were used to depict the range of wet to dry years, depending on the hydrologic index. The hydrologic year types are defined differently for different watershed and drainage areas affected by the WSIP (referred to as the hydrologic index) in order to accurately reflect each area's unique hydrology. A hydrologic year is from October to September.

Hydrologic year types for the Tuolumne River above Don Pedro Reservoir are classified based on the SFPUC's calculation of unimpaired flow[4] for the Tuolumne River at La Grange. The 20 percent of years when unimpaired inflow to Don Pedro Reservoir was lowest were designated as dry years; the next driest 20 percent of years were designated as below-normal years, and so on. This index uses the following year types: wet, above normal, normal, below normal, and dry.

Hydrologic year types for the Tuolumne River below La Grange Dam are classified according to the California Department of Water Resources' San Joaquin River Index, which defines the following categories: wet, above normal, below normal, dry, and critically dry. This index was used to analyze Don Pedro Reservoir operations because release requirements from Don Pedro Reservoir at La Grange Dam are tied to this index.

Hydrologic year types for the Alameda Creek and Peninsula watersheds are also classified by the 20 percent grouping technique and are based on the SFPUC's estimation of local inflow into its five San Francisco Bay Area reservoirs. Annual flow into each of the reservoirs was summed for each water year. The 20 percent of years when total runoff into the five reservoirs was lowest were designated dry years. The next driest 20 percent of years were designated below-normal

[3] The potential effect of climate change on the SFPUC's regional system is addressed in Section 5.7 under Cumulative Impacts.

[4] The natural river flow that existed prior to the placement of upstream water diversions, storage reservoirs, or other impediments.

years, and so on. This index uses the following year types: wet, above normal, normal, below normal, and dry.

Model Assumptions and Output

The model evaluates system operations, performance, and effects on reservoir storage and reservoir releases (i.e., streamflow below the dam) under a given set of operating parameters utilizing the 82 years of historical hydrology. A differing set of operational objectives and/or a change in the physical configuration of the water system could result in different operations, system performance, and effects on reservoir storage and releases. The model is used to compare alternative operational objectives and system configurations. For the impact analysis presented in this chapter, the model was employed to simulate operations and the effects of those operations under an existing conditions scenario (2005) and under a WSIP scenario (2030).

Model Assumptions and Inputs

The model uses input information on key aspects of the regional water system, including the level of annual water delivery provided by the system, the maximum rationing to be allowed during a drought, and the state of the facilities (e.g., reservoir and conveyance capacities and configurations). **Table 5.1-1** summarizes the differences in key assumptions between the existing conditions and WSIP scenarios that were incorporated into the model and used in the CEQA impact analysis.

TABLE 5.1-1
MODELING ASSUMPTIONS USED IN THE CEQA ANALYSIS

Parameter	Existing Conditions Scenario	WSIP Scenario
Planning year	2005	2030
Customer purchase requests (average annual delivery) (mgd)	265 mgd	300 mgd
Average annual demand from regional system water supply sources (Tuolumne River and local watersheds)	265 mgd	290 mgd
Average annual delivery from other sources (recycled water, groundwater, conservation)	See note a	10 mgd[b]
System firm yield[c]	219 mgd	256 mgd
Maximum systemwide rationing during a drought	No policy cap – up to 25%	20%
WSIP facility improvement projects	None	All WSIP projects

[a] San Francisco and many of its retail and wholesale customers currently utilize recycled water, groundwater, and/or conservation practices to some extent, which is reflected in the 265 mgd average annual delivery.
[b] The 10 mgd reflects proposed implementation of recycled water, groundwater, and conservation projects in San Francisco to benefit the regional water system.
[c] System firm yield is defined as the average annual water delivery that can be sustained by the regional water system during an extended drought. The SFPUC uses an 8.5-year design drought for planning purposes. Due to the 2001 DSOD operational restrictions on Calaveras Dam, the system firm yield was 219 mgd as of September 2005, when the NOP for the PEIR was published. Normal system firm yield is 226 mgd, which reflects Calaveras Reservoir operating at its historical capacity.

The existing conditions scenario reflects the key information about the system for the year 2005, in accordance with CEQA guidance on the appropriate timeframe for determining the environmental baseline to be used for impact analysis.[5] The average annual water delivery from the regional system for the base year was 265 mgd. The existing conditions (2005) scenario reflects the regional system facilities as they were in 2005 (and remain today), including the restricted capacity at both Calaveras and Crystal Springs Reservoirs.

As described in Chapter 2, Section 2.2, the California Department of Water Resources, Division of Safety of Dams (DSOD) imposed operational restrictions on Calaveras Reservoir storage capacity in December 2001, which reduced the reservoir's normal capacity of 96,850 acre-feet to approximately 37,800 acre-feet. Prior to the DSOD restriction, Calaveras Reservoir had been operated at its full capacity for over 70 years (since completion of the Alameda Creek Diversion Dam and Tunnel in 1931). As a result of this restricted capacity, the SFPUC has had to significantly reduce its diversions through the Alameda Creek Diversion Dam compared to its 70 -year-long historical operations. The current capacity restriction will remain in effect—and thus the storage capacity will continue to be limited—until such time that the Calaveras Dam Replacement project (SV-2) is implemented. This project is scheduled for completion in 2012, at which time the restricted reservoir capacity will have been part of system operations for approximately 10 years. In order to present the most consistent baseline condition under CEQA, this PEIR uses an existing conditions scenario that reflects the current restriction on Calaveras Reservoir capacity, despite the fact that the reservoir had been operating at full capacity for 70 years. Implementation of the WSIP (specifically the Calaveras Dam Replacement project) would result in a change to these current operating conditions, restoring them in large part to conditions similar to the prior 70 years of operation. This PEIR examines the potential impacts of these changes.

The capacity of Crystal Springs Reservoir has been restricted since 1983 (also described in Chapter 2, Section 2.2.5); therefore, for this reservoir as well, an existing conditions scenario with restricted capacity is assumed, in compliance with CEQA.

As shown on Table 5.1-1, for the WSIP (2030) scenario, the model incorporates information about the expected average annual water delivery from the regional system in 2030, which under the WSIP is proposed to be 290 mgd. The other 10 mgd of supply needed to serve the total 2030 average annual customer purchase requests of 300 mgd is proposed to come from a combination of recycled water, groundwater, and conservation projects in San Francisco, to be implemented as part of the WSIP. The WSIP (2030) scenario also assumes that all proposed facility improvement projects have been fully implemented. This scenario thus includes the restoration of full storage capacity at Calaveras Reservoir and Crystal Springs Reservoir.

[5] CEQA Guidelines Section 15125(a) states that an EIR must include a description of the physical environmental conditions in the vicinity of the project, as they exist at the time the notice of preparation (NOP) is published, and that this environmental setting will normally constitute the baseline physical conditions against which the lead agency determines whether an impact is significant. The NOP for the WSIP PEIR was published in September 2005.

In addition to the input assumptions shown in Table 5.1-1, the model includes, for both the existing condition and WSIP scenarios, the same assumptions and rules for compliance with statutory and contractual obligations, including the Raker Act and minimum instream flow requirements.

Model Outputs

Once the operation of the regional water system was modeled under each scenario, the model provided output information about system performance under that scenario in terms of the WSIP system objectives and about the timing and amount of water in reservoir storage and released from the system reservoirs downstream. In general, the model provides information on a monthly basis. **Table 5.1-2** summarizes key output information provided by the model.

During actual system operations, operators make decisions about how much water to retain in storage and how much water to release from system reservoirs on an hourly, daily, or weekly basis in response to changing conditions. The model does not report these changes at this level of detail. Like other computer models used elsewhere in California to predict the impacts of proposed projects on complex water storage and delivery systems (e.g., the Central Valley Project and State Water Project), the HH/LSM identifies monthly levels in various storage facilities and water bodies, and does not have the necessary precision to deal with hourly, daily, or weekly operational decisions. The state of the art in modeling has not yet reached the point where such precision is possible. In most cases, however, the monthly information about changes in reservoir storage and reservoir releases downstream was adequate for the purpose of assessing the nature, magnitude, and frequency of potential physical changes and environmental impacts associated with operations under the proposed WSIP program scenario compared to the existing condition. In those cases where more detailed information is needed for impact analysis than is available from monthly data, the SFPUC system operators were consulted about daily or weekly operations and, where available, historical data on the system operation were reviewed. Thus, in these instances, the conclusions set forth in the PEIR reflect not only the results of the HH/LSM, but also input from the experienced system operators regarding how they would likely respond to the kinds of issues that might arise on a daily a weekly basis.

Model Limitations

The HH/LSM is the best available tool for depicting changes in the overall regional water system operations; however, as explained above and further explained here, in some cases, limitations inherent in the model required that the analysis be supplemented by additional data.

For example, the HH/LSM was used to estimate baseline and with-WSIP water levels in all SFPUC reservoirs except for Pilarcitos Reservoir. Model results for the Pilarcitos watershed were not directly used to analyze existing and projected water levels in Pilarcitos Reservoir or flows in Pilarcitos Creek. The model does not currently reflect a complete contemporary depiction of the physical operation of the Pilarcitos watershed's facilities. Although adequate for SFPUC's systemwide water supply planning purposes, HH/LSM results for the Pilarcitos watershed at times required supplemental refinement and analysis to accurately reflect the physical infrastructure in place in the watershed.

TABLE 5.1-2
HH/LSM OUTPUT PARAMETERS
(Data provided as monthly time step for 82 years of historical hydrology)

Feature	Output Parameter
TUOLUMNE RIVER SYSTEM	
Unimpaired Inflow (acre-feet)	Inflow to Hetch Hetchy Reservoir
	Inflow to Lake Lloyd
	Inflow to Lake Eleanor
	Unregulated Flow below Hetch Hetchy Reservoir
End-of-Month Storage (acre-feet)	Hetch Hetchy Reservoir Storage
	Lake Lloyd Storage
	Lake Eleanor Storage
	Don Pedro Water Bank Account Storage
	Don Pedro Reservoir Storage
	Total Up-Country Reservoir Storage
	Total Hetch Hetchy System Storage
Releases (acre-feet)	Hetch Hetchy Reservoir Release to Stream
	Hetch Hetchy Reservoir Release to Canyon Tunnel
	Lake Lloyd Release to Stream
	Lake Lloyd Release to Holm Powerhouse
	Lake Eleanor Release to Stream
	Lake Eleanor Tunnel to Lake Lloyd
Evaporation (acre-feet)	Hetch Hetchy Reservoir
	Lake Lloyd
	Lake Eleanor
San Joaquin Pipeline (acre-feet)	SJPL Flow from Lower Cherry Aqueduct
	Total SJPL
Precipitation (inches)	Hetch Hetchy Precipitation – Accumulated
Power Production (MWh)	Moccasin Powerhouse
	Kirkwood Powerhouse
	Holm Powerhouse
	Total
Unimpaired Runoff (acre-feet)	Unimpaired Runoff at La Grange Dam
	TID, MID, and SFPUC Rights and Entitlements
	Unimpaired Runoff Available to San Francisco
Don Pedro Operations (acre-feet)	Inflow
	Storage
	Don Pedro Reservoir Flood Control Limit
	Don Pedro Reservoir Evaporation (San Francisco)
	Total Don Pedro Reservoir Evaporation
	Don Pedro Reservoir Power – MWh
	Total MID Diversion at La Grange Dam
	Total TID Diversion at La Grange Dam
	La Grange Minimum Release Requirement
	Total La Grange Dam Release to River
	Total Release from Don Pedro Reservoir
Water Bank Account (acre-feet)	Water Bank Account Balance
	Water Bank Account Maximum
	Transfer to Water Bank Account
Miscellaneous	SFPUC Shortage Level
	Hetch Hetchy Minimum Stream Release (acre-feet)
LOCAL SYSTEM (ALAMEDA CREEK AND PENINSULA WATERSHEDS)	
Calaveras (MG)	Calaveras Reservoir Storage
	Calaveras Reservoir Inflow from Arroyo Hondo
	Calaveras Reservoir Inflow from Upper Alameda Creek
	Calaveras Reservoir Release to San Antonio Reservoir
	Calaveras Reservoir Release to Sunol Valley WTP
	Calaveras Reservoir Release to Calaveras Creek
	Calaveras Reservoir Spill to Calaveras Creek
	Calaveras Reservoir Evaporation

TABLE 5.1.2 (Continued)
HH/LSM OUTPUT PARAMETERS
(Data provided as monthly time step for 82 years of historical hydrology)

Feature	Output Parameter
San Antonio (MG)	San Antonio Reservoir Storage
	San Antonio Reservoir Inflow from San Antonio Creek
	San Antonio Reservoir Inflow from Calaveras Reservoir/SJPL
	San Antonio Reservoir Release to Sunol Valley WTP
	San Antonio Reservoir Release to San Antonio Creek
	San Antonio Reservoir Evaporation
Crystal Springs (MG)	Crystal Springs Reservoir Storage
	Crystal Springs Reservoir Inflow from San Mateo Creek
	Crystal Springs Reservoir Inflow from San Andreas Reservoir
	Crystal Springs Reservoir Inflow from Bay Division Pipelines
	Crystal Springs Reservoir Pumping to San Andreas Reservoir
	Crystal Springs Reservoir Pumping to Coastside CWD
	Crystal Springs Reservoir Release to San Mateo Creek
	Crystal Springs Reservoir Spill to San Mateo Creek
	Crystal Springs Reservoir Evaporation
San Andreas (MG)	San Andreas Reservoir Storage
	San Andreas Reservoir Inflow from Watershed
	San Andreas Reservoir Inflow from Crystal Springs, San Mateo Creek & Pilarcitos
	San Andreas Reservoir Release to Harry Tracy WTP
	San Andreas Reservoir Release to San Mateo Creek
	San Andreas Reservoir Spill to San Mateo Creek
	San Andreas Reservoir Evaporation
Pilarcitos (MG)	Pilarcitos Reservoir Storage
	Pilarcitos Reservoir Inflow
	Pilarcitos Reservoir Release to San Andreas Reservoir
	Pilarcitos Reservoir Release for Stone Dam Diversion to Coastside CWD
	Pilarcitos Reservoir Pre-Release to Pilarcitos Creek
	Pilarcitos Reservoir Spill to Pilarcitos Creek
	Pilarcitos Reservoir Evaporation
Stone Dam (MG)	Stone Dam Inflow (Accretion)
	Stone Dam Release to Coastside CWD
	Stone Dam Release to Crystal Springs Reservoir
Reservoir Storage (MG)	Total Reservoir Storage – East Bay
	Total Reservoir Storage – Peninsula
	Total Local Storage
	Maximum Targeted Total Local Storage
Demand (MGD)	Delivery to South Bay Demand Center
	Delivery to Crystal Springs Demand Center
	Delivery to San Andreas Demand Center
	Delivery to In-City Demand Center
	Total Delivery to Demand Centers (not including Coastside CWD)
Demand (MG)	Delivery to South Bay Demand Center
	Delivery to Crystal Springs Demand Center
	Delivery to San Andreas Demand Center
	Delivery to In-City Demand Center
	Total Delivery to Demand Centers (not including Coastside CWD)
San Joaquin Pipelines	SJPL Flow – MG
	SJPL Flow – MGD
SJPL (MG)	SJPL Flow to Crystal Springs Reservoir – MG
	SJPL Flow to San Antonio Reservoir – MG
West Basin Reservoir (MG)	Beginning of Month Storage
	West Basin Reservoir – Input Resulting from San Andreas Gradient Deliveries
	West Basin Reservoir – Input Resulting from Crystal Springs Gradient Deliveries
	End of Month Storage
Desalination Project (MG)	Input from Desalination Project
Treatment Plant Delivery (MGD)	Calaveras Reservoir Flow to Sunol Valley WTP
	San Antonio Reservoir Flow to Sunol Valley WTP
	Sunol Valley WTP Production
	Harry Tracy WTP Production

Indicates data used in the PEIR analysis

Coastside CWD = Coastside County Water District; MG = million gallons; MGD = million gallons per day; MWh = megawatt-hours; MID = Modesto Irrigation District; SJPL = San Joaquin Pipelines; TID = Turlock Irrigation District; WTP = water treatment plant.

The HH/LSM was also used to estimate baseline and with-WSIP flows in the Tuolumne River and Alameda Creek. However, the model results were not solely relied upon when evaluating flows in creeks immediately downstream of SFPUC reservoirs that normally have minimal flow or are affected by SFPUC operations for time periods less than a month in duration. This is because the model uses a monthly time interval. The model does not simulate day-to-day variations in water levels or releases to a stream, but instead provides an average water level and an average release in a given month. The inability of the model to illustrate short-term variations is generally not problematic when simulating continuous phenomena like storage or water level in a reservoir or flow in a perennial stream. However, in some cases, the modeling limitation of only providing information at a monthly time interval required additional considerations, such as SFPUC operator experience and knowledge, when simulating intermittent phenomena such as infrequent spills or releases from reservoirs that may last only a few days.

Flow in San Mateo Creek downstream of Lower Crystal Springs Dam provides an example. The SFPUC system operators rarely release water from Crystal Springs Reservoir to San Mateo Creek, and flow in the creek below the dam typically occurs only from seepage from the dam and groundwater infiltration. The SFPUC operators attempt to capture and retain as much runoff as possible from the upper San Mateo Creek watershed in Crystal Springs Reservoir. In all but wet years, the SFPUC captures all of the runoff from the upper watershed. In wet months of wet years, the operators of the reservoir obtain frequent weather forecasts and manage the reservoir to capture as much runoff as possible from the sequence of winter storms that cross the watershed. The operator's decisions with respect to reservoir management are made on a day-to-day, sometimes hour-to-hour, basis. In certain circumstances during wet hydrologic conditions, the operators must release water from the reservoir to the creek due to unpredictable weather conditions and their limited ability to make further adjustments to reservoir levels and other systemwide operations. Releases from Crystal Springs Reservoir to San Mateo Creek are based on day-to-day changes in operations and thus cannot be modeled using the HH/LSM. Consequently, the model does not provide a refined prediction of the magnitude and timing of infrequent and short-term releases from the reservoir. Similarly, the model does not provide a precise prediction of the magnitude and timing of releases from San Antonio Reservoir and flow in San Antonio Creek downstream of the reservoir. However, HH/LSM results are sufficient to depict the general trends of WSIP effects on these parameters on a monthly basis.

For the reasons noted above, HH/LSM results were not used to predict water levels in Pilarcitos Reservoir, flows in Pilarcitos Creek, or the magnitude and timing of spills or releases from Crystal Springs and San Antonio Reservoirs. In these cases, the likely effects of the WSIP were determined through a review of historical data and consultation with individuals knowledgeable about the past and predicted future reservoir operating practices.

In additional instances, such as the analyses of flow effects below Hetch Hetchy Reservoir and below the Alameda Creek Diversion Dam, HH/LSM results were refined or tiered to provide additional insight into the effects of the WSIP on stream flow for time periods of less than a month.

Use of Model Results to Show Water Supply Sources

Figures 5.1-4 and **5.1-5** present model results showing the relative contributions of the various water supply sources to the regional system for the 82-year period of hydrologic record under existing conditions (2005) and WSIP conditions (2030), respectively. The figures illustrate the combination of supply sources the regional system would use year-to-year to serve customer deliveries if it were operated over a series of years similar in terms of climate conditions to those that occurred from 1920 to 2002 under the two scenarios. The figures depict how relative contributions of water supply sources available to the SFPUC would vary from year to year and show the frequency and extent of shortages and rationing that would occur if there were dry years and drought sequences similar to those that occurred during this period.

The figures indicate that there currently is, and would continue to be, a wide annual variation in the amount of water available from the various water sources under both current and future conditions. This, in turn, results in a wide variation in the changes in stream flow and reservoir water levels that would occur under the WSIP compared to the existing condition. Therefore, the impact analysis presented in this chapter addresses the effects of this range of variation in stream flow and reservoir level changes on the potentially affected watersheds and associated resources.

5.1.5 Impact Significance Determinations

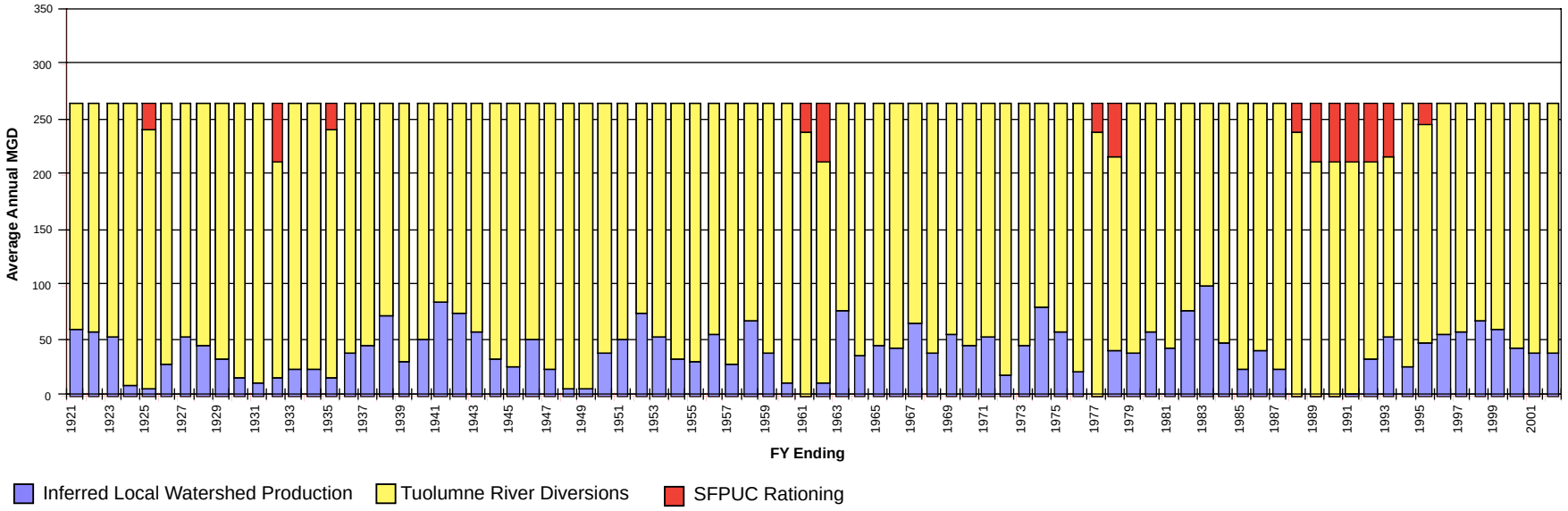
The significance criteria used in this PEIR are based on San Francisco Planning Department, Major Environmental Analysis (MEA) guidance regarding the environmental effects to be considered significant. MEA guidance is, in turn, based on the CEQA Guidelines Appendix G with some modifications. In cases where potential environmental issues associated with the WSIP are identified but are not clearly addressed by MEA's guidance, additional impact significance criteria are presented. Appendix B of this PEIR presents the MEA Initial Study checklist as it applies to the WSIP, and indicates the criteria applicable to the WSIP and discussed in the various chapters in the PEIR. The significance criteria used for each environmental topic/resource area are presented in each section of Chapter 5 following the setting and before the discussion of impacts.

For the impact analyses, the following categories are used to determine impact significance:

Not Applicable/No Impact (N/A). An impact is considered not applicable to the WSIP water supply or system operations if the environmental resource or impact potential does not occur within the project area or the area of potential effect. For example, an impact on a biological resource may not be applicable if the WSIP would not result in changes in stream flow for a specific reach of a creek.

Beneficial (B). An impact is considered beneficial if it is determined that WSIP water supply or system operations would improve an environmental resource or result in a beneficial effect on the environment.

Less than Significant (LS). This determination applies if there is a potential for limited impact, but the impact does not constitute a substantial adverse effect that qualifies under the significance criteria as a significant effect. LS impacts do not require mitigation.

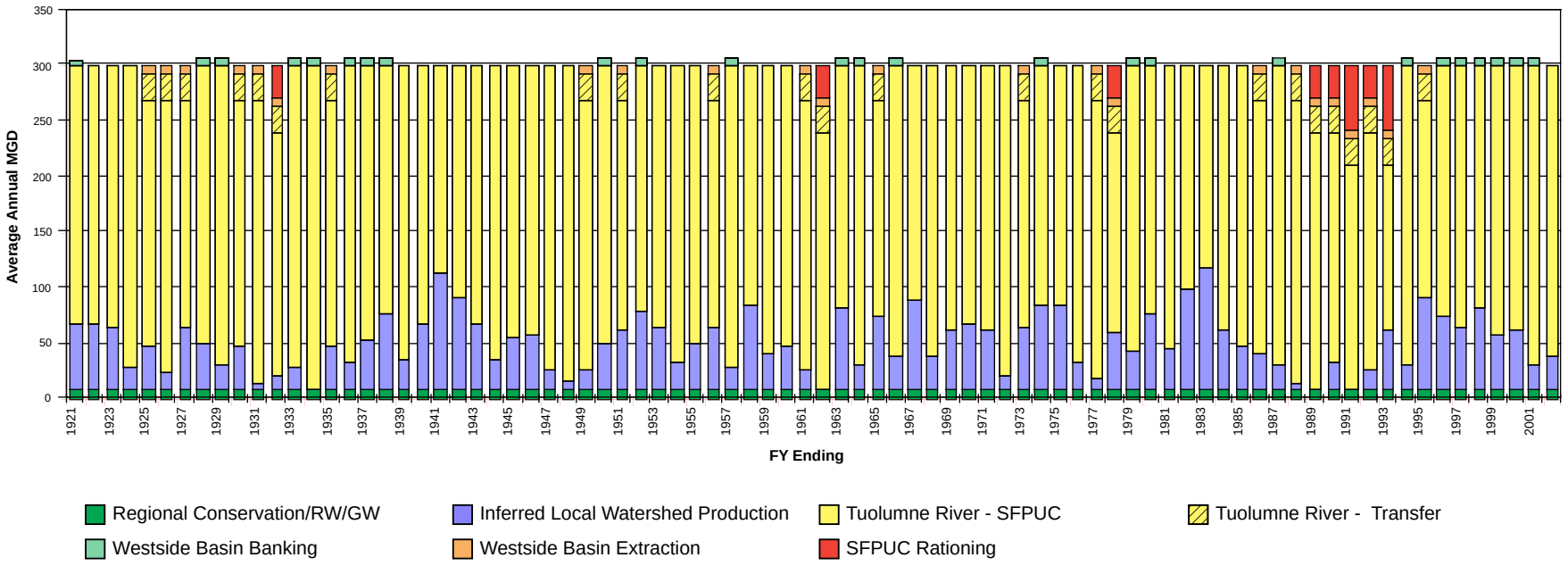


This figure illustrates what combination of supply sources the regional system would use year to year under existing conditions to meet the existing system delivery demand of 265 mgd if it were operated over a long series of years similar in terms of climate conditions to those that occurred between 1920 and 2002. This 82-year simulation illustrates how the relative contribution of water supply sources available to the SFPUC would vary year to year and shows the frequency and extent of supply shortages and rationing that would occur if there were dry years and drought periods similar to those that occurred during this historic period.

NOTES: (1) This figure illustrates a conceptual breakdown of water sources available to the SFPUC regional system. Local Watershed Production (inferred) is estimated as the difference between the amount of water delivered to system customers and the amount of water provided by the San Joaquin pipeline (Tuolumne River) and extracted from the Westside Basin groundwater aquifer. This estimate does not account for the source of Bay Area system reservoir storage used to serve deliveries or the partial use of San Joaquin pipeline deliveries for replenishment of Bay Area system reservoirs.

SOURCE: SFPUC, HH/LSM (see Appendix H)

Figure 5.1-4
Water Supply Sources and Shortages – Existing Conditions (265 mgd Delivery)



This figure illustrates what combination of supply sources the regional system would use year to year under future 2030 conditions to meet the future demand of 300 mgd if it were operated over a long series of years similar in terms of climate condition to those that occurred between 1920 and 2002. This 82-year simulation illustrates how the relative contribution of water supply sources available to the SFPUC would vary year to year and shows the frequency and extent of supply shortages and rationing that would occur if there were dry years and drought periods similar to those that occurred during this historic period.

NOTES: (1) This figure illustrates a conceptual breakdown of water sources available to the SFPUC regional system. Local Watershed Production (inferred) is estimated as the difference between the amount of water delivered to system customers and the amount of water provided by the San Joaquin pipeline (Tuolumne River) and extracted from the Westside Basin groundwater aquifer. This estimate does not account for the source of Bay Area system reservoir storage used to serve deliveries or the partial use of San Joaquin pipeline deliveries for replenishment of Bay Area system reservoirs.
(2) Deliveries in excess of 300 mgd represent banking of water into the Westside Basin groundwater aquifer under the proposed Westside Basin Groundwater conjunctive use program.

SOURCE: SFPUC, HH/LSM (see Appendix H)

Figure 5.1-5
Water Supply Sources and Shortages – 2030 WSIP Conditions (300 mgd Delivery)

Potentially Significant, Mitigable (PSM) / Significant Mitigable (SM). These determinations apply if there is a potential for a substantial adverse effect that meets the significance criteria, but implementation of mitigation measures would reduce the impact to a less-than-significant level. In cases where the analysis cannot conclusively determine the extent of adverse effects, the PEIR errs on the conservative side by identifying the impact as "potentially" significant; the impacts identified as "potentially significant" are treated as significant impacts in this PEIR. Similarly, "significant, mitigable" applies if there is certainty that a substantial adverse effect that meets the significance criteria would occur, but implementation of mitigation measures would reduce the impact to a less-than-significant level. In either event, the mitigation measures identified in this PEIR are expected to reduce any significant effects to a less-than-significant level.

Potentially Significant, Unavoidable (PSU) / Significant, Unavoidable (SU). These determinations apply to impacts that are potentially significant or significant, but for which there appears to be no feasible mitigation available to reduce them to a less-than-significant level. Mitigation might be available to lessen the effect of the impact, but the residual effect, even after implementation of the measure, would remain significant and therefore unavoidable. Alternatively, the PSU determination is applied in cases where mitigation might lessen the effect of an impact, but it is unknown if the mitigation could effectively reduce the impact to a less-than-significant level. When the effectiveness of a mitigation measure is unknown, the PEIR errs on the conservative side and applies this determination. The impacts identified as potentially significant are treated as significant impacts in this PEIR.

In each section of this chapter, a summary table is provided at the beginning of each impact discussion to summarize the potential impacts and to indicate the level of impact significance. The impact discussions for the WSIP water supply and system operations are organized by watershed or affected water resource. Impacts are numbered by section, and corresponding numbers are used to identify the mitigation measures presented in Chapter 6.

References – Overview

San Francisco Public Utilities Commission (SFPUC), *Water Supply System Modeling Report, Hetch Hetchy/Local Simulation Model*, 2007a.

San Francisco Public Utilities Commission (SFPUC), *Water Supply Options*, June 2007b.

5.2 Plans and Policies

Section 5.2 Subsections	
5.2.1	Overview
5.2.2	Regulatory Framework
5.2.3	Relevant Plans, Policies, and Planning Action
5.2.4	Plan Consistency Evaluation
(References included under each section)	

5.2.1 Overview

The purpose of this section is two-fold: (1) to provide an overview of the federal, state, and local plans and policies governing the SFPUC's water supply, including water quality, water use, and natural resource protection; and (2) to describe program consistency with applicable, adopted land use and resource plans and policies relevant to the WSIP water supply option and system operations, pursuant to CEQA Guidelines Section 15125(d).

The regulatory overview for Chapter 5 is summarized in this section to avoid repetition of the general description of applicable environmental regulations in the various sections of this chapter. Because Chapter 5 is organized by watersheds and related drainage areas rather than by environmental resources, only those aspects of the regulations specifically applicable to each watershed are presented in the respective sections. For example, the regulatory overview for Chapter 5 presented in this section includes a general description of the Clean Water Act and the Porter-Cologne Water Quality Control Act, but the description of applicable water quality control plans (WQCPs), beneficial uses, and water quality objectives are described separately in Sections 5.3.3, 5.4.3, and 5.5.3 for the Tuolumne River, Alameda Creek, and Peninsula watersheds, respectively.

The analysis in this section complements that presented in Section 4.2, Plans and Policies, which focuses on land use plans and policies relevant to construction and operation of the proposed WSIP facility improvement projects. Together, Sections 4.2 and 5.2 provide an evaluation of project consistency with the overall plans and policies relevant to the proposed program.

5.2.2 Regulatory Framework

In general, implementation and enforcement responsibility of governmental regulations flows down from federal and state jurisdictions to the regional, county, and municipal levels. Although the federal government establishes programs and sets minimum standards that are applicable nationwide, state and local jurisdictions have the authority to set more stringent standards than those established under federal law. The SFPUC currently complies with all applicable federal, state, and local regulations regarding municipal water supplies and would continue to do so under the WSIP. Responsible agencies and applicable federal, state, and local statutes and agreements

are discussed below. **Table 5.2-1** summarizes the applicability of the statutes and agreements to the proposed WSIP water supply and system operations.

Federal Agencies

U.S. EPA Office of Water

The U.S. Environmental Protection Agency (U.S. EPA) Office of Water, established in 1970, is the primary federal agency responsible for implementation of the Clean Water Act and Safe Drinking Water Act. The U.S. EPA Office of Water provides guidance, specifies scientific methods and data collection requirements, establishes contaminant thresholds, and provides oversight to state and local governments for compliance with the Clean Water Act and Safe Drinking Water Act.

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (Corps) evaluates permit applications for essentially all construction activities that occur in the nation's waters, including wetlands. Corps permits are also necessary for any work, including construction and dredging, in the nation's navigable waters. The Corps enforces the provisions of Section 404 of the Clean Water Act.

U.S. Fish and Wildlife Service

The mission of the U.S. Fish and Wildlife Service (USFWS) is to provide leadership in protecting fish and wildlife, conserving species habitats, and engaging citizens in the shared stewardship of America's natural resources. The USFWS's primary responsibilities involve the protection of migratory birds, endangered species, certain marine animals, and freshwater and anadromous fish through various regulations, including the Federal Endangered Species Act, the Federal Power Act, and Section 404 of the Clean Water Act.

National Marine Fisheries Service

The National Marine Fisheries Service (NMFS) is the primary federal agency involved with the stewardship of marine resources and their habitats through science-based conservation and management. The NMFS receives its ocean stewardship responsibilities under many federal laws, including the Federal Endangered Species Act, Section 404 of the Clean Water Act, and the Federal Power Act.

The Department of the Interior and the Department of Agriculture

The Department of the Interior (DOI) and the Department of Agriculture are the primary federal agencies involved with regulation under and enforcement of the Raker Act (see Chapter 2, Section 2.4.2, for further description of the Raker Act).

TABLE 5.2-1
APPLICABLE FEDERAL, STATE, AND LOCAL STATUTES AND AGREEMENTS

Statute or Agreement / Responsible Agency[a]	Summary Description	Associated Statutes and Plans	Applicability to WSIP Water Supply and System Operations Issues
Federal			
Clean Water Act / U.S. EPA, Corps, USFWS, NMFS	Primary federal law governing water quality. Prescribes basic federal laws for regulating discharges of pollutants into waters of the U.S., including establishing water quality standards for contaminants in surface waters, establishing wastewater and effluent discharge limits from various industry categories, and imposing requirements for controlling nonpoint-source pollution.	Section 303(d), Section 404, various others	Discussed and analyzed by watershed in Sections 5.3.3, 5.3.6, 5.4.3, 5.4.6, 5.5.3, and 5.5.6.
Safe Drinking Water Act / U.S. EPA	Sets health-based standards for drinking water quality to protect against naturally occurring and man-made contaminants that can be found in drinking water.	National Primary and Secondary Drinking Water Regulations	Described in Chapter 2, Section 2.4.1, regarding existing system, and in Chapter 3, Section 3.5.1, regarding proposed program.
Raker Act / U.S. Congress	Granted the City and County of San Francisco (CCSF) rights-of-way to certain public lands, including public lands in Yosemite National Park and Stanislaus National Forest, to develop water and power.		Described in Chapter 2, Section 2.4.2, and in Chapter 3, Sections 3.6 and 3.7, regarding existing and proposed water supply and operations.
Wilderness Act / U.S. Congress	Established the National Wilderness Preservation System to be composed of federally owned lands designated by Congress as wilderness areas, to be administered in such a manner that will leave them unimpaired for future use.	National Wilderness Preservation System	Designation of the 459-square-mile Tuolumne River watershed above Hetch Hetchy Reservoir as a wilderness area provides unique measures of protection to the watershed. Discussed in Section 5.2.3.
Wild and Scenic Rivers Act / BLM, NPS, USFS	Preserves the free-flowing characteristics and outstanding values of designated rivers while allowing uses compatible with the management goals of that river.	Management plans and concept plans for designated rivers	Described in Section 5.2.3 and evaluated in Section 5.2.4 for consistency. Discussed and analyzed in Section 5.3.7 regarding biological resources, as well as in Section 5.3.8 regarding visual resources.
Endangered Species Act / USFWS, NMFS	Provides broad protection for species of fish, wildlife, and plants that are listed as threatened or endangered in the U.S. or elsewhere.	Habitat conservation plans	Discussed by watershed in Sections 5.3, 5.4, and 5.5, under Fisheries and Terrestrial Biological Resources.
New Don Pedro Project FERC Settlement Agreement / FERC	Established a revised instream flow schedule for New Don Pedro Project operation and outlined a strategy for recovery of Tuolumne River Chinook salmon.	Habitat Restoration Plan for the Lower Tuolumne River Corridor (guidance document)	Discussed in Chapter 2, Section 2.5, under Institutional Considerations, in Chapter 3, Section 3.8, regarding proposed operations, and Sections 5.3.6, Fisheries, and 5.3.7, Biological Resources.

TABLE 5.2-1 (Continued)
APPLICABLE FEDERAL, STATE, AND LOCAL STATUTES AND AGREEMENTS

Statute or Agreement / Responsible Agency[a]	Summary Description	Associated Statutes and Plans	Applicability to WSIP Water Supply and System Operations Issues
State of California			
California Water Code / DWR and SWRCB	Contains the basic provisions regarding management of the state's water resources as well as the legislative findings for the California Water Plan.	California Water Plan, Water Reuse Law, California Recycling Act, Urban Water Management Planning Act, Wholesale Regional Water System Security and Reliability Act, etc.	Used in ongoing management and operation of the regional water system as well as in development of the WSIP.
California Water Code, Sections 10610–10656, Urban Water Management Planning Act / DWR	Requires urban water suppliers that provide water to 3,000 or more customers, or that provide over 3,000 acre-feet of water annually, to prepare an urban water management plan (UWMP) every five years.	UWMPs prepared by the CCSF and applicable Bay Area Water Supply and Conservation Agency (BAWSCA) members	Information in the UWMPs of the CCSF and BAWSCA members was used in the development of the WSIP 2030 level of service for water supply, as discussed in Chapter 3, Section 3.4.4, and Chapter 7; the San Francisco UWMP is analyzed in Section 5.2.
California Water Code, Sections 73500–73514, Wholesale Regional Water System Security and Reliability Act (AB 1823) / California legislature / DHS	Requires the SFPUC to operate the regional water system in a manner that will not adversely affect the water system. Includes the Water First Policy, which specifies that the CCSF shall assign higher priority to the delivery of water to the Bay Area than to the generation of electrical power.	WSIP (referred to as a capital improvement program in the legislation but renamed as the WSIP)	Part of WSIP development, goals, objectives, and operations, as described in Chapter 2, Section 2.4, and Chapter 3, Sections 3.4 and 3.7.
Porter-Cologne Water Quality Control Act / SWRCB, RWQCBs	Established SWRCB and RWQCBs as the principal state agencies with primary responsibility for the coordination and control of water quality. Established a comprehensive program for the protection of water quality and beneficial uses of water. Applies to surface waters (including wetlands), groundwater, and point and nonpoint sources of pollution.	Water quality control plans (WQCPs) designate legally binding beneficial uses of water for water bodies, including wetlands, assign water quality objectives (criteria) to protect those uses, and establish appropriate implementation programs.	Discussed and analyzed by watershed in Sections 5.3, 5.4, and 5.5, in the Surface Water Quality and Groundwater sections.
California Safe Drinking Water Act / DHS	Strengthens minimum requirements found in the federal Safe Drinking Water Act. Establishes drinking water standards that are at least as stringent as, and sometimes more stringent than, those established under the federal act.	Drinking water requirements, including Primary and Secondary Maximum Contaminant Levels	Discussed in Chapter 2, Section 2.4.1, and Chapter 3, Section 3.5.1, pertaining to WSIP water quality objectives.
San Joaquin River Agreement / SWRCB	Provides the basis for the development of the Vernalis Adaptive Management Program (VAMP) study and identifies where the water to support the VAMP study would be obtained.	Vernalis Adaptive Management Program (Experimental study)	Discussed in Sections 5.2 and 5.3.1.

TABLE 5.2-1 (Continued)
APPLICABLE FEDERAL, STATE, AND LOCAL STATUTES AND AGREEMENTS

Statute or Agreement / Responsible Agency[a]	Summary Description	Associated Statutes and Plans	Applicability to WSIP Water Supply and System Operations Issues
Regional and Local			
San Francisco City Charter / CCSF	Establishes many of the procedures and requirements for initiative ordinances and declarations of policy.	San Francisco General Plan San Francisco Sustainability Plan SFPUC Alameda Watershed Management Plan SFPUC Peninsula Watershed Management Plan SFPUC Stewardship Policy	Sets forth guidance and authority of the SFPUC for construction, management, supervision, maintenance, extension, expansion, and operation of the regional water system.

[a] Responsible agencies are as follows:

BLM = Bureau of Land Management
CCSF = City and County of San Francisco
Corps = U.S. Army Corps of Engineers
DHS = California Department of Health Services
DWR = California Department of Water Resources
FERC = Federal Energy Regulatory Commission
NMFS = National Marine Fisheries Service
NPS = National Park Service
RWQCB = Regional Water Quality Control Board
SFPUC = San Francisco Public Utilities Commission
SWRCB = State Water Resources Control Board
U.S. EPA = U.S Environmental Protection Agency
USFS = U.S. Forest Service
USFWS = U.S. Fish and Wildlife Service

Bureau of Land Management

The Bureau of Land Management (BLM), an agency within the U.S. Department of the Interior, administers America's public lands within a framework of numerous laws, including the federal Wild and Scenic Rivers Act. The BLM manages a wide variety of resources and uses, including fish and wildlife habitat, wilderness areas, timber, and archaeological, paleontological, and historical sites.

National Park Service

The National Park Service (NPS) is a bureau of the U.S. Department of the Interior. The NPS is responsible for the oversight of nearly 400 natural, cultural, and recreational sites across the nation, including scenic rivers and trails. The NPS is also responsible for the management of Yosemite National Park, administration of the designated wild and scenic reaches of the Tuolumne River under the Wild and Scenic Rivers Act, and preparation of the *Tuolumne Wild and Scenic River Comprehensive Management Plan* and the *Tuolumne Meadows Concept Plan* (both in development).

Federal Statutes and Agreements

Clean Water Act

The Clean Water Act, enacted by Congress in 1972 and amended several times since inception, is the primary federal law regulating water quality in the U.S. and forms the basis for several state and local laws throughout the country. Its objective is to reduce or eliminate water pollution in the nation's rivers, streams, lakes, and coastal waters. The Clean Water Act prescribes the basic federal laws for regulating discharges of pollutants into waters of the U.S., including setting water quality standards for contaminants in surface waters, establishing wastewater and effluent discharge limits from various industry categories, and imposing requirements for controlling nonpoint-source pollution. At the federal level, the Clean Water Act is administered by the U.S. EPA. At the state and regional levels, the act is administered and enforced by the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Boards (RWQCBs).

Section 404 of the Clean Water Act established a program to regulate the discharge of dredged or fill material into waters of the U.S., including wetlands. Activities in waters of the U.S. regulated under this program include the placement of fill for development, water resource, infrastructure, and mining projects. Section 404 requires a permit before dredged or fill material may be discharged into waters of the U.S., unless the activity is exempt from Section 404 regulation.

Safe Drinking Water Act

The Safe Drinking Water Act, passed by Congress in 1974 for the purpose of protecting public health, regulates public drinking water supplies derived from various sources, including rivers, lakes, reservoirs, springs, and groundwater wells. The federal Safe Drinking Water Act is implemented by the U.S. EPA. The Safe Drinking Water Act is discussed in more detail in Chapter 2, Section 2.4.1.

Raker Act

The Raker Act, passed by Congress in 1913, granted to the City and County of San Francisco (CCSF) rights-of-way to certain public lands, including public lands in Yosemite National Park and Stanislaus National Forest, to develop water and power. (See Chapter 2, Section 2.4.2, for further description.)

Wilderness Act

The Wilderness Act,[1] enacted by Congress in 1964, established a National Wilderness Preservation System composed of federally owned and designated wilderness areas. The purpose of the National Wilderness Preservation System is to preserve wilderness areas for future use and enjoyment. Human activities in designated wilderness areas are limited to those that leave no long-term impact on the land or that have little or no effect on the natural resources of the area. With limited exceptions, no commercial enterprises or permanent roads are allowed within a wilderness area.

The portion of the Tuolumne River watershed that drains into Hetch Hetchy Reservoir (459 square miles) is entirely within Yosemite National Park, and approximately 95 percent of the watershed is federally designated wilderness. This designation provides unique measures of protection to the watershed. The NPS manages Yosemite National Park to preserve the resources that contribute to Yosemite's uniqueness and attractiveness in accordance with the goals and principles of the 1964 Wilderness Act (USFS, 1986).

Wild and Scenic Rivers Act

In 1968, Congress enacted the Wild and Scenic Rivers Act[2] for the purpose of preserving the free-flowing characteristics and outstanding values of designated rivers while allowing uses compatible with the management goals of designated rivers. Specifically, designation as a Wild and Scenic River prohibits the federal government from licensing or permitting hydroelectric dams or major diversions along the designated reaches. The act also provides for the management of federal public lands within the corridor of the designated river. Segments are classified into one of three designations that are based on the level of existing development (and not on a description of any particular values): *wild* segments are wild, unroaded, and undeveloped; *scenic* segments are generally undeveloped, but may have occasional road crossings and riverside structures that are visually screened from the river; and *recreational* segments are generally developed with roads, bridges, and structures (Friends of the River, 2007).

1 The Wilderness Act of 1964, Pubic Law Sections 88–577; 16 United States Code Sections 1131–1136.
2 The California Wild and Scenic Rivers Act of 1972 (Public Resources Code, Sections 5093.50 et seq.), modeled after the federal Wild and Scenic Rivers Act, does not designate any rivers that would be affected by WSIP projects.

In 1984, Congress designated 83 miles of the main stem of the Tuolumne River, from its source to Don Pedro Reservoir, as a wild and scenic river, as shown in **Figure 5.2-1**. The classification and mileage of the designated reach is as follows: 47 miles wild, 23 miles scenic, and 13 miles recreational. A total of 54 miles of the designated river are located within Yosemite National Park (not including Hetch Hetchy Reservoir, which was excluded from the designation), and 29 miles of the designated river are located outside of Yosemite National Park (USFWS, 2007). In accordance with the Wild and Scenic Rivers Act, federal agencies are required to prepare a comprehensive management plan for designated rivers within three years of designation to guide future management decisions. The designation does not affect any rights, obligations, privileges, or benefits granted under the Raker Act. The NPS administers wild and scenic rivers that flow wholly or partly within the boundaries of the national park system; the Secretary of Agriculture administers wild and scenic rivers that flow wholly or partly within the boundaries of national forests.

Endangered Species Act

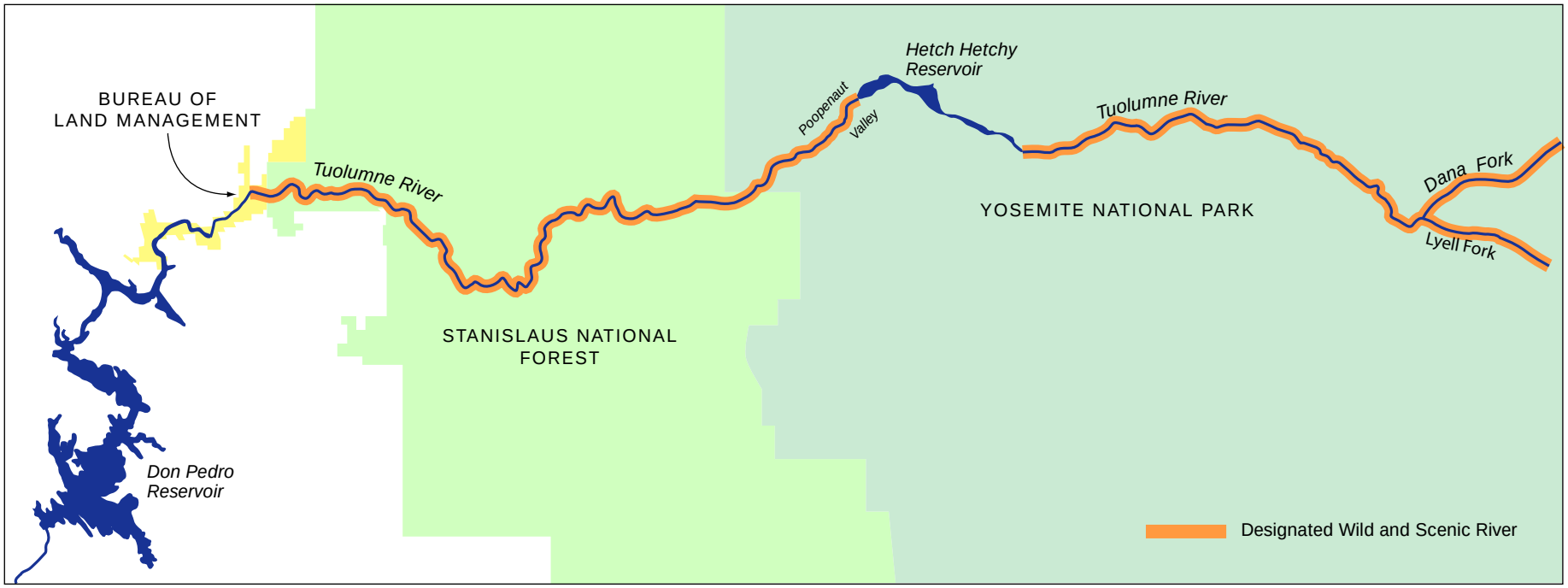
The Federal Endangered Species Act of 1973 provides broad protection for species of fish, wildlife, and plants that are listed as threatened or endangered in the U.S. or elsewhere. Provisions of the act provide for the listing of species, preparation of recovery plans, and designation of critical habitat for listed species. Federal agencies must follow the act's provisions when taking actions that may jeopardize listed species. The Federal Endangered Species Act is enforced by the USFWS and NMFS. The California Endangered Species Act generally parallels the main provisions of the federal law and is administered by the California Department of Fish and Game (CDFG).

Federal Power Act

The Federal Power Act of 1920 requires hydropower project owners to obtain a license from the Federal Energy Regulatory Commission (FERC). Among other purposes, FERC is charged with protecting fish and wildlife, including related spawning grounds and habitat, as well as mitigating impacts on recreation. The Federal Power Act authorizes the USFWS and NMFS to issue mandatory fishway prescriptions to ensure adequate protection, mitigation, and enhancement of fish and wildlife and their habitats. The Hetch Hetchy Project is statutorily exempt from provisions of the Federal Power Act. The Don Pedro Project is subject to FERC jurisdiction for its hydropower operations.

New Don Pedro Project FERC Settlement Agreement

Executed in 1995 by Tuolumne River stakeholder groups, the FERC Settlement Agreement established a revised instream flow schedule for New Don Pedro Project operation and outlined a strategy for recovery of Tuolumne River Chinook salmon (TID/MID, 1996). The revised flow schedule and a monitoring program were subsequently ordered by FERC in 1996, when FERC amended the license for the New Don Pedro Project to incorporate the settlement agreement flow schedules. The agreement requires implementation of measures to improve Chinook salmon habitat and increase populations, including increased flows, habitat rehabilitation and improvement, and measures to improve smolt survival. The FERC order required TID and MID



SOURCE: ESA + Orion

Figure 5.2-1
Tuolumne River, Wild and Scenic River Designation

to file a 10-year report on the success of the flow modifications, and non-flow mitigation measures were reevaluated in 2005 (TID/MID, 2005). In 2000, the Tuolumne River Technical Advisory Committee (TRTAC), completed the *Habitat Restoration Plan for the Lower Tuolumne River Corridor* (TRTAC, 2000) as the primary planning product of the Settlement Agreement. The restoration plan is to be used by the Tuolumne River Technical Advisory Committee to help fulfill its obligations to FERC under the Settlement Agreement. It is a technical resource document intended to aid in identifying areas of potential habitat improvement and to provide guidance for restoring or rehabilitating these areas (see Section 5.2.3 for further description of the plan). The restoration plan has not been formally adopted by any federal, state or local agency.

State Agencies

California Department of Water Resources

The Department of Water Resources (DWR) is responsible for the overall management of California's water resources. Duties performed by the DWR include, but are not limited to, developing strategies for managing the state's water resources, including updates of the *California Water Plan*; operating and maintaining the State Water Project; and providing policy direction and legislative guidance on water and energy issues.

The DWR owns and operates Del Valle Reservoir in the Alameda Creek watershed. The DWR constructed this facility primarily for flood control and recreational purposes as well as to provide regulatory flows in the South Bay Aqueduct (DWR, 1997). Since 1969, through a series of agreements among the DWR, Alameda County Water District, and Zone 7 Water Agency, local water has been stored for later release and subsequent beneficial use by the water districts under their SWRCB permits. The disposition of stored local inflow is determined by the districts. Water can be released into Arroyo del Valle, released into the South Bay Aqueduct, exchanged for an equivalent amount of South Bay Aqueduct water, or any combination of the foregoing (DWR, 1997). Under the current agreement, the DWR is allowed to use local inflow at times when the districts cannot use all or part of this supply.

California Department of Health Services

The California Department of Health Services (DHS) is responsible for the enforcement of the Safe Drinking Water Act and regulation of public water systems through the Drinking Water Program. DHS activities include field inspections of water systems, source water assessments, issuance of operating permits, review of plans and specifications for new facilities, enforcement actions for noncompliance with laws and regulations, and promotion of water system security. The DHS also regulates the use of recycled water by establishing water quality standards and treatment reliability criteria for recycled water under Title 22 of the California Code of Regulations.

State Water Resources Control Board

The SWRCB, created in 1967, has the primary authority over state water rights and water quality policy. The SWRCB is responsible for the enforcement of the Porter-Cologne Water Quality Control Act (Division 7 of the California Water Code), which deals with potential discharges into

water bodies that could result in adverse impacts on water quality. The regulations enacted by the SWRCB are enforced by the nine regional boards at the local and regional level.

California Regional Water Quality Control Boards

The mission of the California RWQCBs is to develop and enforce water quality objectives and implementation plans that will best protect the beneficial uses of the state's waters, recognizing local differences in climate, topography, geology, and hydrology. The RWQCBs engage in a number of water quality functions in their respective regions. One of the most important is preparing and periodically updating WQCPs. The San Francisco Bay and Central Valley RWQCBs are the relevant boards reviewing WSIP projects.

State Statutes and Agreements

California Water Code

The California Water Code contains the fundamental provisions related to management of the state's water resources. The California Water Code requires that water resources of the state be put to beneficial use to the fullest possible extent, and that waste, unreasonable use, or unreasonable method of use be prevented. Acts contained under the California Water Code relevant to the WSIP include the Water Reuse Law, Urban Water Management Planning Act, California Water Recycling Act, and Wholesale Regional Water System Security and Reliability Act.

Urban Water Management Planning Act

The Urban Water Management Planning Act, enacted in 1983 by the state legislature, requires urban water suppliers that provide water to 3,000 or more customers, or that provide over 3,000 acre-feet of water annually, to prepare an urban water management plan (UWMP). UWMPs are updated every five years and must describe and evaluate existing and planned sources of water supply; discuss the reliability of the water supply with respect to seasonal or climatic shortages; describe demand management measures to be implemented by the water supplier; and provide an implementation strategy and schedule for any future planned water supply projects and water supply programs. The act is administered by the DWR (California Water Code Sections 10620–10621).

Wholesale Regional Water System Security and Reliability Act and Water First Policy

California Assembly Bill No. 1823 (AB 1823), known as the Wholesale Regional Water System Security and Reliability Act, imposed various requirements on wholesale water systems. The bill, adopted in 2002, required the SFPUC, acting on behalf of the CCSF, to adopt a capital improvement program by February 1, 2003; to adopt an emergency response plan by September 1, 2003; to distribute available water during any interruption to customers on an equitable basis; to continue operating reservoirs in Tuolumne County in a manner that ensures hydroelectric power generation does not cause any reasonably anticipated impacts on water service; and to assign a higher priority to water Bay Area deliveries than to power generation (California Water Code Sections 73500–73514). The act also includes the SFPUC's Water First Policy.

The Water First Policy, contained in Section 73504(b) of the California Water Code, was formally established in the San Francisco City Charter following adoption of AB 1823 by the state legislature and approval of Proposition E by San Francisco voters. Under this policy, the SFPUC must place water service to the Bay Area before the generation of hydroelectric power. (See Chapter 2, Section 2.4.3 for additional information on AB 1823.)

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act was passed by the state legislature in 1969 and is the primary statute covering the quality of waters in California. The act specifies water quality provisions and discharge requirements for regulating the discharge of waste that could affect the quality of state waters. Under the act, the SWRCB has the ultimate authority over state water rights and water quality policy. The nine RWQCBs are responsible for the oversight of water quality on a day-to-day basis at the local and regional level.

California Safe Drinking Water Act

The California Safe Drinking Water Act, administered by the DHS, strengthens the minimum requirements found in the federal Safe Drinking Water Act and establishes drinking water standards that are at least as stringent as, and sometimes more stringent than, those established under the federal act. California's development of drinking water standards for MTBE is an example of its more aggressive standards.

San Joaquin River Agreement

The 1995 Water Quality Control Plan (WQCP) for the San Francisco/Sacramento–San Joaquin Delta Estuary included water quality and flow objectives pertaining to the San Joaquin River basin. Disputes over the science supporting the flow objective for the San Joaquin River as measured in Vernalis (shown in Section 5.3, Figure 5.3-1) led to the development of an experimental program to develop an adaptive fishery management plan and the water supplies to support that plan. The San Joaquin River Agreement, adopted by the SWRCB in April 1998, provided the basis for development of the Vernalis Adaptive Management Program (VAMP) and identified where much of the water to support the VAMP study would be obtained (specifically, from the San Joaquin River Group Authority). The VAMP is an experimental management program designed to protect juvenile Chinook salmon migrating from the San Joaquin River through the Delta (San Joaquin River Group Authority, 1999). The VAMP study is summarized below in Section 5.2.3 and discussed in more detail in Section 5.3.1.

Local and Regional Agencies

City and County of San Francisco

As a department of the CCSF, the SFPUC has authority over the management, use, and control of the regional water system pursuant to the San Francisco City Charter, Section 8B.121. Chapter 3, Section 3.3, presents the mission of the SFPUC relative to the objectives of the WSIP, and Section 3.13 describes the role of the CCSF and its various departments with respect to the actions and approvals required for adoption of the WSIP.

Alameda Creek Watershed Regional Agencies

In addition to the CCSF, three regional resource agencies have jurisdiction within the Alameda Creek watershed. There are no local or regional resource agencies with jurisdiction over areas within the Tuolumne and Peninsula watersheds or the Westside Groundwater Basin (beyond those described in Chapter 3, Section 3.13, related to the conjunctive-use program) that could be affected by the proposed water supply and system operations.

Alameda County Flood Control and Water Conservation District

The Alameda County Flood Control and Water Conservation District (ACFCWCD) works specifically to protect county citizens from flooding hazards. The ACFCWCD is responsible for planning, designing, and inspecting flood control projects; maintaining flood control infrastructure; assisting in planning new developments to preserve the integrity of the flood control system; and providing public outreach and enforcement of pollution control regulations governing county waterways.

Zone 7 Water Agency

Zone 7 Water Agency, one of 10 active zones of the ACFCWCD, covers the eastern portion (425 square miles) of Alameda County, including Pleasanton, Livermore, and Dublin. Zone 7's entire service area lies within the Alameda Creek watershed. Unlike the other zones, Zone 7 was created by state law and has its own board of directors. Zones 7's water resource management responsibilities include providing a wholesale treated drinking water supply, monitoring and protecting surface water and groundwater quality, operating and maintaining a water treatment system, and managing floodwaters and stormwater for public safety and protection of property. In September 2005, Zone 7 adopted the updated *Urban Water Management and Water Shortage Contingency Plan*, which addresses operations as well as water supply and demand.

Zone 7 is the water quality management agency for the Alameda Creek watershed above the town of Niles. The agency does not generally participate in the management of SFPUC lands, with the exception of managing groundwater activities and monitoring development in the Zone 7 service area for erosion potential and channel capacity impacts through the CEQA process.

Zone 7 also serves as a water wholesaler, with supplies originating from local groundwater sources, imported water from the State Water Project, and local water stored in Del Valle Reservoir. The agency is also responsible for mitigating flood hazards in its service area and has undertaken channelization projects on sections of Arroyo de la Laguna, Arroyo del Valle, and Arroyo Mocho.

East Bay Regional Park District

The East Bay Regional Park District's (EBRPD) Sunol and Ohlone Regional Wilderness preserves are within the watersheds of Alameda Creek (below Calaveras Reservoir) and San Antonio Reservoir, respectively. Watershed management activities in these preserves can affect water quality in those receiving waters. The EBRPD has worked with the SFPUC on a number of fish enhancement projects in the watershed, including cattle fencing to keep livestock out of sensitive riparian areas.

Local Regulation

The only local regulation relevant to the WSIP is the San Francisco City Charter.

San Francisco City Charter

The San Francisco City Charter was adopted on November 7, 1995, and became effective July 1, 1996. In November 2002, the voters adopted Proposition E, which amended the charter as it relates to the SFPUC. The charter establishes many of the procedures and requirements for initiative ordinances and declarations of policy. Where the charter does not address a particular aspect of the initiative process, applicable provisions of California law apply. As specified in Section 8B.122 of the charter, the SFPUC is required to develop, periodically update, and implement programs consistent with the following goals and objectives related to water resources:

(1) Provide water and clean water services to San Francisco and water service to its wholesale customers while maintaining stewardship of the system by the City;

(2) Establish equitable rates sufficient to meet and maintain operation, maintenance, and financial health of the system;

(3) Provide reliable water and clean water services and optimize the systems' ability to withstand disasters;

(4) Protect and manage lands and natural resources used by the SFPUC to provide utility services consistent with applicable laws in an environmentally sustainable manner. Operate hydroelectric generation facilities in a manner that causes no reasonably anticipated adverse impacts on water service and habitat;

(5) Develop and implement priority programs to increase and to monitor water conservation and efficiency systemwide;

(6) Utilize state-of-the-art innovative technologies where feasible and beneficial;

(7) Develop and implement a comprehensive set of environmental justice guidelines for use in connection with its operations and projects in the city;

(8) Create opportunities for meaningful community participation in development and implementation of the SFPUC's policies and programs; and

(9) Improve drinking water quality with a goal of exceeding applicable drinking water standards if feasible.

5.2.3 Relevant Plans, Policies, and Planning Actions

Regional Natural Resource Protection Plans

Many of the federal and state statutes and agreements summarized in Section 5.2.2 form the basis for development of the regional natural resource protection plans and policies described in this section. These plans and policies play an important role in the SFPUC's current and future operation of the regional water system by establishing guidelines for the protection of fish,

wildlife, and riparian habitat and by setting enforceable water quality objectives/criteria for surface waters potentially affected by the regional water system. As indicated below, the plans and policies are in various stages of development; only some of the plans and policies are adopted and many are either under development or in a study or experimental stage.

Tuolumne Wild and Scenic River Management Plan

The *Tuolumne Wild and Scenic River Management Plan* (Wild and Scenic Plan) was approved in 1986 and is administered by the U.S. Forest Service, Pacific Southwest Region. The Wild and Scenic Plan, applicable only to the 29 miles of the Tuolumne Wild and Scenic River located outside of Yosemite National Park (see Figure 5.2-1), provides direction for managing the use of federal lands within the boundaries of the designated corridor and for protecting the unique qualities of the designated river. The Wild and Scenic Plan does not apply to the exercise of the CCSF's water rights under the existing Raker Act grant, as stated in the Wild and Scenic Rivers Act (Section 3 [a] [53] Tuolumne, California) as follows: "Nothing in this section is intended or shall be construed to affect any rights, obligations, privileges, or benefits granted under any prior authority of law including chapter 4 of the Act of December 13, 1913, commonly referred to as the Raker Act (38 Stat. 242) and including any agreement or administrative ruling entered into or made effective before the enactment of this paragraph [September 28, 1984]."

The Wild and Scenic Plan includes general management objectives and guidelines applicable to the entire designated corridor as well as reach-specific management prescriptions and recreational improvement opportunities assigned to particular management areas. All land uses within the designated corridor are subject to the provisions of the Wild and Scenic Plan. Selected management objectives, standards, and guidelines applicable to the entire designated corridor are listed below.

Management Objectives

Physical Setting Opportunities – Fish and Wildlife

1. Provide habitat for management of indicator species including threatened, endangered, and sensitive species. These include peregrine falcon, bald eagle, mule deer, western gray squirrel, yellow warbler, and Sierra Nevada red fox.

Physical Setting Opportunities – Timber

1. Manage vegetation to protect and enhance Wild and Scenic River values, placing special emphasis on protecting streamside vegetation.

Physical Setting Opportunities – Water

1. Maintain or improve the existing high water quality for fisheries, aesthetics, and other ecological considerations. Give priority to protection of water quality in cases of conflict with other resource uses. Prevent alteration of natural channels or stream banks that would significantly affect the free-flow of water, the appearance of the stream, fish habitat, or water quality.

Physical Setting Opportunities – Lands

2. Work with proponents and operators of hydroelectric projects outside of the corridor to provide mitigation to eliminate or minimize adverse environmental impacts and to provide for recreation opportunities created by the project that will meet the objectives of this management plan.

Managerial Setting Opportunities

5. Manage the Tuolumne Wild and Scenic River and its immediate environment to preserve its free-flowing condition and to protect its outstandingly remarkable values.[3] Provide opportunities for public recreation and other resources based on the classification of each river segment.

Standards and Guidelines

Fish and Wildlife

- Fish and Wildlife Habitat Coordination (C1-WS). Maintain and enhance habitat for fish and wildlife species.

- Stream Fisheries Habitat Improvement and Maintenance (C2-WS). Provide medium- to high-quality habitat for resident trout species (rainbow, brown, and brook) according to the habitat capability model.

- Riparian and Meadow Vegetation Management (C4-WS). Provide cover and forage for fish and wildlife species associated with riparian habitats by maintaining medium- to high-habitat quality according to the Habitat Quality Criteria for Riparian Habitat.

Specific impacts on potentially affected resources covered in this plan—including water, fish and wildlife, vegetation, recreational, and visual resources—resulting from implementation of the proposed WSIP water supply and system operations are analyzed in this chapter in the corresponding subsections of Section 5.3.

Tuolumne Wild and Scenic River Comprehensive Management Plan, General Management Plan for Yosemite National Park, and Wilderness Management Plan

The NPS is currently in the process of preparing a comprehensive management plan for the 54 miles of designated wild and scenic river within Yosemite National Park, as mandated by the Wild and Scenic Rivers Act. This reach of designated river includes portions of the river extending from the Tioga Pass Entrance and Lyell Canyon to the Poopenaut Valley, as shown in Figure 5.2-1. The lands immediately surrounding Hetch Hetchy Reservoir are not included in the plan area; environmental stewardship of these lands is the responsibility of the SFPUC and is performed in coordination with the NPS, as described in Chapter 2, Section 2.3.8. However, the six-mile reach of the Tuolumne River, downstream of Hetch Hetchy Reservoir, that passes through the Poopenaut Valley is covered under this plan.

[3] Outstandingly remarkable values are defined by the Wild and Scenic Rivers Act as the unique characteristics that make a river worthy of special protection.

The intended purpose of the plan currently under development, known as the *Tuolumne Wild and Scenic River Comprehensive Management Plan* (Tuolumne River Plan), is to establish the overall goals and vision for the river corridor. It will provide broad, conceptual-level management objectives that may amend the *General Management Plan for Yosemite National Park* (1980) for the river corridor. The Tuolumne River Plan is not intended to include specific implementation strategies or plans. Concurrent with the Tuolumne River Plan, the NPS is also developing an implementation plan for Tuolumne Meadows that will be guided by the Tuolumne River Plan. Public scoping related to development of the two plans was completed in September 2006, and the draft environmental impact statement is scheduled for release in 2008, with the final report expected in 2009 (NPS, 2006b, 2007).

As part of the development of the Tuolumne River Plan, the NPS developed a draft report entitled *Tuolumne Wild and Scenic River Outstandingly Remarkable Values* (NPS, 2006a). This report presents the proposed revision of the outstandingly remarkable values for the portion of the Tuolumne Wild and Scenic River within Yosemite National Park. Outstandingly remarkable values are identified for natural (ecologic, hydrologic, geologic, and biologic), sociocultural (prehistoric, historic, scenic, and recreational), and scientific values by river segment and for the corridor as a whole. A final report will incorporate comments received during public scoping and review of the draft Tuolumne River Plan and become the foundation for the final Tuolumne River Plan. The *Outstandingly Remarkable Values* includes specific description of cultural, historic, hydrologic, geologic, biologic, scenic, and recreational attributes of the reach of the Tuolumne River below Hetch Hetchy Reservoir, including the Poopenaut Valley, potentially affected by the proposed water supply and system operations.

Much of the area around the Tuolumne River is federally designated as wilderness and is covered under the NPS's *Wilderness Management Plan*. The general guidance and direction for the *Wilderness Management Plan* currently derive from the *General Management Plan for Yosemite National Park*, the Wilderness Act, and NPS policy. When the *Wilderness Management Plan* is updated, the NPS will incorporate guidance and direction established by the Tuolumne River Plan.

Although the Tuolumne River Plan is still under development, specific impacts on potentially affected resources to be covered in the plan—including water, biological, recreational, and visual resources—resulting from implementation of the proposed WSIP water supply and system operations are analyzed in this chapter in the corresponding subsections of Section 5.3.

Vernalis Adaptive Management Program

The VAMP, a product of the San Joaquin River Agreement and officially initiated as part of SWRCB Decision 1641, is a 12-year experimental adaptive management program to study the effects of alterations in San Joaquin River flows and Delta pumping rates on the migration of salmon within the San Joaquin River basin. Under the VAMP, a barrier was installed at the head of Old River, and different amounts of water are released down the San Joaquin River, curtailing exports from the Delta by the State Water Project and Central Valley Project to varying degrees for one month in the spring when juvenile salmon are migrating. Information on the effects of different river flow and export rates on migrating salmon is being gathered and may be used to

establish future standards for their protection. The VAMP is administered by the parties to the San Joaquin River Agreement, including the U.S. Bureau of Reclamation, DWR, CDFG, USFWS, and San Joaquin River Group Authority.

The VAMP is discussed in this chapter because the WSIP would affect flows in the Tuolumne River, a tributary to the San Joaquin River and the Sacramento–San Joaquin Delta. Specific impacts on potentially affected resources covered in this plan—including flows in the San Joaquin River—resulting from implementation of the proposed WSIP water supply and system operations are discussed in Section 5.3.1 of this chapter. The VAMP is not an adopted plan, but rather a temporary experimental program; however, it is expected that either the VAMP or a "VAMP-like" program will be continued when the current program expires.

Habitat Restoration Plan for the Lower Tuolumne River Corridor

Under the 1995 FERC Settlement Agreement (described above and in Chapter 2, Section 2.5.2), the TRTAC is responsible for developing and implementing a Chinook salmon restoration plan and salmon management and habitat restoration activities as part of the strategy to address a decline in fall-run Chinook salmon in the lower Tuolumne River (FERC, 1996). The *Habitat Restoration Plan for the Lower Tuolumne River Corridor* (TRTAC, 2000) is a technical resource document, not an adopted plan, intended to aid the TRTAC in identifying areas of potential habitat improvement and in restoring or rehabilitating these areas.

The restoration plan integrates salmon ecology and geomorphic and hydrologic processes into a riverwide and reach-specific plan. The plan includes goals and strategies to guide future management, specific monitoring objectives, a comprehensive list of all potential restoration sites and actions, and conceptual designs for 14 high-priority restoration projects.

The restoration plan describes how cumulative water storage and diversion projects in the lower Tuolumne River watershed have led to a reduction in annual water yield below La Grange Dam, reductions in the magnitude and variability of the annual hydrograph,[4] and a reduction in the magnitude, duration, and frequency of winter floods. The restoration plan promotes the recovery of Chinook salmon and the river's natural animal and plant communities through the reestablishment of fluvial geomorphic functions, processes, and characteristics. The plan includes the following riverwide restoration goals for the Tuolumne River:

- A continuous river floodway from La Grange Dam to the confluence of the San Joaquin River
- A continuous riparian corridor from La Grange Dam to the San Joaquin River confluence, with a minimum width of 500 feet and a width of up to 2,000 feet near the San Joaquin River
- A dynamic alluvial channel maintained by flood hydrographs of variable magnitude and frequency adequate to periodically initiate geomorphic processes
- The establishment of variable stream flows to benefit salmon and other aquatic resources

[4] A chart that illustrates the pattern of flow in a stream as a function of time.

- Chinook salmon habitat created and maintained by natural processes, sustaining a resilient, naturally reproducing Chinook salmon population

- Self-sustaining, dynamic, native woody riparian vegetation

- Continual revision of the adaptive management program, addressing areas of scientific uncertainty that will improve our understanding of river ecosystem processes and refine future restoration and management

Specific impacts on potentially affected resources covered in this plan—including water, geomorphological, biological, recreational, and visual resources—resulting from implementation of the proposed WSIP water supply and system operations are addressed in this chapter in the corresponding subsections of Section 5.3, and information from this plan is used as a resource for mitigation strategies.

Water Quality Control Plans

Each RWQCB is required to develop, adopt, and implement a Water Quality Control Plan (WQCP), also known as a Basin Plan, for its respective region. The WQCP is the master policy document that contains descriptions of the legal, technical, and programmatic bases of water quality regulation. WQCPs identify beneficial uses of surface waters and groundwater within the corresponding region; specify water quality objectives and standards for both surface water and groundwater; and develop the actions necessary to maintain the standards in order to control nonpoint and point sources of pollutants to the state's waters.

WQCPs are adopted and amended by the RWQCBs and approved by the SWRCB. Adoption of or revisions to the surface water objectives/standards contained in the WQCPs are subject to U.S. EPA approval. All discretionary projects requiring permits from the RWQCB (i.e., waste discharge requirements and National Pollutant Discharge Elimination System permits) must implement WQCP requirements, taking into consideration the beneficial uses to be protected.

Two adopted WQCPs govern the management of surface and ground waters that could be affected by proposed WSIP system operations. The Central Valley WQCP covers the Sacramento and San Joaquin River basins, including the Tuolumne River watershed. The San Francisco Bay/Delta WQCP covers those portions of Alameda, Contra Costa, Marin, Napa, San Mateo, San Francisco, Santa Clara, Solano, and Sonoma Counties that drain to the San Francisco Bay Estuary, including the Delta, as well as areas draining to the Pacific Ocean; this plan includes the Alameda Creek watershed, the Peninsula watershed (including San Mateo and Pilarcitos Creeks), and the Westside Groundwater Basin. Water objectives/standards contained in the WQCPs are enforceable against the SFPUC. Specific impacts on water quality associated with implementation of the proposed WSIP water supply and system operations are analyzed by watershed in Sections 5.3.3, 5.4.3, and 5.5.3 of this chapter.

Regional Habitat Conservation Plans

Habitat conservation plans (HCPs) are land use and biological planning documents that provide comprehensive, long-term conservation measures for species listed as threatened or endangered under the California and Federal Endangered Species Acts, or for species that could be listed in the future. One adopted HCP covering an area that could be affected by WSIP implementation was identified (see separate discussion below of SFPUC HCPs). In 1995, the City of Waterford prepared an HCP for the incidental take of valley elderberry longhorn beetle (VELB) on the Tuolumne River at the discharge point of its wastewater treatment facility, located between La Grange Dam and the city of Modesto. The HCP involved the removal of about 150 elderberry bushes on five acres and the installation of over 800 small bushes.

Alameda Creek Watershed Management Planning Efforts

Multiple stakeholders in the Alameda Creek watershed area, including the SFPUC, Alameda County Water District, ACFCWCD, Zone 7, EBRPD, and various environmental interest groups, are involved in ongoing planning efforts to manage the Alameda Creek watershed. Although no specific plans have been adopted, planning efforts include the development of a comprehensive management plan for the watershed; the plan, which is being prepared in conjunction with the Alameda Creek Fisheries Restoration Workgroup, will focus on restoring steelhead to the Alameda Creek watershed. In October 2006, 17 public agencies and nonprofit organizations[5] signed a formal agreement to collaborate on stream flow requirements for steelhead, other native fish and wildlife, and drinking water supplies (Alameda Creek Fisheries Restoration Workgroup, 2006). This planning effort is discussed in the Alameda Creek watershed fisheries section and in cumulative analysis of the WSIP water supply and system operations, in Sections 5.4.5 and 5.7, respectively.

Pilarcitos Creek Watershed Restoration Plan

Developed in coordination with the California Department of Fish and Game, Regional Water Quality Control Board, and a citizen's advisory committee, the *Pilarcitos Creek Restoration Plan* (Philip William & Associates, Ltd., 1996) details the major issues of concern regarding Pilarcitos Creek and its tributaries, and prioritizes alternatives to significantly enhance the physical and biological attributes of the watershed. The alternatives involve reducing sedimentation in the creek and its tributaries, enhancing fish migration and rearing and riparian habitat, and providing educational resources. Not an adopted plan, this document and its subsequent updates serve as a guide to restoration projects and related activities in the Pilarcitos watershed. It is considered in this chapter with respect to providing documentation of existing conditions in the Pilarcitos watershed and potential mitigation strategies for potential impacts associated with the WSIP water supply option and system operations.

[5] Participating organizations in the Alameda Creek Fisheries Restoration Workgroup include: the Alameda County Water District, Alameda County Flood Control and Water Conservation District, Alameda Creek Alliance, Coastal Conservancy, Zone 7, Pacific Gas and Electric Company, SFPUC, Alameda County Resource Conservation District, American Rivers, California Department of Fish and Game, East Bay Regional Park District, National Marine Fisheries Service, Natural Resources Defense Council, San Francisco Bay Regional Water Quality Control Board, U.S. Army Corps of Engineers, U.S. Natural Resources Conservation Service, and U.S. Fish and Wildlife Service.

Pilarcitos Creek Integrated Watershed Management Plan

The Pilarcitos Creek Restoration Workgroup[6] is currently developing the *Pilarcitos Creek Integrated Watershed Management Plan*, the intended purpose of which is to "determine how to more effectively manage the competing beneficial uses of water from Pilarcitos Creek and promote balanced solutions that satisfy environmental, public health, recreational, and economic interests. An important component of the plan will be an assessment of existing conditions and a strategy for addressing the actions necessary for the protection and restoration of [steelhead trout] and other species of concern that depend on aquatic and riparian habitats throughout the watershed" (San Mateo County Resource Conservation District, 2006). The plan will build on the 1996 *Pilarcitos Creek Restoration Plan*, and a Memorandum of Understanding has been developed among the 19 participants in the workgroup to outline the process for developing the plan (Pilarcitos Creek Restoration Workgroup, 2007). It is expected that the *Pilarcitos Creek Integrated Watershed Management Plan* will be completed in 2008. This plan is considered in the cumulative analysis of the WSIP water supply and system operations, as discussed in Section 5.7.

City and County of San Francisco Plans and Policies

Chapter 4, Section 4.2, Plans and Policies, provides an overview of the relationship of CCSF planning documents to the WSIP and discusses the specific CCSF plans and policies that pertain to the WSIP facility improvement projects. This section focuses on those plans and polices that relate to the WSIP water supply and system operations.

San Francisco General Plan

Section 4.2.2 provides an overview of the San Francisco General Plan. Although the majority of policies contained in the general plan were developed for lands within San Francisco and are not generally relevant to extraterritorial lands, several policies and objectives provided in the Environmental Protection Element are relevant to the proposed operational changes and sources of water supply under the WSIP. The Fresh Water sub-element of the Environmental Protection Element of the San Francisco General Plan includes objectives aimed at the protection of freshwater resources (Objective 6) in conjunction with responsible utilization of these resources for water supply (Objective 5). Policies associated with the reliability of the regional water system include Policy 5.1 and Policy 5.2. Policy 5.3 and Policy 5.4 address water quality; Policy 6.1 specifies the continued implementation of a leak detection program; and Policy 6.2 deals with water reclamation. The Flora and Fauna sub-element of the Environmental Protection Element deals with the protection of plant and animal life (Objective 8) and specifies the protection of plant and animal species and their habitats through coordination with animal protection programs (Policy 8.1, Policy 8.2, Policy 8.3). Specific impacts on potentially affected

[6] Participating organizations in the Pilarcitos Creek Restoration Workgroup include: the SFPUC, California State Parks, San Mateo County Resource Conservation District, San Francisco Bay Regional Water Quality Control Board, Pilarcitos Creek Advisory Council, City of Half Moon Bay, Coastside County Water District, Committee for Green Foothills, Gulf of the Farallones National Marine Sanctuary, Half Moon Bay Fishermans Association, Midpeninsula Regional Open Space District, California Department of Fish and Game, Monterey Bay National Marine Sanctuary, National Marine Fisheries Service, Peninsula Open Space Trust, Pilarcitos Creek Advisory Committee, San Mateo County Farm Bureau, Sewer Authority Mid-Coastside, and Surfrider Foundation–San Mateo Chapter.

resources covered in this plan—including water and biological resources—resulting from implementation of the WSIP water supply and system operations are analyzed by watershed in the corresponding sections of this chapter.

San Francisco Sustainability Plan

The San Francisco Board of Supervisors endorsed the *San Francisco Sustainability Plan* in 1997, but has not committed the City to perform the actions addressed in the plan. The plan serves as a blueprint for sustainability, with many of its individual proposals requiring further development and public comment. The underlying goals of the plan are to maintain the physical resources and systems that support life in San Francisco and to create a social structure that will allow such maintenance. The plan is divided into 15 topic areas, 10 that address specific environmental issues (air quality; biodiversity; energy, climate change, and ozone depletion; food and agriculture; hazardous materials; human health; parks, open spaces and streetscapes; solid waste; transportation; and water and wastewater), and five that are broader in scope and cover many issues (economy and economic development, environmental justice, municipal expenditures, public information and education, and risk management). Under the topic "Water," there are goals addressing water reuse, water quality, adequacy of water supply, groundwater supply, and infrastructure. Each topic area in the plan has a set of indicators to be used over time in determining whether San Francisco is moving in a sustainable direction in that particular area (CCSF, 1997).

Specific impacts on potentially affected resources addressed in this plan—including water and groundwater resources—resulting from implementation of the WSIP water supply and system operations are analyzed by watershed in the corresponding sections of this chapter.

San Francisco Urban Water Management Plan

As discussed in *2005 Urban Water Management Plan for the City and County of San Francisco*, approximately 96 percent of the city's total water supply is provided by the SFPUC regional water system. The remaining 4 percent of the water demand is met through locally produced, nonpotable groundwater and secondary-treated recycled water used for irrigation. San Francisco overlies all or part of seven groundwater basins. Of these, only the Westside Basin and the Lobos Basin are considered adequate for municipal supplies. Groundwater pumped from wells located in Golden Gate Park and at the San Francisco Zoo is used by the Recreation and Park Department for irrigation. Tertiary-treated recycled water from the SFPUC's Southeast Water Pollution Control Plant is used on a limited basis for washdown operations.

The 2005 UWMP identifies various local water supply plans and programs that represent potential options to maximize resources and minimize the need to import water. These include ongoing implementation of water conservation programs; implementation of the *Recycled Water Master Plan* (SFPUC, 2006a), which explores additional opportunities for recycled water use in San Francisco; and implementation of the *Draft North Westside Basin Groundwater Management Plan*, which identifies several new local groundwater projects to produce an additional 2 million gallons per day of groundwater for potable purposes (SFPUC, 2005).

Information in the UWMPs of both the retail and wholesale customers of the regional water system, including the CCSF and applicable Bay Area Water Supply and Conservation Agency members, was used in the development of the WSIP level of service water supply goal for 2030.

SFPUC Watershed Management Plans

The SFPUC has adopted watershed management plans for CCSF-owned lands in the Alameda and Peninsula watersheds to provide a policy framework for activities and actions on watershed lands. Watershed lands are managed by the SFPUC Natural Resources Division, Land and Resource Management Section. The plans provide goals, policies, and management actions that address watershed activities and reflect the unique qualities of each watershed. Changes in system operations proposed under the WSIP would be required to conform to the goals, policies, and management actions contained in the Alameda and Peninsula Watershed Management Plans (WMPs) as well as applicable environmental codes and regulations. Specific impacts on affected resources covered in these plans—including water, biological, recreational, and visual resources—resulting from implementation of the WSIP water supply and system operations are analyzed for the Alameda and Peninsula watersheds in the corresponding sections of this chapter.

For both watershed plans, the SFPUC considers water quality protection as the first and foremost goal. The goals and policies are organized around the primary goal of water quality protection and six secondary goals pertaining to water supply, natural resource protection, watershed protection, land use compatibility, fiscal management, and public awareness. The primary and secondary goals were established by the Watershed Planning Committee, a group of SFPUC division and department representatives who assisted in plan development and review. The primary and secondary goals in common to both watershed management plans are as follows:

- *Primary Goal*: Maintain and Improve Source Water Quality to Protect Public Health and Safety

- *Secondary Goals*:
  - Maximize water supply
  - Preserve and enhance the ecological and cultural resources of the watershed
  - Protect the watersheds, adjacent urban areas, and the public from fire and other safety hazards
  - Continue existing compatible uses and provide opportunities for potential compatible uses on watershed lands, including educational, recreational, and scientific uses
  - Provide a fiscal framework that balances financial resources, revenue-generating activities, and overall benefits and an administrative framework that allows implementation of the watershed management plans
  - Enhance public awareness of water quality, water supply, conservation, watershed protection issues

Alameda Watershed Management Plan

The SFPUC's Alameda WMP is described in Chapter 4, Section 4.2, in the context of WSIP facilities improvement projects located in the Alameda watershed. The Alameda watershed lands are shown in Figure 2.2. The Alameda WMP provides a policy framework for the SFPUC to make consistent decisions about the activities, practices, and procedures that are appropriate on CCSF-owned lands in the Alameda watershed to protect the watershed and ensure a pure and reliable supply for San Francisco. The plan applies best management practices for the protection of water and natural resources and their conservation, enhancement, restoration, and maintenance and is intended to be used by the SFPUC as watershed management implementation guidelines.

Peninsula Watershed Management Plan

The SFPUC's Peninsula WMP is described in Chapter 4, Section 4.2, in the context of WSIP facilities improvement projects located in the Peninsula watershed. The Peninsula watershed lands are shown in Figure 2.3.The Peninsula WMP was developed in the same manner as the Alameda WMP and consists of the same primary and secondary goals as those contained in the Alameda WMP; however, some policies contained in the plan have been formulated to address the specific management issues of the Peninsula watershed.

SFPUC Habitat Conservation Plans

As part of watershed management plan implementation, the SFPUC is in the process of developing HCPs for the Alameda and Peninsula watersheds, as discussed in Chapter 4, Section 4.2. Both watersheds contain known habitat for sensitive species, and the HCPs are being developed in compliance with federal and state regulations for endangered species protection. The draft HCP for the Alameda watershed is scheduled for public review in 2007, and the draft HCP for the Peninsula watershed is scheduled for public review in 2008. Both plans will require preparation of a joint environmental impact report/environmental impact statement before the SFPUC can consider adoption and begin implementation. (See Chapter 4, Section 4.2, for additional information regarding the development of HCPs for the SFPUC Alameda and Peninsula watersheds.)

Although the HCPs are still under development, specific WSIP impacts on the resources anticipated to be covered in the plans—particularly steelhead and other federal- or state-listed biological resources—are analyzed for the Alameda and Peninsula watersheds in the corresponding sections of this chapter.

SFPUC Water Enterprise Environmental Stewardship Policy

Adopted in June 2006, the Water Enterprise Environmental Stewardship Policy established the long-term management direction for CCSF-owned lands and natural resources affected by operation of the SFPUC regional water system within the Tuolumne River, Alameda Creek, and Peninsula watersheds (SFPUC, 2006b). It also addresses rights-of-way and properties in urban surroundings under SFPUC management. The policy includes the following specifically relevant to the proposed water supply and system operations:

- The SFPUC will proactively manage the watersheds under its responsibility in a manner that maintains the integrity of the natural resources, restores habitats for native species, and enhances ecosystem function.

- To the maximum extent practicable, the SFPUC will ensure that all operations of the SFPUC water system (including water diversion, storage, and transport), construction and maintenance of infrastructure, land management policies and practices, purchase and sale of watershed lands, and lease agreements for watershed lands protect and restore native species and the ecosystems that support them.

- It is the policy of the SFPUC to operate the SFPUC water system in a manner that protects and restores native fish and wildlife downstream of SFPUC dams and water diversions, within SFPUC reservoirs, and on SFPUC watershed lands.

- Releases from SFPUC reservoirs will mimic the variation of the seasonal hydrology (e.g., magnitude, timing, duration, and frequency) of their corresponding watersheds in order to sustain the aquatic and riparian ecosystems upon which these native fish and wildlife species depend (consistent with the SFPUC mission, existing agreements, and applicable state and federal laws).

- The SFPUC will actively monitor the health of the terrestrial and aquatic habitats, both under SFPUC ownership and affected by SFPUC operations, in order to continually improve ecosystem health.

The Environmental Stewardship Policy calls for implementation and update of the Alameda and Peninsula WMPs (described above), development of habitat conservation plans for the Alameda and Peninsula watersheds (described above), and development and implementation of the Watershed Environmental Improvement Program (described in Chapter 3, Section 3.12, WSIP-Related Activities), as well as specific integration of this policy into the WSIP and individual infrastructure projects.

General Plans of Potentially Affected Counties

Chapter 4, Section 4.2.2, describes the applicability of city and county general plan policies to the WSIP facility improvement projects; much of that discussion also applies to the proposed WSIP water supply and system operations. No local agency approvals other than those of the CCSF are expected to be needed for the proposed water supply and system operations (see Chapter 3, Section 3.13). Any county required to determine consistency of a part of the WSIP with their general plan pursuant to California Government Code 65402(b) would be notified by the SFPUC prior to implementation. Notwithstanding the limited authority of cities and counties over implementation of the WSIP, where CCSF-owned facilities are sited and operated outside of San Francisco, the SFPUC seeks to work cooperatively with cities and counties to avoid conflicts with local plans and policies. For the WSIP, a key issue for local agencies that receive all or part of their water from the SFPUC is whether the WSIP adequately addresses community goals regarding water service for existing and future land uses; this topic is addressed in Section 4.2.3. A second issue of importance to local agencies is whether implementation of the WSIP would be consistent with community goals regarding resource protection. Counties in which WSIP

operations could result in surface water or groundwater hydrology impacts and/or secondary biological effects include the following:

- Tuolumne
- Stanislaus
- Alameda
- San Joaquin
- Santa Clara
- San Mateo

Table 5.2-2 presents an overview of policies and goals from these counties' general plans that address water resources management and biological resources. The issues shown in the table are addressed in the impact analyses presented in Chapter 5. The only significance criterion applicable to the impact analysis in Chapter 5 regarding WSIP compatibility with certain aspects of local land use plans and polices is "Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan." This impact is analyzed in Sections 5.3.7, 5.4.6, and 5.5.6, Terrestrial Biological Resources in the Tuolumne, Alameda Creek, and Peninsula watersheds, respectively.

TABLE 5.2-2
SUMMARY OF GENERAL PLAN POLICIES OF COUNTIES
WITH SURFACE WATER AND GROUNDWATER RESOURCES
POTENTIALLY AFFECTED BY THE PROPOSED WSIP WATER SUPPLY AND SYSTEM OPERATIONS

Resource Area	Summary Description of General Plan Policy
Water Resources Management	Preserve water resources for all beneficial uses of water; ensure the adequate quantity and quality of water for municipal and industrial uses, agriculture, recreation, fish and wildlife, and Delta outflows for salinity repulsion.
	Recognize surface water resources of state and national significance for which environmental and scenic values must be protected; minimize alteration of natural water bodies; support "properly timed, sufficient flows" in rivers.
	Protect groundwater resources.
Biological Resources	Develop comprehensive watershed management plans to assure that cumulative impacts on water quality, reservoir operations, and watershed resources are addressed and mitigated.
	Recognize and protect resources of significant biological and ecological importance; protect habitats of rare and endangered fish and wildlife species; maintain adequate stream/river flows for salmon migration; protect fish and wildlife habitat and recreational uses when implementing water diversion projects; require that water projects contain safeguards to protect fish and wildlife; design public projects to avoid damage to freshwater and stream environments; require mitigation of impacts on sensitive areas (e.g., riparian habitats, vernal pools, rare plants, flyways, and other waterfowl habitats); restore freshwater habitats.
	Protect and restore natural resources like wetlands and riparian areas; achieve a "no net loss" of wetland areas through avoidance, protection, and appropriate mitigation; protect riparian habitat along rivers and natural waterways; address potential impacts on waterways and wetlands resulting from increased erosion and siltation.

Specific impacts on affected resources addressed in these plans—including water, biological, recreational, and visual resources—resulting from implementation of the WSIP water supply and system operations are analyzed by watershed in the corresponding sections of this chapter.

5.2.4 Plan Consistency Evaluation

The evaluation of plan/policy consistency in this section is based on the applicability of adopted plans and policies to the proposed WSIP water supply and system operations and associated effects. The consistency evaluation in this PEIR represents the best attempt to advise the decision-makers as to whether the proposed program is consistent with applicable *adopted* land use and resource plans and policies. No consistency determination is made for draft plans/policies, plans in development, guidance/planning documents, or agreements. However, the resources addressed in the draft plans/policies or guidance/planning documents are evaluated in the impact analyses in the appropriate sections of this chapter. In general, implementation of the WSIP would be consistent with natural resource and other applicable plans described in Section 5.2.3, particularly with respect to the WSIP sustainability goal of managing natural resources and physical systems to protect watershed ecosystems and with implementation of mitigation measures identified in this PEIR.

Consistency with Regional Natural Resource Protection Plans

WQCPs identify water quality issues and prescribe enforceable water quality objectives/criteria for specific water bodies and their tributaries. Because these standards are based on designated beneficial uses of the respective waterways, violation of the water quality objectives/criteria can adversely affect fish, wildlife, and other protected resources. SFPUC operations currently comply with water quality standards contained in the WQCPs, and the WSIP goals and objectives would be consistent with the applicable WQCPs. The potential impacts of WSIP implementation on water quality in the Tuolumne River watershed, Alameda Creek watershed, Peninsula watershed, and Westside Groundwater Basin are analyzed in Sections 5.3.3, 5.4.3, 5.5.3, and 5.6, respectively.

One adopted HCP covering an area that could be affected by WSIP implementation was identified; this plan was prepared by the City of Waterford for the incidental take of valley elderberry longhorn beetle (VELB) on the Tuolumne River at a location between La Grange Dam and Modesto. The goals and objectives of the WSIP would be consistent with this HCP, and, as described in Section 5.3.7, implementation of the WSIP would not adversely affect the VELB or elderberry population in this plan area.

Consistency with CCSF Plans and Policies

San Francisco General Plan

The San Francisco General Plan provides general environmental resource policies related to the protection of natural resources, including freshwater resources. The WSIP goals and objectives would be consistent with the goals and objectives of this plan, and more specifically with policies related to freshwater resources. The impact analyses presented in Sections 5.3 through 5.7 of this chapter assess the potential for physical environmental impacts from implementation of the WSIP water supply and system operations. The impact analyses identify a variety of potentially significant physical impacts under all environmental topics, but, as described in those sections,

many of these impacts would be reduced to a less-than-significant level with implementation of mitigation measures and compliance with applicable regulations, as outlined in Chapter 6.

San Francisco Sustainability Plan

The *San Francisco Sustainability Plan* was developed for the purpose of addressing San Francisco's long-term environmental sustainability. Water supply goals relevant to the WSIP deal with ensuring a sustainable and adequate water supply; maximizing public health by providing safe drinking water; ensuring public input into the water planning process; restoring and enhancing groundwater supplies; and upgrading infrastructure in a timely and environmentally sound manner. The WSIP water supply and system operations, and particularly the WSIP sustainability objective, would be consistent with the goals of the Sustainability Plan. The WSIP would be consistent with goals pertaining to increasing water reuse, ensuring an adequate water supply under normal and extraordinary conditions, restoring groundwater supplies, and upgrading infrastructure.

San Francisco Urban Water Management Plan

The *2005 Urban Water Management Plan for the City and County of San Francisco* evaluates regional water system reliability and the SFPUC's existing and planned sources of water supply. The plan describes demand management measures to be implemented and provides an implementation strategy and schedule for future planned projects and schedules. Information in the UWMP was used in the development of WSIP levels of service and complements the operational strategy and future water supplies proposed under the WSIP. Therefore, the WSIP is and would be inherently consistent with the UWMP.

Consistency with Adopted SFPUC Plans and Policies

Alameda and Peninsula Watershed Management Plans

Watershed management plans prepared by the SFPUC for the purpose of water resource management and planning provide much of the framework used in the development of various components of the WSIP. The Peninsula and Alameda WMPs are designed to improve the SFPUC's ability to protect its overall watershed as well as the specific resources that make up the watershed. The WMPs include goals and policies related to maximizing the local water supply and improving source water quality to protect public health and safety; these goals are aligned with the goals of the WSIP. As part of implementing the WMPs, the SFPUC Natural Resources Division will review WSIP activities proposed within these watersheds for conformity with the WMPs as well as for compliance with environmental codes and regulations; thus, changes in system operations proposed under the WSIP would be reviewed for conformity with the goals, policies, and management actions contained in the Alameda and Peninsula WMPs. Overall, the WSIP would be consistent with the WMPs. Potential impacts of WSIP system operations on water quality and biological resources in the Alameda and Peninsula watersheds are described in Sections 5.4 and 5.5 of this chapter.

SFPUC Water Enterprise Environmental Stewardship Policy

The WSIP would be consistent with the underlying goals of the Water Enterprise Environmental Stewardship Policy, particularly with respect to the WSIP sustainability goal and the WSIP objective to manage natural resources and physical systems to protect watershed ecosystems. The Stewardship Policy implementation strategy specifically calls for integration of the policy into the WSIP. However, implementation of the proposed water supply and system operations would affect stream flow in the Tuolumne River, Alameda Creek, and Peninsula watersheds, as analyzed and described in Sections 5.3.1, 5.4.1, and 5.5.1. This operational change and resultant effects on stream flow could in turn affect native fish and wildlife downstream of SFPUC dams and water diversions, within SFPUC reservoirs, and on SFPUC watershed lands. Impacts on fisheries and the terrestrial biological resources in the Tuolumne River, Alameda Creek, and Peninsula watersheds are analyzed in Sections 5.3.6, 5.3.7, 5.4.5, 5.4.6, 5.5.5, and 5.5.6. Mitigation measures described in Chapter 6 identify operational approaches to managing releases from SFPUC reservoirs and other measures to reduce impacts on fisheries and other biological resources.

Consistency of WSIP Operations with the General Plans of Potentially Affected Counties

Overall, the WSIP water supply and system operations would be generally consistent with the community goals related to water resources protection described above. Through preparation of this PEIR and attendant scoping and public outreach efforts, the CCSF has systematically identified significant environmental impacts associated with the WSIP as well as feasible measures and alternatives to avoid or substantially lessen such effects. The impact analyses presented in this PEIR reflect the intent of general plan policies related to the protection of water resources. As detailed throughout the rest of Chapter 5, most of the environmental impacts associated with the proposed water supply and system operations would be reduced to a less-than-significant level with measures proposed as part of the WSIP or otherwise committed to by the SFPUC.

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5.3 Tuolumne River System and Downstream Water Bodies

Section 5.3 Subsections	
5.3.1	Stream Flow and Reservoir Water Levels
5.3.2	Geomorphology
5.3.3	Surface Water Quality
5.3.4	Surface Water Supplies
5.3.5	Groundwater
5.3.6	Fisheries
5.3.7	Terrestrial Biological Resources
5.3.8	Recreational and Visual Resources
5.3.9	Energy Resources
(References included under each section)	

5.3.1 Stream Flow and Reservoir Water Levels

The following setting section describes the streams and reservoirs in the Tuolumne River watershed and downstream that could be affected by the WSIP. The impact section (Section 5.3.1.2) provides a description of the changes in stream flow and reservoir water levels that would result from implementation of the WSIP.

5.3.1.1 Setting

The Tuolumne River flows from the crest of the Sierra Nevada westward to its confluence with the San Joaquin River. The San Joaquin River flows north to the Sacramento–San Joaquin Delta. Water from the Delta discharges to the San Francisco Bay Estuary and the Pacific Ocean.

Surface water bodies in the Tuolumne River system that could be affected by the proposed program include the Tuolumne River, Cherry Creek, Eleanor Creek, and a quarter-mile reach of Moccasin Creek. Several reservoirs could be affected by the WSIP, including Hetch Hetchy Reservoir, Lake Lloyd, Lake Eleanor, and Don Pedro Reservoir. Because the Tuolumne River drains to the San Joaquin River and the Sacramento–San Joaquin Delta, these water bodies could also be affected by the WSIP. The proposed program could affect flow in the streams and water levels and water quality in the reservoirs.

Tuolumne River

General Description

The Tuolumne River rises in Yosemite National Park and flows approximately 130 miles to its confluence with the San Joaquin River about 10 miles west of the city of Modesto. Its headwaters are streams that descend the slopes of Mount Lyell and Mount Dana in the Sierra Nevada and join

to form the river itself at Tuolumne Meadows. The Tuolumne River drains an area of 1,958 square miles. Its watershed is shown in **Figure 5.3.1-1**.

From Tuolumne Meadows (at an elevation of 8,600 feet above sea level), the river descends rapidly through a deep canyon in wilderness areas of Yosemite National Park to Hetch Hetchy Reservoir (at an elevation of about 3,500 feet). Six miles below O'Shaughnessy Dam, which impounds Hetch Hetchy Reservoir, the Tuolumne River leaves Yosemite National Park and enters the Stanislaus National Forest. Except for a short reach at Early Intake Reservoir, the river flows unimpeded through a deep canyon for approximately 40 miles, from O'Shaughnessy Dam to the upstream end of Don Pedro Reservoir.

Don Pedro Reservoir is at an elevation of about 500 feet. Several tributaries, including Cherry Creek, Jawbone Creek, the Clavey River, the North Fork of the Tuolumne River, and Turnback Creek, join the river from the north between Hetch Hetchy and Don Pedro Reservoirs. The South Fork of the Tuolumne joins the river from the south. Moccasin Creek and Woods Creek drain directly into Don Pedro Reservoir.

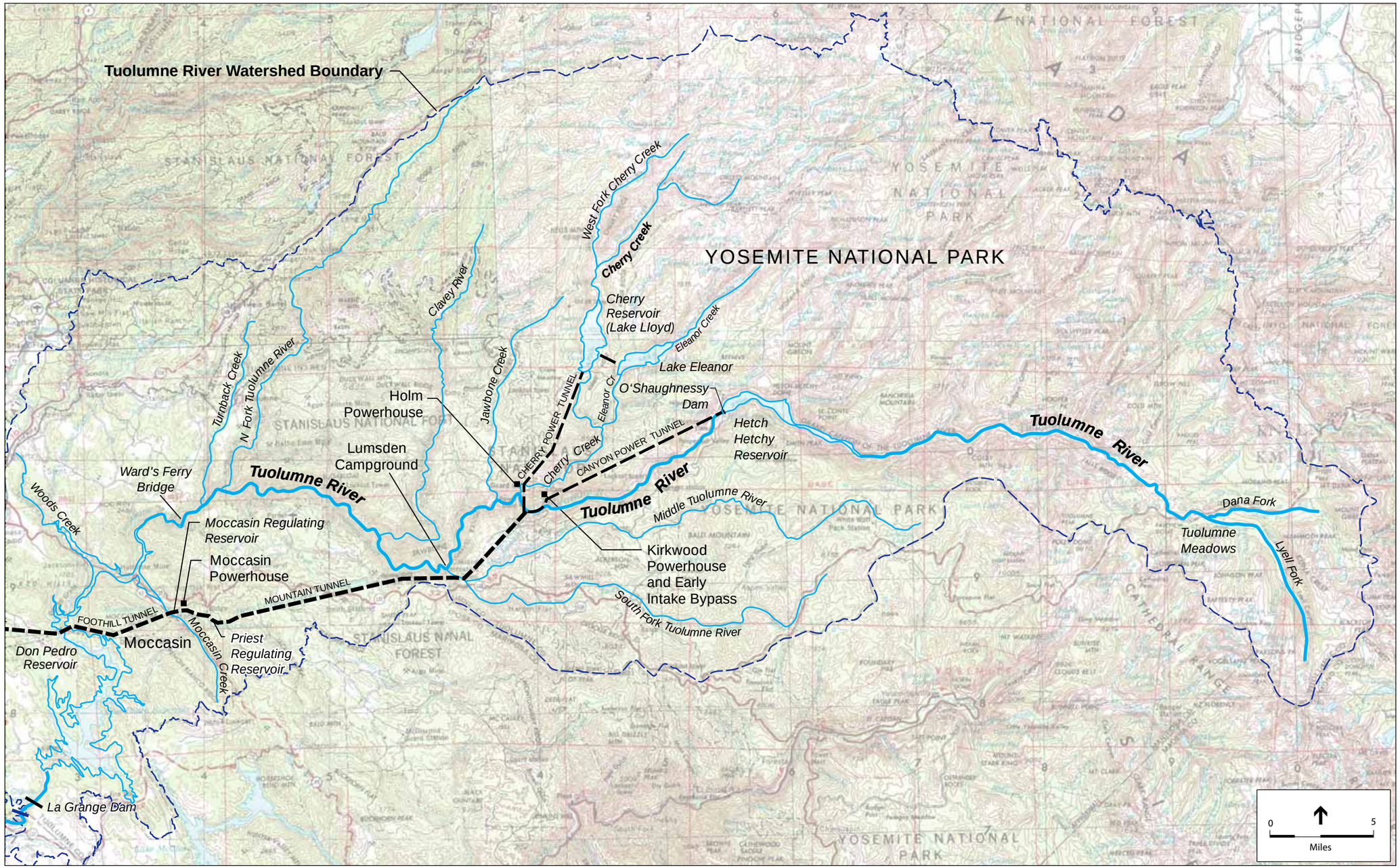
Below Don Pedro Reservoir, the Tuolumne River flows 2.3 miles to La Grange Dam, where water is diverted into two irrigation canals. Below La Grange Dam, the Tuolumne River descends through the Sierra Nevada foothills to the floor of the San Joaquin Valley and on to its confluence with the San Joaquin River, which is at an elevation of about 60 feet above sea level. This reach of the river flows through land used primarily for irrigated agriculture. A major tributary, Dry Creek, joins the river from the north in the city of Modesto.

Runoff in the Tuolumne River basin is produced by rainfall and snowmelt. Rainfall runoff occurs primarily in the Sierra foothills and the valley floor between December and March. Runoff from the upper basin is produced by snowmelt and occurs primarily between April and July. Annual runoff in the Tuolumne River basin is highly variable. Average annual "unimpaired" runoff[1] at Don Pedro Reservoir is estimated to be about 1.85 million acre-feet for the period from 1918 to 1991. The maximum estimated value is 3.84 million acre-feet in 1969, and the minimum is 0.39 million acre-feet in 1977 (Beck, 1992).

Stream Flow and Water System Operations

Flow in the Tuolumne River remained unaffected by humans until the 1860s, when water from the lower reaches of the river began to be diverted for agricultural irrigation. In 1871, a private company constructed Wheaton Dam near the site of present-day La Grange Dam. Wheaton Dam was used to divert water into irrigation canals. In 1887, the newly formed Turlock Irrigation District (TID) and Modesto Irrigation District (MID) constructed a new diversion dam, La Grange Dam, to replace Wheaton Dam (TID/MID, 2005).

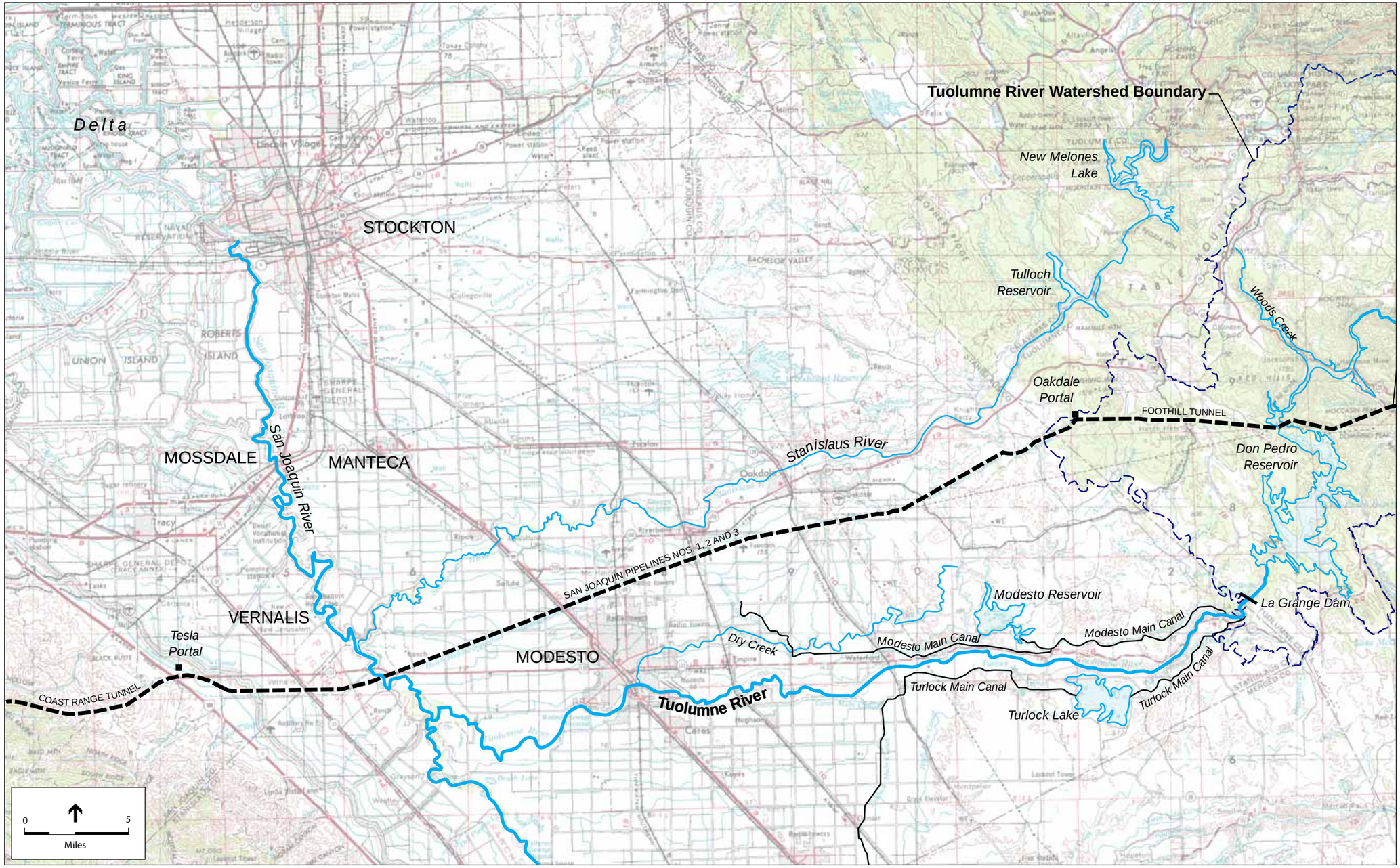
[1] Unimpaired flow at a point on a river is the flow that would have occurred if there were no upstream water diversions or storage reservoirs. For the Tuolumne River, it is roughly equivalent to "natural flow"; that is, the flow that would have occurred prior to Euro-American settlement.



SOURCE: ESA+Orion, 2006; USGS 1970

SFPUC Water System Improvement Program . 203287

Figure 5.3.1-1a
Tuolumne River Watershed,
Headwaters to Don Pedro Reservoir



SOURCE: ESA+Orion, 2006; USGS 1970

SFPUC Water System Improvement Program . 203287

Figure 5.3.1-1b

Tuolumne River Watershed,
Don Pedro Reservoir to San Joaquin River

Early in the 20th century, development of the Tuolumne River accelerated. In 1918, the City and County of San Francisco (CCSF) completed Lake Eleanor, a reservoir on Eleanor Creek. Eleanor Creek is a tributary of Cherry Creek, which is itself a tributary of the Tuolumne River. Hetch Hetchy Reservoir and the original Don Pedro Reservoir, on the main stem of the river, were completed in 1923 (Hetch Hetchy by the CCSF and Don Pedro Reservoir by TID and MID). Hetch Hetchy Reservoir was expanded in 1938. In 1955, the CCSF completed Lake Lloyd on Cherry Creek. In 1971, TID and MID completed the new Don Pedro Reservoir, a much larger reservoir two miles downstream of the site of the original Don Pedro Reservoir (SFPUC, 2005).

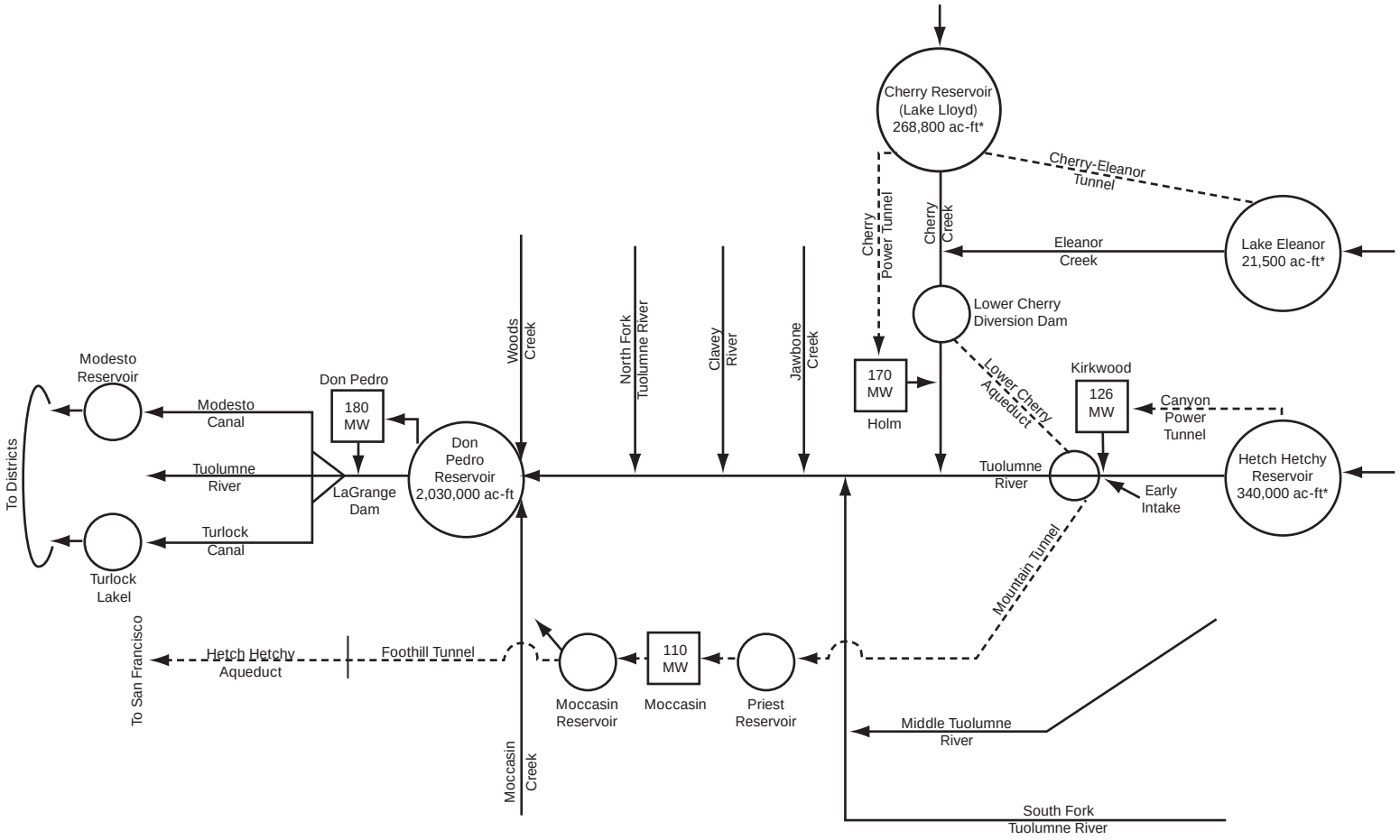
Hetch Hetchy Reservoir, Lake Eleanor, and Lake Lloyd are owned by the CCSF and operated by the SFPUC, and Don Pedro Reservoir is owned and operated by TID and MID. The CCSF paid a portion of the construction costs of Don Pedro Reservoir and in return has indirect access to, and control of, a portion of the storage capacity of the reservoir by means of a water banking arrangement with the districts.[2]

Figure 5.3.1-2 is a diagrammatic representation of the natural features of the Tuolumne River showing the water and hydropower facilities that affect flow in the river. The figure also shows the approximate storage capacity of the reservoirs and the electrical generation capacity of the hydropower facilities.

The SFPUC diverts water from Hetch Hetchy Reservoir in the upper Tuolumne River basin and conveys it to the Bay Area in the Hetch Hetchy Aqueduct. The Hetch Hetchy Aqueduct consists of a series of facilities extending from Hetch Hetchy Reservoir to Crystal Springs Reservoir in San Mateo County (see Figure 2.1 in Chapter 2). Water leaves Hetch Hetchy Reservoir in the Canyon Power Tunnel, which delivers water to Kirkwood Powerhouse at Early Intake. Water leaving the powerhouse is either returned to the Tuolumne River or discharged into the Mountain Tunnel. The Mountain Tunnel conveys water to Priest Reservoir and Moccasin Powerhouse. Water discharged from Moccasin Powerhouse is either returned to the Tuolumne River via Moccasin Reservoir and Moccasin Creek or discharged to the Foothill Tunnel for conveyance to the Bay Area. Priest and Moccasin Reservoirs are small reservoirs used to control flow into Moccasin Powerhouse and regulate discharge of water to Moccasin Creek.

The SFPUC diverts an average of 244,000 acre-feet per year (afy) (218 million gallons per day [mgd]) from the Tuolumne River at Hetch Hetchy Reservoir and uses it for municipal water supply to about 2.4 million people in Tuolumne, Alameda, Santa Clara, San Mateo, and San Francisco Counties. Additional water is diverted at Hetch Hetchy Reservoir for hydropower generation at Kirkwood Powerhouse, but is returned to the Tuolumne River below Early Intake. The water diverted by the SFPUC for water supply represents about 32.5 percent of the average annual unimpaired runoff at Hetch Hetchy Reservoir, which is estimated to be 749,607 acre-feet. **Figure 5.3.1-3** shows the historical record of water storage in Hetch Hetchy Reservoir, as reflected in water levels, from 1989 to 2005.

[2] The SFPUC does not have direct access to its portion of storage in Don Pedro Reservoir. Instead, the SFPUC diverts water at Hetch Hetchy Reservoir by withholding water that TID and MID are entitled to receive under the Raker Act, thereby reducing the SFPUC's storage in Don Pedro Reservoir.

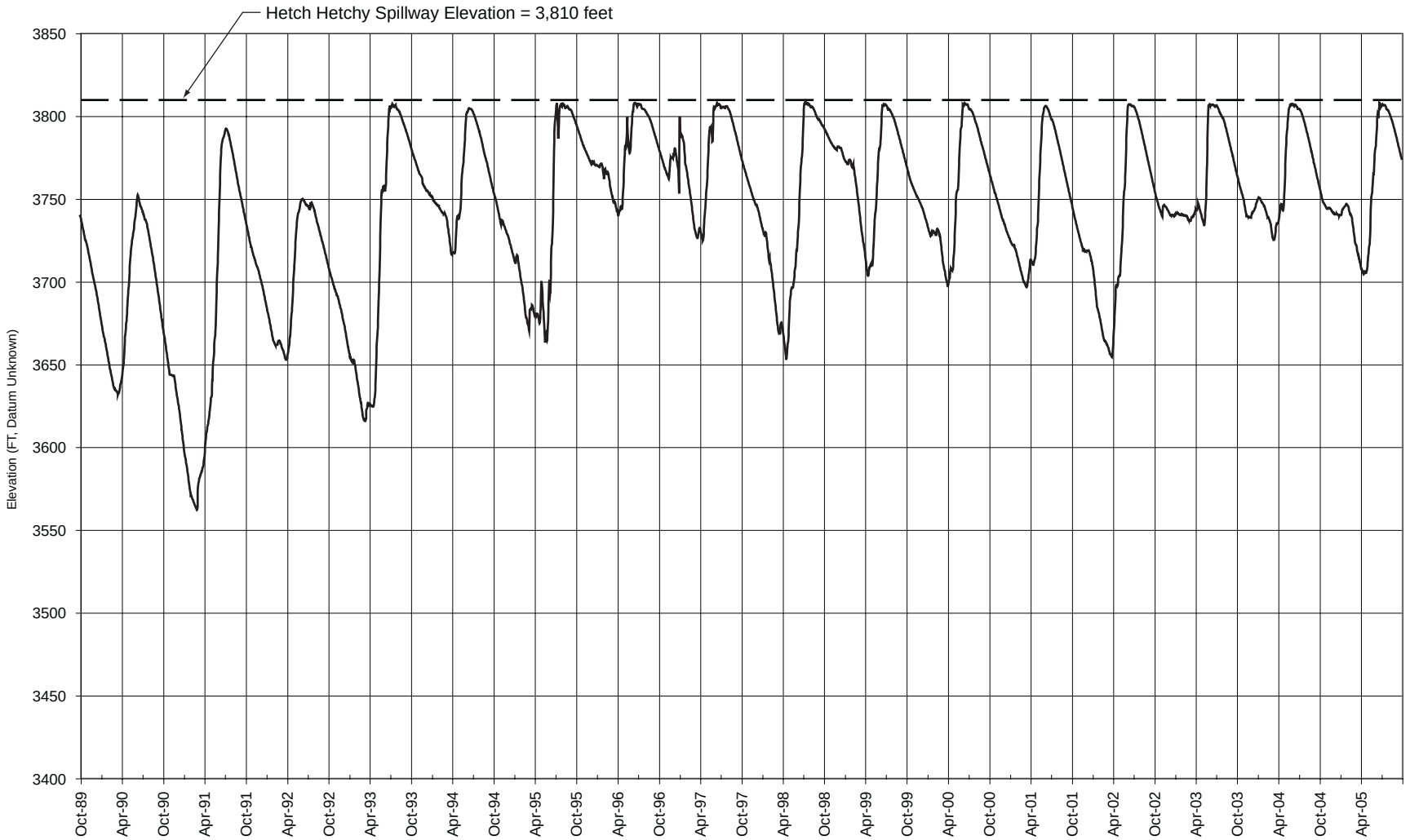


Districts = Turlock Irrigation District and Modesto Irrigation District

*Reservoir capacities without flashboards installed and with drum gates lowered.

SOURCE: Beck, 1992; SFPUC, 2004

Figure 5.3.1-2
Tuolumne River Schematic
Showing Water and Hydropower Facilities



SOURCE: SFPUC, 2007

Figure 5.3.1-3

Hetch Hetchy Reservoir, Historical Water Levels, 1989 to 2005

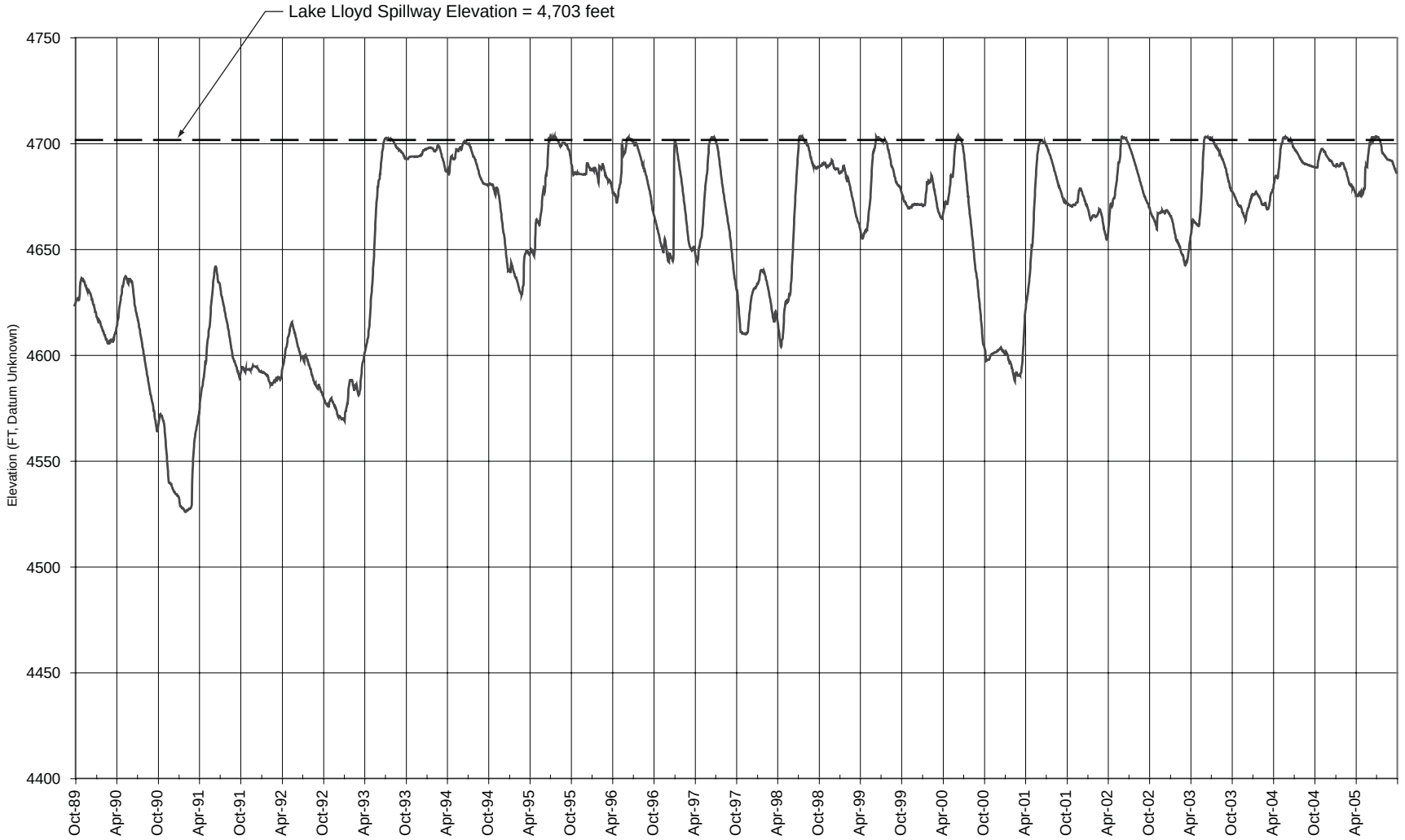
The SFPUC uses most of the water impounded in Lake Lloyd to generate electrical power at Holm Powerhouse. Water released from the powerhouse returns to Cherry Creek and is used to satisfy TID's and MID's flow entitlement. Water impounded in Lake Eleanor is conveyed to Lake Lloyd and then to Holm Powerhouse for electric power generation. **Figures 5.3.1-4** and **5.3.1-5** show the historical record of water storage in Lake Lloyd and Lake Eleanor, respectively, as reflected in water levels, from 1989 to 2005.

TID and MID divert water from the Tuolumne River at La Grange Dam. Water is conveyed to users in the two districts' service areas via the Modesto and Turlock Canals. Most of the users of water from the two canals are farmers, but some water is used for municipal supply by the city of Modesto. TID and MID typically divert 800,000 to 900,000 afy from the Tuolumne River. **Figure 5.3.1-6** shows the historical record of water storage in Don Pedro Reservoir, as reflected in water levels, from 1989 to 2005. Average annual unimpaired runoff at La Grange Dam is estimated to be 1,850,000 acre-feet. Thus, TID and MID currently divert 49.6 percent of the estimated average unimpaired flow of the Tuolumne River at La Grange. Together, the SFPUC, TID, and MID divert and use about 62.8 percent of the estimated average unimpaired flow of the Tuolumne River at La Grange.

Table 5.3.1-1 shows monthly average flows in the Tuolumne River below Hetch Hetchy Reservoir, below La Grange Dam, and at Modesto under current conditions, calculated from stream gaging records. Monthly average flows below Hetch Hetchy Reservoir range from 382 to 2,293 cubic feet per second (cfs) and peak in the late spring and early summer as the snow in the Sierra Nevada melts. Monthly average flows in the Tuolumne River below La Grange range from 243 to 1,884 cfs. Monthly average flows in the river at Modesto range from 431 to 2,236 cfs. Monthly average flows below La Grange and at Modesto peak in the late winter and early spring as a result of rainfall runoff and releases from Don Pedro Reservoir. Water may be released from Don Pedro Reservoir in the late winter and spring to provide capacity in the reservoir for floodwaters and snowmelt.

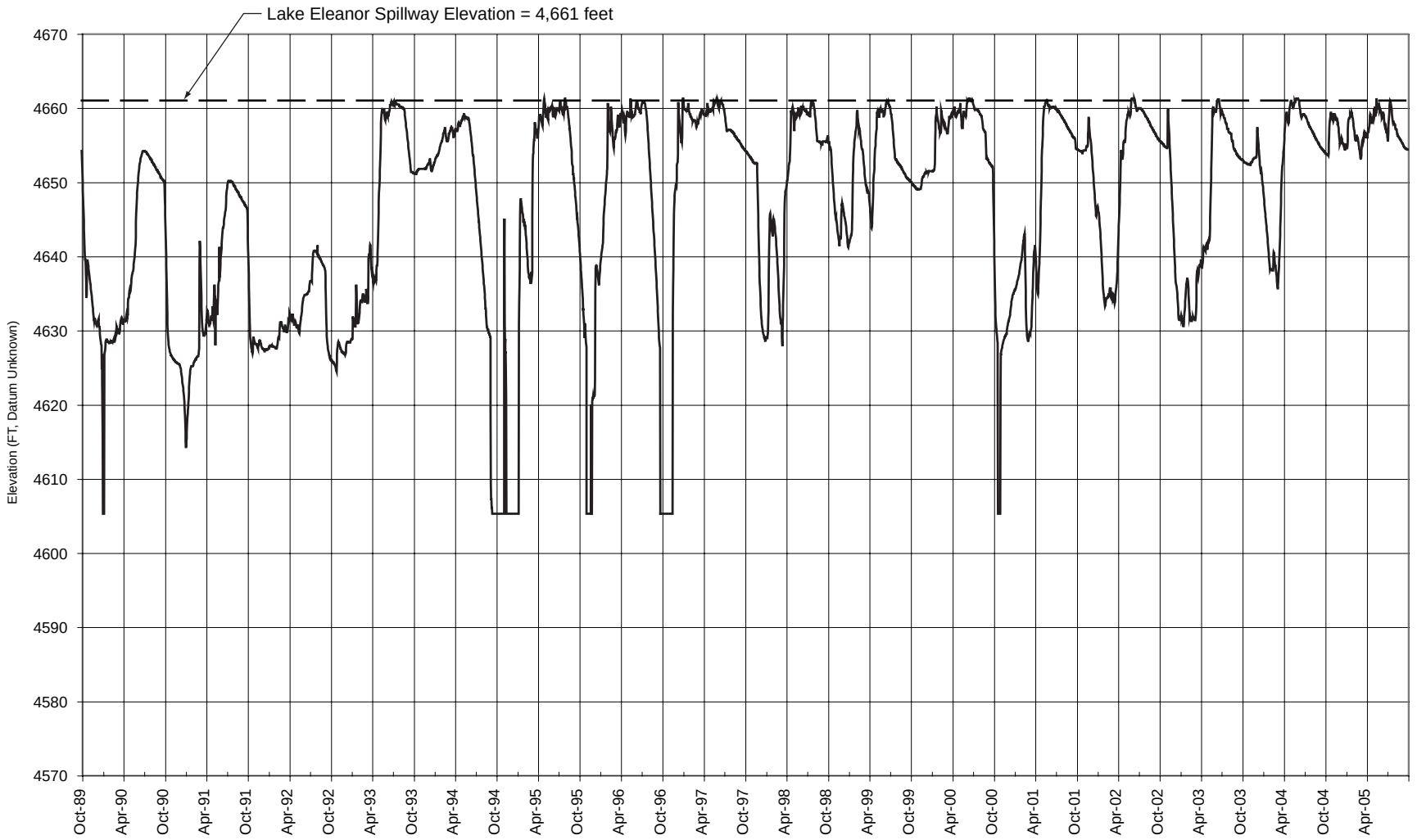
Reservoirs and diversions have altered the magnitude and seasonal patterns of flow in the Tuolumne River. Prior to construction of the reservoirs, the river experienced large and sustained flows in the spring as snow melted at higher elevations in the watershed. Now a portion of the spring flows is stored in the reservoirs for later municipal or agricultural use. Peak flows below reservoirs, particularly the large Don Pedro Reservoir, are greatly reduced from their historical value. The two-year return-period flood flow in the Tuolumne River downstream of La Grange Dam is 4,100 cfs; its predevelopment value was 21,000 cfs. The 20-year return-period flood flow on the Tuolumne River downstream of La Grange Dam is 11,000 cfs; its predevelopment value was 59,000 cfs (FERC, 1996).

As discussed below, various regulations and agreements require that reservoir operators maintain minimum flows in the Tuolumne River and its tributaries downstream of dams. During the late summer and early fall, the required minimum flows may be greater than those that occurred prior to development.



SOURCE: SFPUC, 2007

Figure 5.3.1-4
Lake Lloyd, Historical Water Levels, 1989 to 2005



SOURCE: SFPUC, 2007

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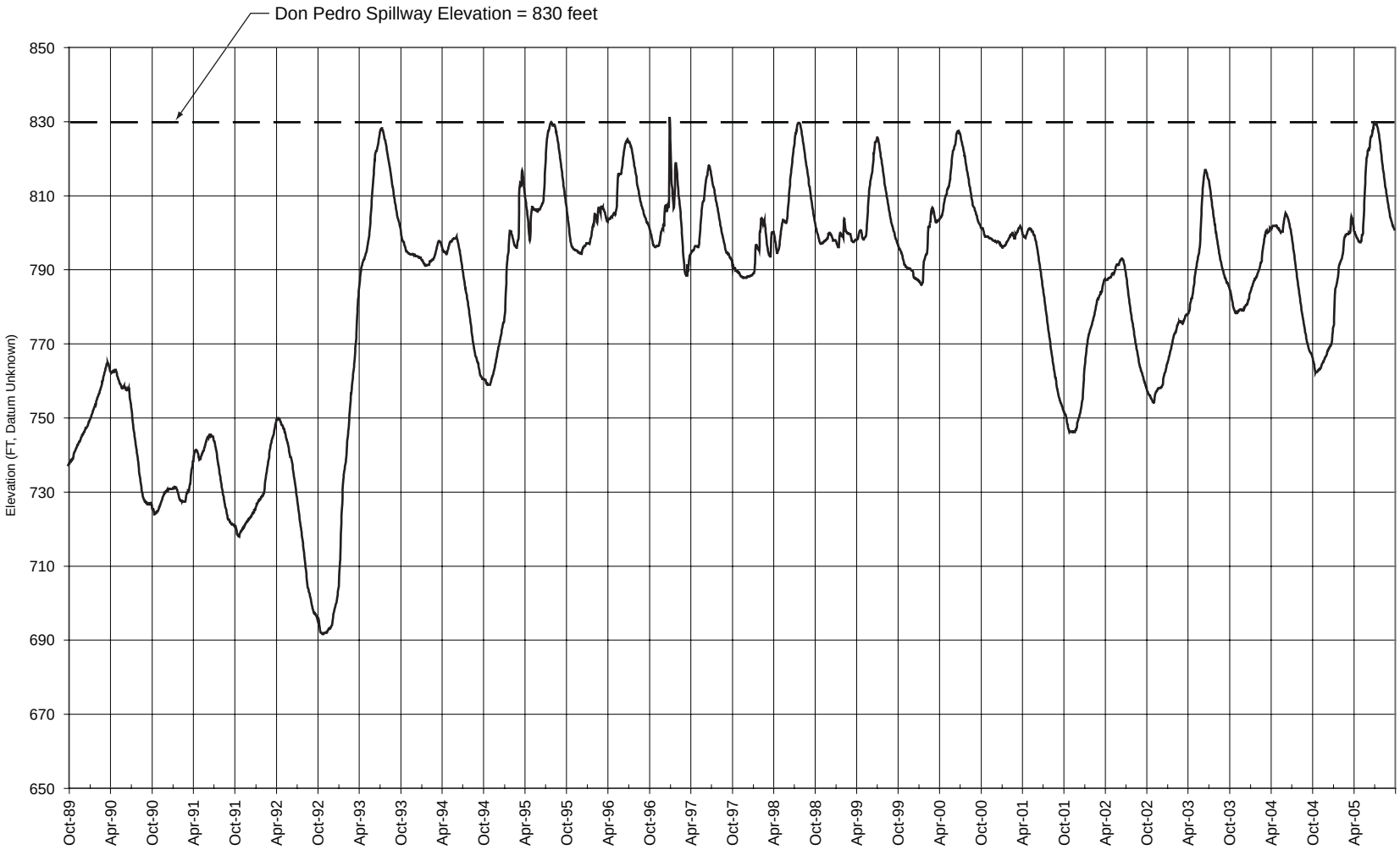
Figure 5.3.1-5

Lake Eleanor, Historical Water Levels, 1989 to 2005



SOURCE: SFPUC, 2007

Figure 5.3.1-6

Don Pedro Reservoir, Historical Water Levels, 1989 to 2005

TABLE 5.3.1-1
MEAN MONTHLY STREAM FLOWS AT SELECTED LOCATIONS ON WATERWAYS POTENTIALLY AFFECTED BY THE WSIP
(cubic feet per second)

Location	Tuolumne River below Hetch Hetchy	Tuolumne River below La Grange	Tuolumne River at Modesto	San Joaquin River at Newman	San Joaquin River at Vernalis	Delta Freshwater Outflow
Period	1937–2003	1974–2004	1974–2004	1942–2004	1943–2004	1984–2004
January	384	1,484	1,840	2,334	5,353	44,035
February	351	1,884	2,236	3,249	6,947	61,511
March	374	1,845	2,209	3,186	7,061	50,090
April	565	1,591	1,835	2,989	6,586	25,326
May	1,344	1,417	1,644	2,847	6,730	21,166
June	2,293	694	899	2,274	5,181	13,077
July	1,116	438	615	1,008	2,322	8,715
August	461	243	431	510	1,496	6,075
September	402	498	711	600	1,880	6,427
October	385	681	937	704	2,422	6,946
November	382	368	724	679	2,386	11,394
December	403	854	1,142	1,189	3,710	23,820

SOURCES: USGS, 2005a, 2005b, 2005c; DWR, 2007.

Minimum Releases to Support Fisheries

Dams and reservoirs alter the pattern of flow in the streams they impound. Depending on their size and type of use, these facilities can completely eliminate flow in the streams below the dams. The owners of some dams and reservoirs, including the SFPUC, MID, and TID, have agreed to make minimum releases to stream channels below dams to support fish and aquatic life.

Below Hetch Hetchy Reservoir. In accordance with an agreement with the U.S. Department of the Interior, the SFPUC releases a minimum stream flow from Hetch Hetchy Reservoir.[3] Minimum flow requirements depend on the hydrologic year type and are shown in **Table 5.3.1-2**. Releases in normal, dry, and critical years total at least 59,235, 50,019, and 35,215 acre-feet. The SFPUC must release an additional 64 cfs into the river below Hetch Hetchy Reservoir when the diversion through Canyon Tunnel exceeds 920 cfs. Finally, the agreement provides for an additional supplemental release, depending on hydrologic year type, subject to the completion of a fish habitat study and the determination of appropriate timing for the release. Once made, releases cannot be diverted below O'Shaughnessy Dam (i.e., at Early Intake); they flow down the Tuolumne River, are supplemented by tributary flow and releases at Kirkwood Powerhouse, and enter Don Pedro Reservoir.

[3] Stipulation for the Amendment of Rights-of-Way for Canyon Power Project Approved by Secretary of the Interior on May 26, 1961, to fulfill the conditions set forth in Provision 6 of said Amended Permit, dated January 31, 1985, *as modified by*, Modification for Kirkwood Powerhouse Unit No.3 to Stipulation for Amendment of Rights-of-Way for Canyon Power Project Approved by Secretary of the Interior on May 26, 1961, to fulfill the conditions set forth in Provision 6 of said Amended Permit, as dated March 10, 1987.

TABLE 5.3.1-2
SCHEDULE OF AVERAGE DAILY MINIMUM REQUIRED RELEASES TO SUPPORT FISHERIES BELOW O'SHAUGHNESSY DAM

Month	Year Type A		Year Type B		Year Type C
	Release	Criteria[a,b]	Release	Criteria[a,b]	Release
January	50 cfs	8.80 inches	40 cfs	6.10 inches	35 cfs
February	60 cfs	14.00 inches	50 cfs	9.50 inches	35 cfs
March	60 cfs	18.60 inches	50 cfs	14.20 inches	35 cfs
April	75 cfs	23.00 inches	65 cfs	18.00 inches	35 cfs
May	100 cfs	26.60 inches	80 cfs	19.50 inches	50 cfs
June	125 cfs	28.45 inches	110 cfs	21.25 inches	75 cfs
July	125 cfs	575,000 acre-feet	110 cfs	390,000 acre-feet	75 cfs
August	125 cfs	640,000 acre-feet	110 cfs	400,000 acre-feet	75 cfs
September 1–14	100 cfs		80 cfs		75 cfs
September 15–30	80 cfs		65 cfs		50 cfs
October	60 cfs		50 cfs		35 cfs
November	60 cfs		50 cfs		35 cfs
December	50 cfs		40 cfs		35 cfs

[a] Precipitation indicators in inches are cumulative, measured at Hetch Hetchy Reservoir, starting October 1. For example, if October 1 through December 31 precipitation is greater than or equal to 8.80 inches, refer to year type A schedule for January.
[b] Runoff indicators in acre-feet are the calculated inflow into Hetch Hetchy Reservoir commencing on the previous October 1 of each year.

SOURCE: See Footnote 3, page 5.3.1-12.

Below Lake Lloyd. The minimum required stream flow below Lake Lloyd is 5 cfs from October through June and 15 cfs from July through September.

Below Lake Eleanor. In years when no pumping occurs between Lake Eleanor and Lake Lloyd, the minimum required stream flow below Lake Eleanor is 5 cfs from October through June and 15.5 cfs from July through September. In years when pumping occurs, the minimum required stream flow is 5 cfs from November through February, 10 cfs from March 1 through April 14, 20 cfs from April 15 through September 15, and 10 cfs from September 16 through October.

Below Don Pedro Reservoir/La Grange Dam. TID and MID are required to maintain minimum stream flows in the Tuolumne River at La Grange Bridge below Don Pedro Reservoir and La Grange Dam as a condition of their license to operate the Don Pedro Project (issued by the Federal Energy Regulatory Commission, or FERC). Minimum required releases are 100 to 300 cfs from October 1 to 15 and 150 to 300 cfs from October 16 to May 31, depending on hydrologic conditions. From June 1 to September 30, the minimum required releases range from 50 to 250 cfs depending on hydrologic conditions. Additional pulse releases must be made to assist upstream migrating adult Chinook salmon and downstream migrating juveniles. Minimum annual releases from La Grange Dam, including the pulse releases, vary from at least 94,000 acre-feet in critically dry years to approximately 300,000 acre-feet in above-normal and wet years. A detailed minimum stream flow schedule is shown in **Table 5.3.1-3**.

TABLE 5.3.1-3
MINIMUM STREAM FLOW REQUIREMENTS – TUOLUMNE RIVER AT LA GRANGE BRIDGE

Schedule / Occurrence	Days per Year	Critical Year and Below 6.4%	Median Critical Year 8.0%	Intermediate Critical – Dry Year 6.1%	Median Dry 10.8%	Intermediate Dry – Below-Normal Year 9.1%	Median Below-Normal Year 10.3%	All Years above Median Below-Normal Years 49.3%
October 1 – October 15	15	100 cfs 2,975 ac-ft	100 cfs 2,975 ac-ft	150 cfs 4,463 ac-ft	150 cfs 4,463 ac-ft	180 cfs 5,355 ac-ft	200 cfs 5,950 ac-ft	300 cfs 8,926 ac-ft
Attraction Pulse Flow		None	None	None	None	1,676 ac-ft	1,736 ac-ft	5,950 ac-ft
October 16 – May 31	228	150 cfs 67,835 ac-ft	150 cfs 67,835 ac-ft	150 cfs 67,835 ac-ft	150 cfs 67,835 ac-ft	180 cfs 81,402 ac-ft	175 cfs 79,140 ac-ft	300 cfs 135,669 ac-ft
Outmigration Pulse Flow		11,091 ac-ft	20,091 ac-ft	32,619 ac-ft	37,060 ac-ft	35,920 ac-ft	60,027 ac-ft	89,882 ac-ft
June 1 – September 30	122	50 cfs 12,099 ac-ft	50 cfs 12,099 ac-ft	50 cfs 12,099 ac-ft	75 cfs 18,149 ac-ft	75 cfs 18,149 ac-ft	75 cfs 18,149 ac-ft	250 cfs 60,496 ac-ft
Volume (ac-ft)	365	94,000	103,000	117,016	127,507	142,502	165,002	300,923

SOURCE: FERC, 1996.

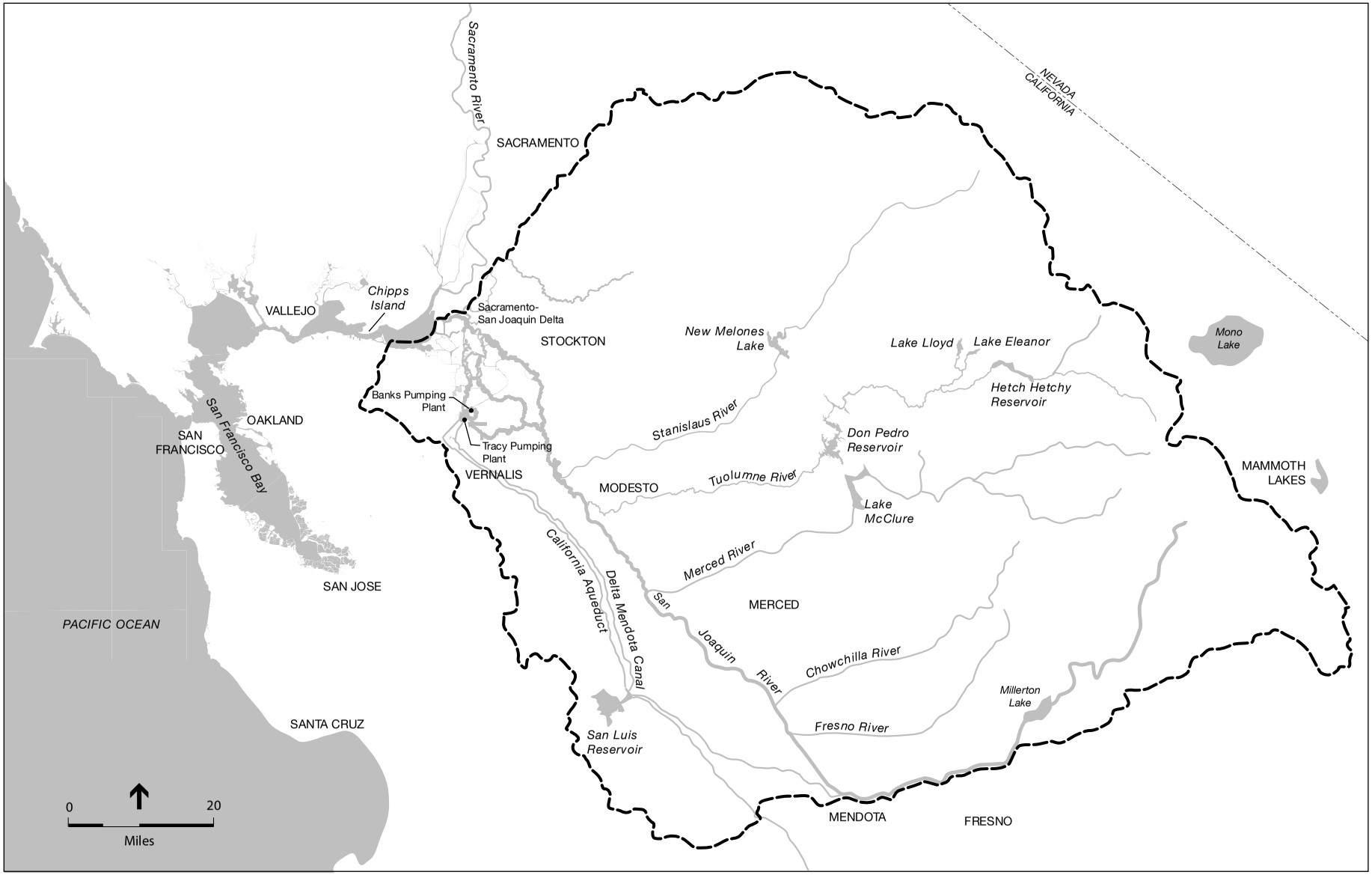
San Joaquin River

General Description

The San Joaquin River rises in the Sierra Nevada west of Mammoth Lakes and drains an area of approximately 13,500 square miles. The river flows southwestward, through the Sierra foothills, to the floor of the San Joaquin Valley near the city of Fresno. After reaching the valley floor, it turns and flows northwest for about 100 miles to the Sacramento–San Joaquin Delta. Several major tributaries join the San Joaquin River from the east, including the Fresno, Chowchilla, Merced, Tuolumne, and Stanislaus Rivers. The San Joaquin River watershed is shown in **Figure 5.3.1-7**.

Stream Flow and Water System Operations

Flow in the San Joaquin River is controlled by releases from Millerton Lake on the main stem of the river and from several reservoirs on the San Joaquin's tributaries. Millerton Lake is part of the federal Central Valley Project. It is impounded by Friant Dam, which was completed in 1942. The Central Valley Project's Friant-Kern and Madera Canals convey most of the runoff from the San Joaquin River drainage above Millerton Reservoir to agricultural and urban water users. The U.S. Bureau of Reclamation (USBR) releases enough water at Friant Dam to maintain a flow of 5 cfs past Gravelly Ford, which is 35 miles below the dam, to meet downstream riparian water rights. The reach of the river between Gravelly Ford and Mendota is essentially dry, except when flood releases are being made. In the future, flow will be restored in the San Joaquin River between Friant Dam and the confluence with the Merced River in accordance with a recent settlement agreement between the USBR and an environmental advocacy organization, the Natural Resources Defense Council.



SOURCE: ESA + Orion

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Figure 5.3.1-7

San Joaquin River Watershed

The San Joaquin River gains water as it flows toward the Sacramento–San Joaquin Delta from agricultural irrigation return flows and tributaries. Flow in the San Joaquin River at Newman upstream of the river's confluence with the Tuolumne River averaged 1,789 cfs based on stream flow gaging records for the period between 1942 and 2004. Flow in the San Joaquin River at Vernalis, upstream of the Delta and downstream of the Tuolumne River confluence, averaged 4,328 cfs based on stream flow gaging records for the period between 1942 and 2004. Mean monthly stream flows at Newman and Vernalis are shown in Table 5.3.1-1. The highest flows occur in February, March, April, and May and the lowest in August and September. A substantial proportion of the increase in San Joaquin River flow between Newman and Vernalis is contributed by the Tuolumne River, which has an average annual flow of 1,265 cfs as measured at Modesto.

Sacramento–San Joaquin Delta

General Description

The Sacramento–San Joaquin Delta is a 600-square-mile area of channels and islands at the confluence of the Sacramento and San Joaquin Rivers. Freshwater draining from a 41,300-square-mile watershed enters the Delta from the Sacramento and San Joaquin Rivers and several smaller rivers. Some of the freshwater is diverted from the Delta channels for municipal and agricultural purposes. The remainder flows through the Delta to the San Francisco Bay Estuary.

The Delta is a tidal region. Every 12.4 hours, the tides cause water to move in and out of the Delta. Most of the time, tides cause a five- to eight-mile back and forth movement of water in the western part of the Delta. The average tidal flow into the Delta on the flood tide and out of the Delta on the ebb tide is 170,000 cfs (Miller, 1993). The movement of freshwater through the Delta is superimposed on the tidal flows. Typical freshwater flows are much smaller than tidal flows, usually in the range of 5 to 15 percent of the tidal flows.

Stream Flow and Water System Operations

On average, about 21 million acre-feet of water reaches the Delta annually, but actual inflow varies widely from year to year and within the year. In 1977, a year of extraordinary drought, Delta inflow totaled 5.9 million acre-feet. In 1983, an exceptionally wet year, Delta inflow was about 70 million acre-feet. On a seasonal basis, average monthly flow into the Delta varies by more than a factor of 10 between the highest month in the winter or spring and the lowest month in the fall (SWRCB, 1997).

The Sacramento River, which enters the Delta from the north, contributes an average of 77 percent of the inflow to the Delta. The San Joaquin River, which enters the Delta from the south, contributes about 15 percent of the inflow. The remainder is contributed by the Mokelumne, Cosumnes, and Calaveras Rivers, which enter the Delta from the east (DWR, 1998).

Most of the Delta islands are used to grow crops. Delta farmers divert water directly from the Delta channels to irrigate their land. A portion of the diverted water is returned to the Delta channels as agricultural return. The average annual net diversion of water for irrigation within the Delta is estimated to be 960,000 acre-feet (San Francisco Estuarine Project, 1992).

California's two largest engineered water systems, the Central Valley Project and the State Water Project, also divert water from the Delta. The Central Valley Project diverts water from Old River in the south Delta at the Jones Pumping Plant (formerly Tracy Pumping Plant) and exports it to Central Valley Project contractors via the Delta-Mendota Canal. Contra Costa Water District, a Central Valley Project contractor, diverts its water from Old River and Rock Slough in the south Delta and Mallard Slough in the west Delta. The State Water Project diverts water from Old River at the Banks Pumping Plant and exports it to customers via the California Aqueduct, the South Bay Aqueduct, and the Central Coast Aqueduct. The State Water Project diverts smaller amounts of water from Barker Slough in the north Delta to serve customers in Napa and Solano Counties. Between 1995 and 2004, the State Water Project diverted an average of 2.4 million afy from the Delta. The Central Valley Project diverts an average of 1.7 million afy from the Delta.

Delta freshwater outflow, commonly referred to simply as Delta outflow, is roughly equal to Delta inflow minus net water diversions in the Delta for use in the Delta and diversions for export. Like Delta inflow, Delta outflow varies widely from month to month and from year to year. Between 1984 and 2004, Delta outflow averaged 16.9 million acre-feet. The greatest annual Delta outflow in the period was 43.5 million acre-feet in 1998. The smallest Delta outflow in the period was 3.9 million acre-feet in 1990 (DWR, 2007). Average monthly Delta outflow for the same period is shown in Table 5.3.1-1. The largest Delta outflow typically occurs in January, February, and March, when surface runoff is high and demand for irrigation water is low. The smallest Delta outflow typically occurs in July, August, September, and October.

The diversion of water by the Central Valley Project, State Water Project, and others in the south Delta as well as upstream depletion of San Joaquin River flows affect the pattern of flow in the Delta channels. Historically, net flow in the Delta channels was toward the San Francisco Bay Estuary. Now, because freshwater inflow to the south Delta from the San Joaquin River is small relative to the diversions at the Banks and Tracy Pumping Plants, net flow in many south Delta channels reverses during summer and fall. Flow in the lower San Joaquin River and the south Delta channels is directed upstream toward the pumping plants rather than downstream toward the estuary (Miller, 1993).

The diminution of flow and flow reversals in the lower San Joaquin River as a result of water diversions by the State Water Project and Central Valley Project are harmful to migrating salmon. In 1990, the California Department of Water Resources (DWR) began installing temporary barriers in several waterways in the south Delta to improve conditions for migrating salmon. Temporary barriers have been placed across the Grant Line Canal, Middle River, and Old River. The purpose of the barriers is to control water levels for irrigators, improve water quality, and direct more water down the lower San Joaquin River for downstream migrating juvenile salmon in the spring and upstream migrating adults in the fall. It is expected that permanent operable barriers will replace the temporary barriers in the future years.

Flow Objectives for the Sacramento–San Joaquin Delta

As noted above, the Sacramento–San Joaquin Delta lies at the heart of California's natural and manmade water systems. The Delta's physical complexity and competing interests for water make management of the Delta difficult. Since water quality objectives alone are insufficient to protect the Delta, regulators have also established objectives for flow. These objectives have been the subject of much controversy and have frequently been revised. Some issues remain unresolved, including the degree to which parties that divert water upstream of the Delta are responsible for meeting Delta objectives. Resolution of these issues could affect all upstream diverters, including the SFPUC, TID, and MID.

The State Water Resources Control Board (SWRCB) is the agency responsible both for setting water quality objectives for the Delta and for issuing and administering water-rights permits in California. The degree to which parties that divert water upstream of the Delta are responsible for maintenance of Delta water quality and flow objectives may ultimately be resolved through a water-rights proceeding.

Water-Rights Decisions

In 1997, the SWRCB began examining long-term alternatives that would enable compliance with the flow objectives for the Delta. Water rights proceedings to determine responsibility for meeting the flow objectives began in 1998 (see Section 5.3.3 for more detail). The water-rights proceedings were to be conducted in eight phases. The SWRCB's policy in the water-rights proceedings was to encourage water agencies to resolve among themselves the responsibilities for meeting the objectives in the 1995 Water Quality Control Plan (WQCP) and to bring their proposals to the SWRCB for approval. In 1999, the SWRCB published a final EIR on the WQCP, which presented the environmental effects of a range of alternatives but did not identify a preferred alternative (SWRCB, 1999).

In late 1999, following Phases 1 through 7 of the Bay-Delta water rights proceedings, the SWRCB issued Water Rights Decision 1641. The SWRCB revised D-1641 in early 2000 by issuing Order WR 2000-02, and again in 2001 by issuing Order WR 2001-05. D-1641 and Order WR 2001-05 contain the water-right requirements to implement the flow objectives for the Delta. D-1641 includes both long-term and temporary requirements that will remain in effect for up to 35 years. Order WR 2001-05 called for partial implementation of the requirements.

In D-1641 and Order WR 2001-05, the SWRCB assigned responsibilities to water-rights holders for specified periods, including the USBR and DWR, in certain watersheds tributary to the Delta. The SWRCB accepted with modifications the proposals made by some water agencies and groups of water agencies with respect to their responsibilities for meeting flow objectives in the Delta. The responsibilities of various parties, including water users in the Sacramento, San Joaquin, Mokelumne, Calaveras, and Cosumnes River watersheds, were defined in D-1641. These responsibilities require that the water users in these watersheds contribute specified amounts of water to protect water quality or implement agreements (including the San Joaquin River Agreement, as described below), and that the USBR and/or DWR ensure the objectives are met in the Delta.

Phase 8 of the water-rights proceedings would have ultimately determined the responsibilities of the Sacramento Valley water-rights holders for meeting the objectives in the 1995 WQCP. The SWRCB's Order WR 2001-05 stayed Phase 8 of the proceedings and required the USBR and DWR to continue to meet certain objectives in the 1995 WQCP until adoption of another decision assigning responsibility for meeting the objectives. During 2002, the USBR, DWR, Sacramento Valley upstream water users, and certain downstream users negotiated a settlement in lieu of continuing Phase 8 of the water-rights proceedings. Beginning in December 2002, the parties to the negotiations executed the Sacramento Valley Water Management Agreement, or Short Term Settlement Agreement. The agreement establishes a planning process for actions that would help meet objectives in the Delta.

Vernalis Adaptive Management Program

Shortly after the Bay-Delta WQCP was published, an association of users of San Joaquin River water filed suit against the SWRCB, challenging the flow objectives in the WQCP. The association claimed that the flow objectives were based on an inadequate understanding of the relationship between flow and salmon survival. In an effort to settle the issue out of court, the San Joaquin River interests collaborated with other water users, environmental groups, and government agencies to develop an alternative that would provide an equivalent level of fishery protection to that provided by the Bay-Delta WQCP. The result was the San Joaquin River Agreement, of which the Vernalis Adaptive Management Program (VAMP) was a key component (San Joaquin River Group Authority, 2007).

The VAMP is an experimental management program designed to protect juvenile Chinook salmon migrating from the San Joaquin River through the Delta. The San Joaquin River Agreement, including the VAMP, was submitted to the SWRCB as a proposal. It was accepted by the SWRCB and made a part of D-1641. In February 2006, however, the Third Appellate District overturned that part of D-1641 and ordered to SWRCB to commence further proceedings to either assign responsibility for meeting the Vernalis pulse-flow objectives in full or to modify those objectives. In December 2006, the SWRCB adopted amendments to the 1995 Bay-Delta WQCP, including allowing for staged implementation through the San Joaquin River Agreement until December 2011.

The VAMP provides for a 31-day pulse flow in the San Joaquin River at Vernalis, together with a reduction in State Water Project and Central Valley Project exports from the south Delta. The pulse usually occurs from mid-April to mid-May, but its timing may be adjusted based on hydrology and fishery conditions. The effects of different flow rates in the lower San Joaquin River and different State Water Project and Central Valley Project export rates on juvenile and smolt Chinook salmon survival are being studied as part of the VAMP. The VAMP is scheduled to end in 2011.

5.3.1.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to stream flow and reservoir water levels, but generally considers that implementation of the proposed program would have a significant impact if it were to:

- Substantially alter stream flows such that they are outside of the range of pre-project conditions and result in adverse hydrologic effects

The stream flow significance threshold is based on the fact that natural stream flows and controlled reservoir levels have varied substantially in the past 50 years, and such variations are a part of the existing baseline. Therefore, variations substantially outside of these past levels due to implementation of the proposed program that would result in an adverse hydrologic effect (such as flooding, dewatering, drainage alteration, or erosion, among others) would be considered a significant direct impact.

This PEIR also considers indirect impacts due to changes in stream flows and reservoir levels. However, for organizational purposes, the indirect impacts are not described in this section of this chapter, but rather in the sections describing the resources that would be indirectly affected by changes in flows and reservoir levels. These include geomorphology, surface water quality, surface water supplies, groundwater, fisheries, terrestrial biological resources, and recreational and visual resources. It should be noted that there might be cases where significant indirect impacts could result from less-than-significant direct flow impacts.

Approach to Analysis

Changes in flow in rivers and streams and changes in reservoir storage and water levels attributable to the WSIP were estimated using the Hetch Hetchy/Local Simulation Model (HH/LSM). An overview of the model is presented in Section 5.1. The HH/LSM simulates water deliveries, reservoir storage, and releases to rivers under different conditions using hydrologic data from the 82-year period 1920 to 2002. Detailed information on the model and the assumptions that underlie it is provided in Appendix H.

The following section addresses the impacts of the WSIP on water levels in Hetchy Hetchy and Don Pedro Reservoirs and flow along the Tuolumne River. WSIP impacts on flow along the San Joaquin River and Sacramento-San Joaquin Delta are also described. In applying the above significance criteria, very infrequent changes in reservoir levels and/or flow are not generally considered to generate a significant effect.

Impact Summary

Table 5.3.1-4 presents a summary of the impacts on stream flow and reservoir levels in the Tuolumne River system and downstream water bodies that could result from implementation of the proposed water supply and system operations.

TABLE 5.3.1-4
SUMMARY OF IMPACTS – STREAM FLOW IN THE TUOLUMNE RIVER SYSTEM AND DOWNSTREAM WATERBODIES

Impact	Significance Determination
Impact 5.3.1-1: Effects on flow along the Tuolumne River below O'Shaughnessy Dam	LS
Impact 5.3.1-2: Effects on flow along Cherry Creek below Cherry Dam	LS
Impact 5.3.1-3: Effects on flow along Eleanor Creek below Eleanor Dam	LS
Impact 5.3.1-4: Effects on flow along the Tuolumne River below La Grange Dam	LS
Impact 5.3.1-5: Effects on flow along the San Joaquin River and the Sacramento–San Joaquin Delta	LS

LS = Less than Significant impact, no mitigation required

Impact Discussion

Impact 5.3.1-1: Effects on flow along the Tuolumne River below O'Shaughnessy Dam.

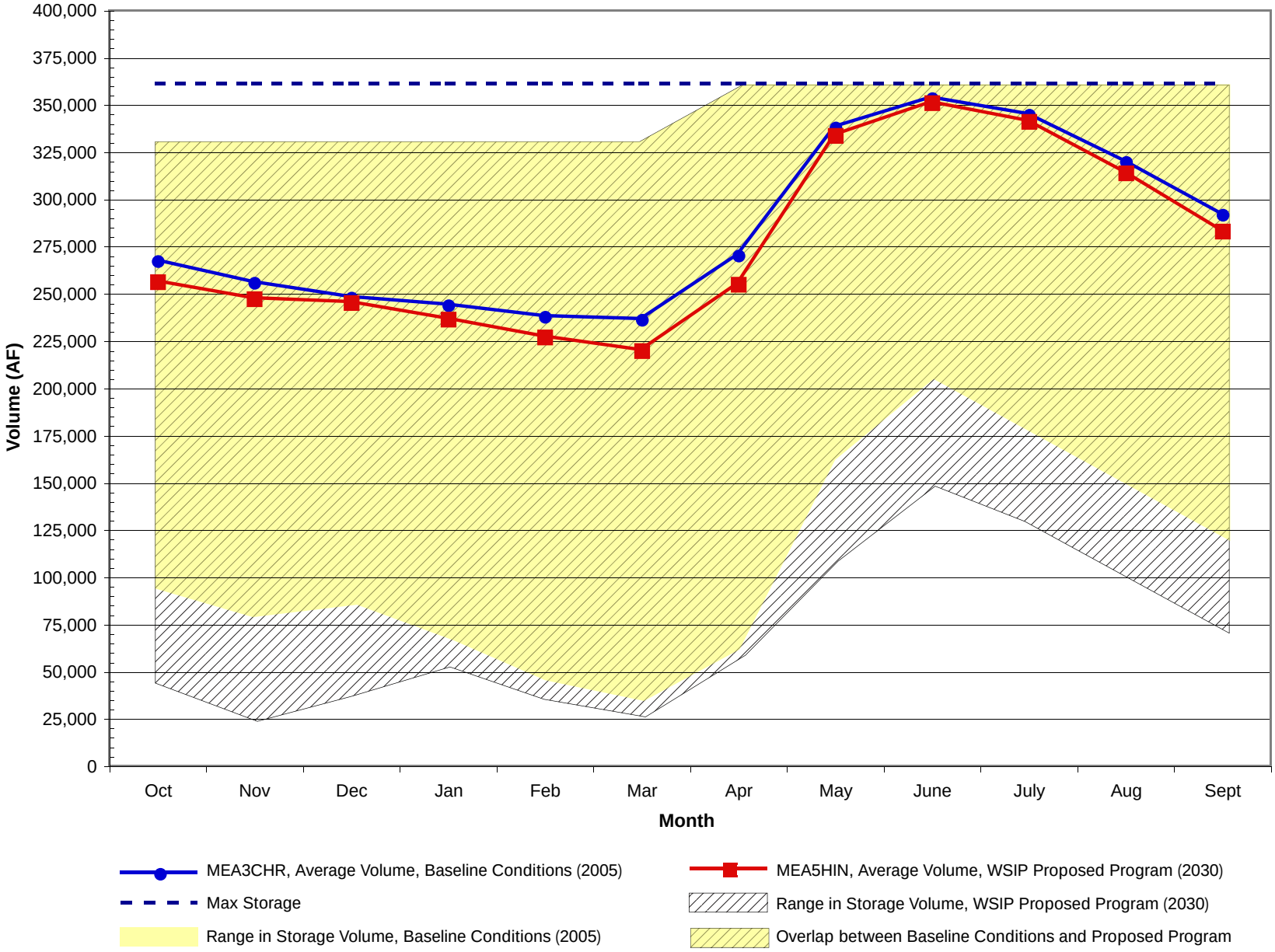
Reservoir Operations

Hetch Hetchy Reservoir stores water from the upper reaches of the Tuolumne River within Yosemite National Park. During the snowmelt season the reservoir is filled. During the rest of the year, when flow into the reservoir is reduced, the reservoir is drawn down to meet water demand in the service areas of the SFPUC and its customers, instream flow release requirements, and, if necessary, TID's and MID's Raker Act entitlements. Most years, the SFPUC is able to completely refill the reservoir during the snowmelt season. One of the SFPUC's operating goals is to fill the reservoir by the end of June. The WSIP would not change this or any of the SFPUC's other operational goals for Hetch Hetchy Reservoir, but it would affect water levels in the reservoir and the magnitude and timing of releases to the Tuolumne River.

Water Storage and Water Levels in Hetch Hetchy Reservoir

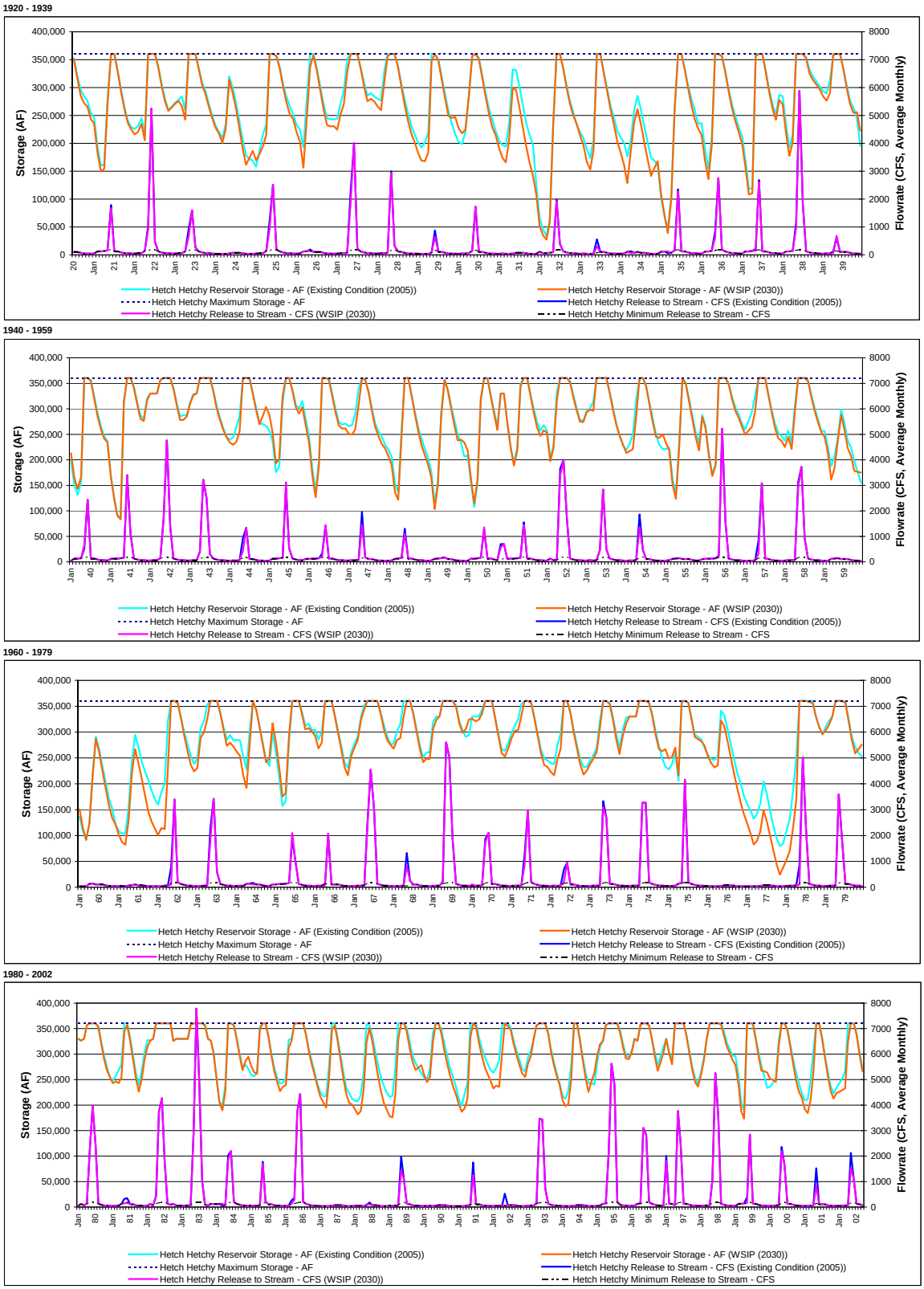
The WSIP would reduce average monthly storage in Hetch Hetchy Reservoir compared to the existing condition. **Figure 5.3.1-8** shows average monthly storage and the range of monthly storage in the reservoir with the WSIP and under existing conditions. The decrease in storage is primarily attributable to increased water demand in the service areas of the SFPUC and its customers. As demand increases, so would diversions of water from Hetch Hetchy Reservoir to supply the SFPUC's customers. Because of the decrease in storage in Hetch Hetchy Reservoir with the WSIP, monthly average water levels would fall by 1 to 10 feet compared to the existing condition.

Figure 5.3.1-9 shows modeled chronological storage in Hetch Hetchy Reservoir and releases to the Tuolumne River using hydrology from the 82-year period 1920 to 2002. The figure compares the WSIP 2030 condition to the existing condition. It shows that, under the existing condition, the SFPUC normally fills Hetch Hetchy Reservoir in the spring and early summer and draws from



SOURCE: SFPUC, HH/LSM (see Appendix H)

Figure 5.3.1-8
Average Monthly Storage Volume,
Hetch Hetchy Reservoir



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SOURCE: SFPUC, HH/LSM (see Appendix H).

Figure 5.3.1-9
Hetch Hetchy Storage and Releases to the Tuolumne River

storage to meet water demand in the summer, fall, and winter. In the early spring, the SFPUC may additionally draw water from the reservoir for power generation, provided it is confident that the coming snowmelt will fill the reservoir.

In the future with the WSIP, the SFPUC would continue to fill the reservoir in the spring and early summer and draw it down during the rest of the year, but the magnitude of the drawdown would be greater than under the existing condition. The reductions in storage and the lowering of water levels attributable to the WSIP would be the greatest in dry years. In average dry years, Hetch Hetchy Reservoir would be drawn down 18 feet more in March (just before refilling begins) than under the existing condition. The WSIP would lower water levels in Hetch Hetchy Reservoir in some months of severe droughts by up to 64 feet compared to the existing condition.

Beginning in July, when the reservoir is usually full, the rate of drawdown with the WSIP would be greater than under the existing condition. As shown in Figure 5.3.1-8, the difference in storage between the two scenarios would increase steadily through the summer, fall, and winter in most years. The pattern would be altered every five years when, with the WSIP, the SFPUC would take a portion of the conveyance system between Hetch Hetchy Reservoir and the Bay Area out of service so it can be maintained. During maintenance, water demand in the Bay Area would be met from local reservoirs, and drawdown of Hetch Hetchy Reservoir would cease for several weeks. On completion of maintenance, drawdown of Hetch Hetchy Reservoir would recommence at an accelerated rate as water is moved to storage in the local reservoirs. The WSIP would not alter water levels in Hetch Hetchy Reservoir such that they would be substantially outside the range experienced under the existing condition. Under the existing condition and in almost all years, the reservoir fills to its maximum capacity of 360,400 acre-feet in the spring and early summer and then is drawn down through the rest of the year. Maximum storage corresponds with a water surface level of 3,806 feet above mean sea level. Only rarely does storage in the reservoir decline below 150,000 acre-feet. A storage capacity of 150,000 acre-feet corresponds with a water surface level of 3,684 feet above mean sea level. Thus, under the existing condition and almost all of the time, the water level fluctuates between 3,806 feet and 3,684 feet, a range of 122 feet. With the WSIP, the water level in Hetch Hetchy Reservoir would fluctuate within the same range almost all of the time.

Occasionally in extended droughts, storage in Hetch Hetchy Reservoir would be drawn down severely. Under the existing condition, the water level in the reservoir would be drawn down to 3,573 feet, or 233 feet below the maximum, once in the 82-year hydrologic record. With the WSIP, the water level would be drawn down to 3,562 feet, or 244 feet below the maximum, once in the hydrologic record. Thus, water levels with the WSIP would remain substantially within the same range as occurs under the existing condition, although very infrequently water levels would decline slightly below the lower end of the range.

Flow in the Tuolumne River Between O'Shaugnessy Dam and Early Intake

Figure 5.3.1-9 shows the frequency and magnitude of modeled chronological releases from Hetch Hetchy Reservoir to the Tuolumne River under the existing condition and with the WSIP. Under the existing condition, releases to the Tuolumne River are at least equal to the required releases to

support fisheries shown in Table 5.3.1-2. In many years, the volume of spring snowmelt from the watershed upstream of Hetch Hetchy Reservoir exceeds the capacity of the reservoir and the SFPUC's ability to divert water through Canyon Tunnel. Water that cannot be stored or diverted through Canyon Tunnel is released to the Tuolumne River. Occasionally, during the winter, the SFPUC will release excess inflow produced by warm storms to the Tuolumne River.

In the future with the WSIP, the SFPUC would draw the reservoir down farther in most years than it would under the existing condition. Consequently, with the WSIP, the SFPUC would capture a greater proportion of spring runoff to refill the reservoir. As a result, the volume of water released to the Tuolumne River would be reduced compared to the existing condition.

This circumstance is illustrated by the hydrology that occurred in 1991 and 1992. As shown in Figure 5.3.1-9, by the end of the 1991 conditions, Hetch Hetchy Reservoir would be drawn down to a lower level after WSIP implementation than it would under the existing condition. To refill the reservoir in the fairly dry spring of 1992, the SFPUC would have to capture a larger portion of the spring runoff, with the consequence that releases from the reservoir and flow in the Tuolumne River below the reservoir would be reduced, as indicated in the figure.

Table 5.3.1-5 shows average monthly flows in the Tuolumne River immediately below Hetch Hetchy Reservoir in different hydrologic year types for the existing condition and after WSIP implementation. The percentage change in average monthly flow attributable to the WSIP is also shown in the table. The WSIP would have little or no effect on average monthly flow in most summer, fall, and winter months in all hydrologic year types. In most summer, fall, and winter months, only the required fishery release would be made under the existing condition and with the WSIP. With the WSIP, the number of months in which only the required fishery release would be made would increase slightly. Under the existing condition, the model indicates that the minimum release would be made 84.2 percent of the time (837 months in the 987-month hydrologic record); with the WSIP the minimum release would be made 85.4 percent of the time (843 months in the 987-month hydrologic record).

The WSIP would result in reductions in average monthly flow of up to 30 percent in April, May, and June when the SFPUC fills Hetch Hetchy Reservoir with snowmelt. The greatest percentage reduction in flow would occur in normal, below-normal, and dry years because, in these year types, a greater proportion of the snowmelt currently released to the river would be needed to fill the reservoir. For example, in May of an average dry year, flow in the Tuolumne River below O'Shaughnessy Dam would be 224 cfs under the existing condition; with the WSIP it would be 157 cfs, a reduction of 30 percent.

In individual months in the 82-year hydrologic simulation, the absolute and percentage changes in flow in the Tuolumne River below O'Shaughnessy Dam attributable to the WSIP vary widely. The chronological analysis shows that the maximum percentage reduction in average monthly flow would be 80 to 90 percent, occurring three times in the 82-year hydrologic simulation. For example, under the existing condition, May 1992 flow would be 520 cfs; with the WSIP it would be 50 cfs. Reductions in average monthly flow of 30 percent or more would occur in some months of 20 springs in the 82-year simulation, or about once in every four springs on average.

TABLE 5.3.1-5
ESTIMATED AVERAGE MONTHLY FLOWS FOR THE TUOLUMNE RIVER BELOW O'SHAUGNESSSY DAM UNDER VARIOUS CONDITIONS
(cubic feet per second)

	Wet	Above Normal	Normal	Below Normal	Dry	All
Existing Condition (2005)						
Oct	55	55	54	55	53	54
Nov	51	96	54	55	53	62
Dec	51	88	50	46	44	56
Jan	180	66	51	43	40	75
Feb	88	88	74	51	44	69
Mar	93	86	74	63	50	73
Apr	148	131	98	91	64	107
May	2,518	1,273	1,479	758	224	1,245
June	4,534	3,092	1,913	768	168	2,091
July	2,034	379	167	113	86	548
Aug	184	125	122	111	86	125
Sept	90	89	86	73	65	81
Future with WSIP (2030)						
Oct	55	55	54	55	53	54
Nov	51	89	54	55	53	61
Dec	51	88	50	46	44	56
Jan	167	66	55	43	40	74
Feb	88	88	74	51	44	69
Mar	84	94	74	63	50	73
Apr	144	131	98	88	56	103
May	2,416	1,187	1,260	564	157	1,111
June	4,548	3,095	1,907	709	139	2,075
July	2,034	379	167	113	86	548
Aug	184	125	122	111	86	125
Sept	89	89	86	73	65	81
Difference and Percent Change, Existing Condition (2005) vs WSIP (2030)						
Oct	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]
Nov	0 [0%]	-8 [-8%]	0 [0%]	0 [0%]	0 [0%]	-2 -[3%]
Dec	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]
Jan	-12 -[7%]	0 [0%]	4 [8%]	0 [0%]	0 [0%]	-2 -[2%]
Feb	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]
Mar	-9 -[9%]	8 [9%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]
Apr	-4 -[3%]	0 [0%]	0 [0%]	-4 -[4%]	-8 -[12%]	-3 -[3%]
May	-103 -[4%]	-86 -[7%]	-220 -[15%]	-195 -[26%]	-67 -[30%]	-134 -[11%]
June	14 [0%]	3 [0%]	-6 [0%]	-59 -[8%]	-29 -[17%]	-16 -[1%]
July	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]
Aug	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]
Sept	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]

Key
> 0%
< 0 to -5%
< -5%

SOURCE: SFPUC, HH/LSM (see Appendix H).

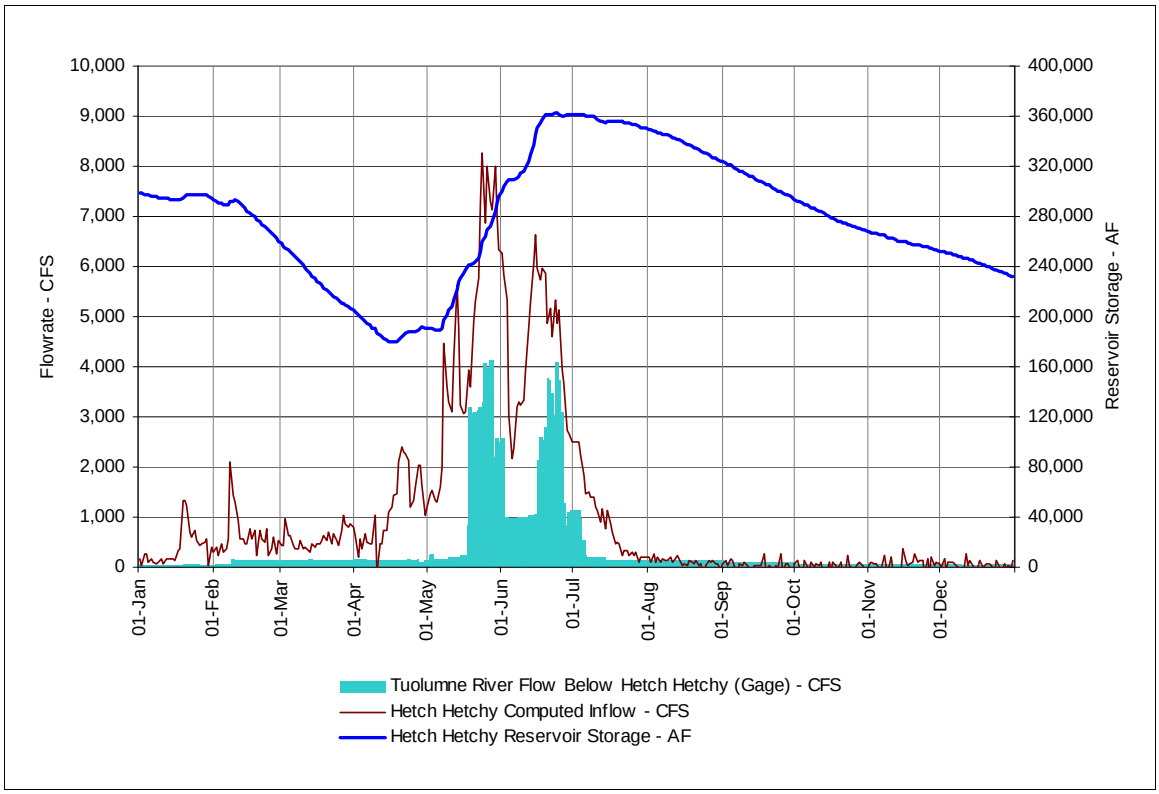
The results presented above are described in terms of average monthly flows because the HH/LSM is a monthly time-step model. The SFPUC's actual operational decisions may occur in smaller time increments, perhaps daily or weekly, depending on meteorological and operational circumstances. For example, if inflow to Hetch Hetchy Reservoir increases rapidly, operators may decide to adjust the rate at which water is routed to Canyon Tunnel or released to the river several times within a month. These within-month operational changes cannot be simulated with the HH/LSM, nor can the model be used to estimate the effects of the WSIP on peak flows in the river, because the peaks may only last for a few hours or days.

Insight into the effects of the WSIP on peak flows below O'Shaughnessy Dam can be obtained by examination of operational data. **Figure 5.3.1-10** shows actual data for 1999, an above-normal year; the greatest effects on peak flows would occur in wet and above-normal years. The figure shows storage in Hetch Hetchy Reservoir falling in the first four months of the year because the rate of withdrawal from the reservoir exceeds the rate of inflow into the reservoir. In April, inflow into the reservoir increases and continues to do so through May. In June, inflow into the reservoir decreases from its peak but remains considerable. Storage in the reservoir increases from its minimum value of about 190,000 acre-feet in mid-April to its maximum value of 360,000 acre-feet in mid-June. The SFPUC reacted to increasing reservoir inflow and diminishing reservoir storage around the middle of May by increasing releases to the Tuolumne River. Measured flow in the Tuolumne River below O'Shaughnessy Dam shows a number of step increases and decreases in flow during May and June lasting several days, as operators balanced reservoir inflow, gains in storage, and releases to the river in response to changing conditions.

If the WSIP had been in place in 1999, and water demand was at 2030 levels, storage in mid-April in Hetch Hetchy Reservoir would have been about 175,000 acre-feet. With the WSIP, operators would need to capture 185,000 acre-feet of runoff to fill the reservoir. Under the existing condition, the operators had to capture 160,000 acre-feet. Needing to capture a higher proportion of runoff with the WSIP than under the existing condition, operators would likely delay releases of water to the Tuolumne River by two to three days. After the initial delay, the releases to the river with the WSIP would follow the same pattern as under the existing condition and would be of a similar magnitude.

The pattern and magnitude of releases from Hetch Hetchy Reservoir to the Tuolumne River with the WSIP in any particular year would depend on meteorological and operational circumstances, as they do under the existing condition. Under the existing condition, there would be no releases from the reservoir to the river in excess of the minimum required release in 15 years of the 82-year hydrologic record. With the WSIP, there would be no releases above the minimum required in 18 years of the 82-year hydrologic record. In years when a release above the minimum required is made, the WSIP would delay the release of water and reduce the total volume of releases to the river in the snowmelt period compared to the existing condition. The WSIP would delay the release of water in excess of minimum requirements by an average of one to two days and could delay the release by up to eight days.[4] The infrequent large peak flows (greater than

[4] The estimates of delay in spring releases are based on the assumption that operators would release water from Hetch Hetchy Reservoir at a rate of 3,000 cfs. A review of past practice indicates that this springtime release rate is typical. If the release rate were to be reduced, as might happen in a dry year, the delay would be extended.



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SOURCE: SFPUC, HH/LSM (see Appendix H).

Figure 5.3.1-10
Hetch Hetchy Reservoir Storage and Inflow,
Calendar Year 1999

5,000 cfs) in the river below O'Shaughnessy Dam produced by rapidly melting abundant snowpack would not be affected by the WSIP. Peak flows in years when runoff is less (dry years) might be reduced by the WSIP, depending on decisions made by reservoir operators.

Impact Conclusions

The WSIP would not alter stream flow in the Tuolumne River below O'Shaughnessy Dam such that it would be substantially outside the range experienced under the existing condition, nor would the flow alterations result in adverse hydrologic effects or be sufficient to change the character of the river. Large, infrequent peak flows under the existing condition and with the WSIP would be similar in magnitude. Minimum flows are the subject of an agreement with the U.S. Department of the Interior and would be the same with the WSIP as under the existing condition. The Department of the Interior could increase the minimum flows in the future based on the fish habitat study referred to above. Overall, the effects of the WSIP on flow along the Tuolumne River below O'Shaughnessy Dam would be *less than significant*, and no mitigation measures would be required.

Impact 5.3.1-2: Effects on flow along Cherry Creek below Cherry Dam.

Reservoir Operations

Lake Lloyd stores water from the upper reaches of Cherry Creek. During the snowmelt season the reservoir is filled. During the rest of the year, when flow into the lake is reduced, the reservoir is drawn down to generate hydroelectric power at the Holm Powerhouse. The releases, which are sized and timed for power generation purposes, also provide opportunities for river rafting and contribute to the releases that the SFPUC must make to satisfy TID's and MID's flow entitlements. Most years, the SFPUC is able to completely refill the lake during the snowmelt season. The WSIP would not change the SFPUC's operational goals for Lake Lloyd, and it would have little or no effect on water levels in the lake and the magnitude and timing of releases to Cherry Creek.

Water Storage and Water Levels in Lake Lloyd

The WSIP would not alter water levels in Lake Lloyd such that they would be substantially outside the range experienced under the existing condition. The WSIP would reduce year-round average monthly storage in Lake Lloyd by about 1,000 acre-feet and average monthly water levels by about 1 foot. Most of the time, storage in Lake Lloyd would be the same with the WSIP as under the existing condition. Infrequent reductions in storage attributable to the WSIP would occur at the end of dry periods, similar to the period that occurred between 1987 and 1992. At the end of dry periods, the SFPUC might release additional water from Lake Lloyd to offset the WSIP-induced reduction in releases from Hetch Hetchy Reservoir. The releases would be needed to satisfy TID's and MID's flow entitlements.

Flow in Cherry Creek

Releases from Lake Lloyd with the WSIP and under the existing condition would be the same and would be at least equal to the fishery release schedule. Thus, the WSIP would have no effect on flow in Cherry Creek.

Impact Conclusions

The WSIP would not alter releases from Lake Lloyd to Cherry Creek. Adverse impacts on flow in Cherry Creek would be *less than significant,* and no mitigation measures would be required.

Impact 5.3.1-3: Effects on flow along Eleanor Creek below Eleanor Dam.

Reservoir Operations

Lake Eleanor stores water from the upper reaches of Eleanor Creek; it fills in the winter and spring of each year and is drawn down in the summer as water is transferred to the lake. The WSIP would not change the SFPUC's operational goals for Lake Eleanor, and it would have little effect on water levels in the lake and the magnitude and timing of releases to Eleanor Creek.

Water Storage and Water Levels in Lake Eleanor

The WSIP would have essentially no effect on monthly storage or water levels in Lake Eleanor compared to the existing condition. The only change in modeled chronological storage using hydrology from the period 1920 to 2002 occurs during the last year of the 1987–1992 drought. Under 2002 conditions with the WSIP, additional water would be transferred from Lake Eleanor to supplement storage in Lake Lloyd. Such a transfer would occur very infrequently. The WSIP would not alter water levels in Lake Eleanor such that they would be substantially outside the range experienced under the existing condition.

Flow in Eleanor Creek below Eleanor Dam

Releases from Lake Eleanor with the WSIP and under the existing condition would be the same and would be at least equal to the fishery release schedule. Thus, the WSIP would have no effect on flow in Eleanor Creek.

Impact Conclusions

The WSIP would not alter releases to Eleanor Creek. Adverse impacts on flow in Eleanor Creek would be *less than significant*, and no mitigation measures would be required.

Impact 5.3.1-4: Effects on flow along the Tuolumne River below La Grange Dam.

Reservoir Operations

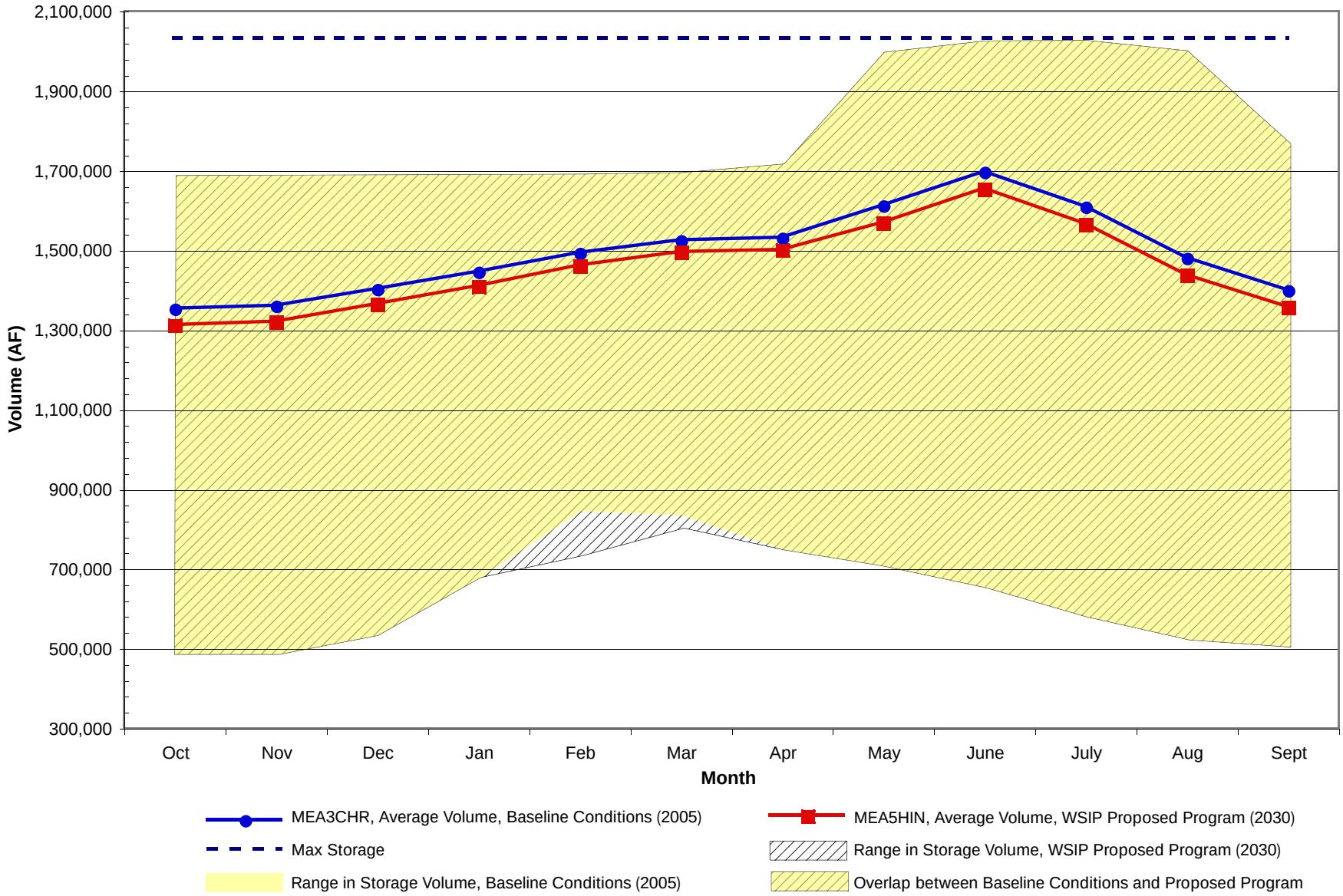
Don Pedro Reservoir, operated by TID, stores water from the upper Tuolumne River. Under typical conditions, the reservoir begins to fill with rainfall runoff from lower elevations in November and continues to fill through the winter and spring with a combination of rainfall runoff and snowmelt from higher elevations. The reservoir is drawn down from June through October to meet demand for irrigation supply in the TID and MID service areas.

Don Pedro Reservoir is a multipurpose facility that provides water supply and flood control benefits as well as recreational opportunities. To provide a prescribed level of downstream flood protection, storage space must be kept available in Don Pedro Reservoir to store floods that might occur. The space maintained in the reservoir for floodwater is referred to as the “flood control reservation.” It increases from zero on September 8 to 340,000 acre-feet on October 7. The reservation is maintained at 340,000 acre-feet until April 27, after which it declines to zero again by June 3.

The WSIP would not change TID’s operational goals for Don Pedro Reservoir or the flood control reservation requirements, but it would affect water levels in the reservoir and the magnitude and timing of releases to the Tuolumne River.

Water Storage and Water Levels in Don Pedro Reservoir

The WSIP would reduce average monthly storage in Don Pedro Reservoir year-round compared to the existing condition. **Figure 5.3.1-11** shows the average monthly storage and the range of monthly storage in the reservoir with the WSIP and under the existing condition. The



SOURCE: SFPUC, HH/LSM (see Appendix H)

Figure 5.3.1-11
Average Monthly Storage Volume,
Don Pedro Reservoir

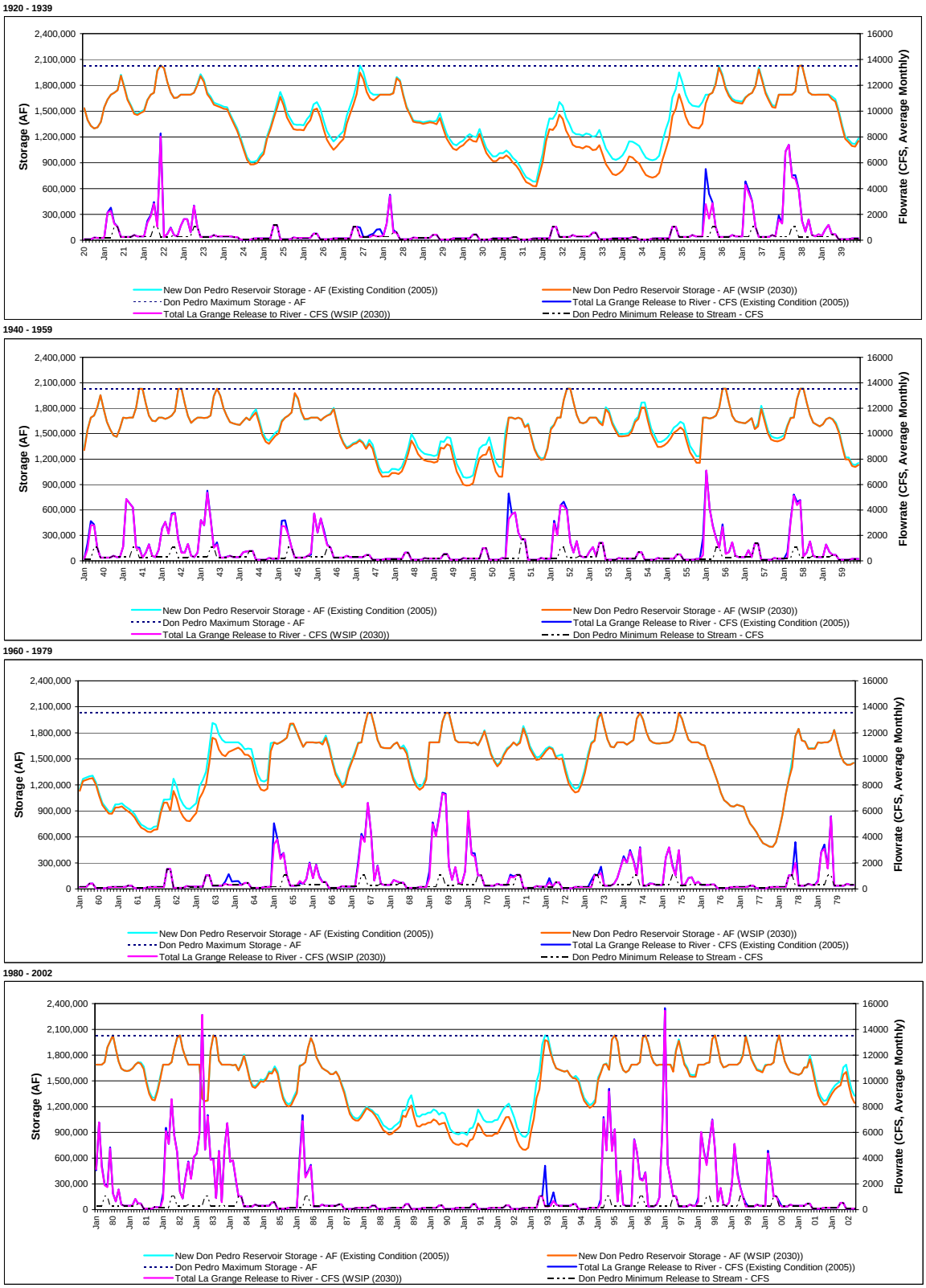
decrease in stored volume is primarily attributable to increased water demand in the service areas of the SFPUC and its customers. As demand increases, so do diversions of water at Hetch Hetchy Reservoir for delivery to the Bay Area. As a result, less water flows down the Tuolumne River to Don Pedro Reservoir. Because of the decrease in stored volume in Don Pedro Reservoir with the WSIP, monthly average water levels would fall by 1 to 10 feet compared to the existing condition.

Figure 5.3.1-12 shows modeled chronological storage in Don Pedro Reservoir and releases to the Tuolumne River at La Grange Dam using hydrology from the period 1920 to 2002. The figure compares the WSIP to the existing condition. It shows that, under the existing condition, TID and MID fills Don Pedro Reservoir in the winter and draws from storage to meet agricultural water demand in the summer and early fall. Because the storage capacity of Don Pedro Reservoir is greater than the average volume of runoff produced in its watershed, TID and MID is unable to fill the reservoir completely every year. Currently, TID and MID is able to fill to its allowable October to April maximum storage capacity about 51 percent of the time and to its maximum physical capacity about 27 percent of the time. In the future with the WSIP, these values would be reduced to 48 percent and 21 percent.

The reductions in stored volume and lowering of water levels attributable to the WSIP would be greatest in critically dry years, particularly following a sequence of dry years. In average critically dry years, Don Pedro Reservoir would be drawn down 10 feet more in September than under the existing condition. The WSIP would lower water levels in Don Pedro Reservoir in some months during severe droughts by up to 27 feet compared to the existing condition.

The WSIP would not alter water levels in Don Pedro Reservoir such that they would be substantially outside the range experienced under the existing condition. Almost all of the time, storage in Don Pedro Reservoir fluctuates between its maximum capacity of 2,080,000 acre-feet, which corresponds with a water level of 834 feet above mean sea level, and 900,000 acre-feet, which corresponds with a water level of 714 feet. Thus, under the existing condition and almost all of the time, the water level fluctuates between 834 feet and 714 feet, a range of 120 feet. With the WSIP, the water level in Don Pedro Reservoir would fluctuate within the same range almost all of the time.

Occasionally, in extended droughts, storage in Don Pedro Reservoir would be drawn down severely. Under the existing condition, the water level in the reservoir would be drawn down to 643 feet, or 191 feet below the maximum, once in the 82-year hydrologic record. With the WSIP, the water level would be drawn down to essentially the same level once in the 82-year hydrologic record, but it would never be drawn down below that level. Thus, water levels with the WSIP would remain substantially within the same range as occurs under the existing condition.



SOURCE: SFPUC, HH/LSM (see Appendix H).

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Figure 5.3.1-12
Don Pedro Storage and La Grange Releases to the Tuolumne River

Flow in the Tuolumne River below La Grange Dam

Figure 5.3.1-12 shows the frequency and magnitude of modeled chronological releases from La Grange to the Tuolumne River under the existing condition and with the WSIP. Under the existing condition, releases to the Tuolumne River are at least equal to the fishery release schedule shown in Table 5.3.1-3. In most below-normal or drier years, almost all the winter and spring runoff from the watershed upstream of Don Pedro is captured in the reservoir. In years when the reservoir fills, usually wet or above-normal years, excess water is released to the Tuolumne River.

In the future with the WSIP, MID and TID would draw Don Pedro Reservoir down farther in many years than it would under the existing condition as shown in Figure 5.3.1-12. Consequently, MID and TID would have to capture a greater proportion of spring runoff to refill the reservoir with the WSIP. As a result, the volume of water released to the Tuolumne River would be reduced compared to the existing condition but would be at least equal to the required releases to support fisheries shown in Table 5.3.1-3.

Average monthly flows in the Tuolumne River immediately below La Grange Dam in different hydrologic year types for the existing condition and with the WSIP are shown in **Table 5.3.1-6**. The percentage change in average monthly flow attributable to the WSIP is also shown in the table. The WSIP would have little or no effect on average monthly flow in most summer, fall, and winter months in all hydrologic year types. The WSIP would have no effect on average monthly flow in any months of critically dry years or in most summer months of dry, below-normal, and above-normal years. Only the required fishery release would be made in these months under the existing condition and with the WSIP. With the WSIP, the number of months in which only the required fishery release would be made would increase slightly. Under the existing condition, the model indicates that the minimum release would be made 72.6 percent of the time (717 months in the 987-month hydrologic record); with the WSIP the minimum release would be made 74.4 percent of the time (734 months in the 987-month hydrologic record).

The WSIP would typically result in reductions of less than 10 percent in average monthly flow in the Tuolumne River below La Grange Dam in the November through June period when TID fills Don Pedro Reservoir, although reductions in average monthly flow could be as high as 25 percent. Reductions in flow would occur in some months of all year types, except for critically dry years. For example, in June of an average above-normal year, flow in the Tuolumne River below La Grange Dam would be 408 cfs under the existing condition; with the WSIP it would be 306 cfs, a reduction of 25 percent.

The absolute and percentage changes in flow in the Tuolumne River below La Grange Dam in individual months of wet, above-normal, below-normal, and dry years in the 82-year hydrologic simulation attributable to the WSIP vary widely. The chronological analysis shows that the maximum percentage reduction in average monthly flow attributable to the WSIP would be about 92 percent, occurring in one month in the 82-year hydrologic simulation. In that month, June 1993, the flow below La Grange Dam under the existing condition would be 3,409 cfs; with the WSIP it would be 250 cfs. Reductions in average monthly flow of 30 percent or more would occur in some months of 17 springs in the 82-year simulation, or about once in every four springs on average.

TABLE 5.3.1-6
ESTIMATED AVERAGE MONTHLY FLOWS FOR THE TUOLUMNE RIVER BELOW LA GRANGE DAM UNDER VARIOUS CONDITIONS
(cubic feet per second)

	Wet	Above Normal	Below Normal	Dry	Critical Dry	All
Existing Condition (2005)						
Oct	431	298	294	351	236	333
Nov	374	507	314	324	195	350
Dec	857	1,230	422	292	204	654
Jan	2,161	1,257	318	285	189	1,022
Feb	3,493	2,381	647	478	188	1,723
Mar	4,096	1,969	654	421	189	1,806
Apr	3,424	1,568	958	497	344	1,613
May	3,161	1,348	943	497	344	1,489
June	3,633	408	75	73	50	1,180
July	1,300	240	75	73	50	463
Aug	516	240	75	73	50	233
Sept	1,299	249	75	73	50	464
Future with WSIP (2030)						
Oct	429	292	284	337	236	327
Nov	371	515	270	260	195	334
Dec	790	1,111	370	272	204	599
Jan	2,023	1,272	318	262	189	981
Feb	3,400	2,152	630	432	188	1,638
Mar	3,990	1,708	630	421	189	1,718
Apr	3,350	1,539	943	497	344	1,584
May	3,081	1,346	943	497	344	1,465
June	3,369	306	75	73	50	1,082
July	1,282	240	75	73	50	457
Aug	503	240	75	73	50	229
Sept	1,263	240	75	73	50	452
Difference and Percent Change, Existing Condition (2005) vs WSIP (2030)						
Oct	-2	[0%]	-6	-[2%]	-9	-[3%]	-14	-[4%]	0	[0%]	-5	-[2%]
Nov	-3	-[1%]	8	[2%]	-44	-[14%]	-64	-[20%]	0	[0%]	-16	-[4%]
Dec	-67	-[8%]	-119	-[10%]	-52	-[12%]	-20	-[7%]	0	[0%]	-55	-[8%]
Jan	-138	-[6%]	14	[1%]	0	[0%]	-23	-[8%]	0	[0%]	-41	-[4%]
Feb	-93	-[3%]	-229	-[10%]	-16	-[3%]	-47	-[10%]	0	[0%]	-85	-[5%]
Mar	-107	-[3%]	-261	-[13%]	-24	-[4%]	0	[0%]	0	[0%]	-89	-[5%]
Apr	-74	-[2%]	-28	-[2%]	-15	-[2%]	0	[0%]	0	[0%]	-30	-[2%]
May	-81	-[3%]	-2	[0%]	0	[0%]	0	[0%]	0	[0%]	-24	-[2%]
June	-264	-[7%]	-102	-[25%]	0	[0%]	0	[0%]	0	[0%]	-98	-[8%]
July	-19	-[1%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	-5	-[1%]
Aug	-13	-[2%]	-1	[0%]	0	[0%]	0	[0%]	0	[0%]	-4	-[2%]
Sept	-36	-[3%]	-9	-[4%]	0	[0%]	0	[0%]	0	[0%]	-12	-[3%]

Key
> 0%
< 0 to -5%
< -5%

SOURCE: SFPUC, HH/LSM (see Appendix H).

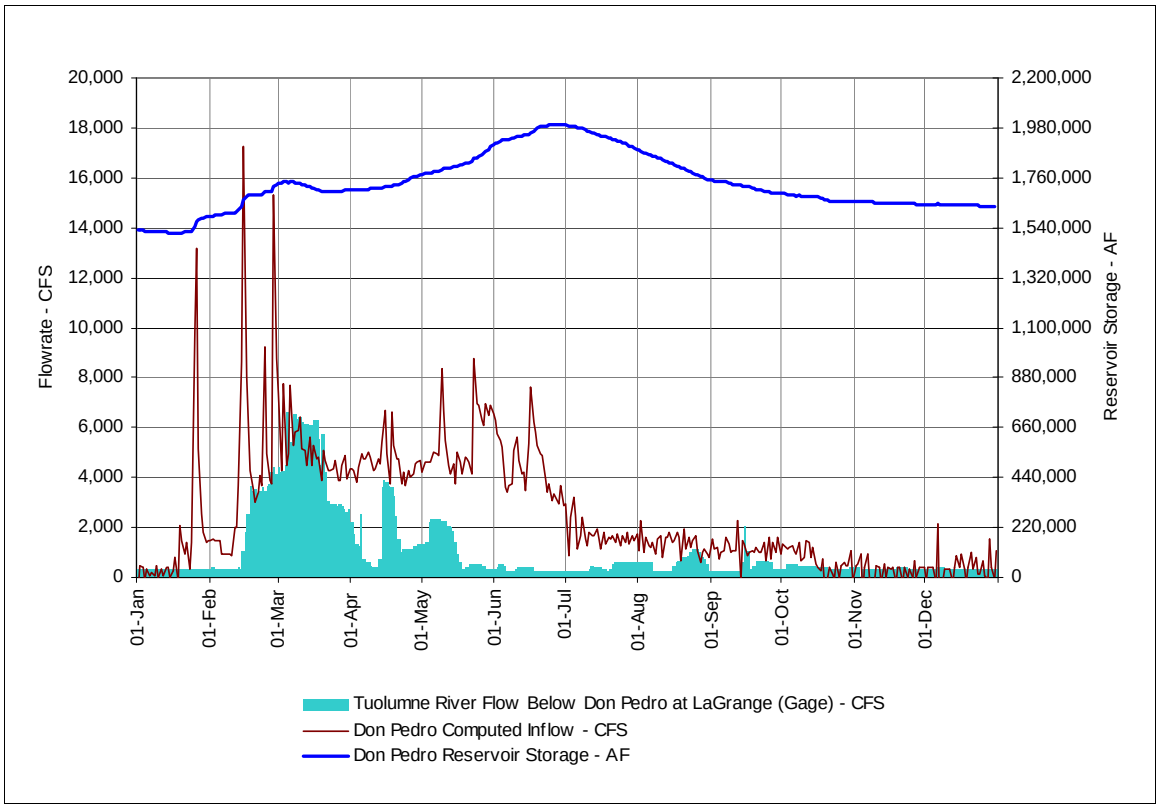
The results presented above are described in terms of average monthly flows because the HH/LSM is a monthly time-step model. TID's actual operational decisions may occur in smaller time steps, perhaps daily or weekly, depending on meteorological and operational circumstances. These within-month operational changes cannot be simulated with the HH/LSM, nor can the model be used to estimate the effects of the WSIP on peak flows in the river, because the peaks may only last for a few hours or days.

Insight into the effects of the WSIP on peak flows below La Grange Dam can be obtained by examining operational data. **Figure 5.3.1-13** shows actual data for 2000, an above-normal year; the greatest effects on peak flows would occur in wet and above-normal years. The figure shows storage in Don Pedro Reservoir falling slightly in the first half of January and then increasing to a maximum of about 2 million acre-feet at the end of June, as first rainfall runoff and then snowmelt enters the reservoir. Through January and the first half of February, TID added to storage in the reservoir and released only the minimum required to the Tuolumne River below La Grange Dam. In mid-February, faced with increasing quantities of rainfall runoff, the operators began to release water to the Tuolumne River in excess of the minimum required in order to maintain the required flood control storage reservation. Releases in excess of the minimum continued though March, April, and the first half of May. Beginning in April, the required flood control reservation decreased, enabling TID to add more water to storage. In mid-May, the operators reduced releases to the river, which remained at or close to the minimum for the remainder of the year. Measured flow in the Tuolumne River below La Grange Dam shows a number of step increases and decreases in flow from mid-February to mid-May lasting several days, as operators sought to balance reservoir inflow, gains in storage, and releases to the river in response to changing conditions.

If the WSIP had been in place in 1999, and water demand was at 2030 levels, storage during December in Don Pedro Reservoir (its seasonal low point) would have been about 1,600,000 acre-feet, similar to but less than under the existing condition. Needing to capture a slightly higher proportion of runoff with the WSIP than under the existing condition, operators would likely delay releases of water to the lower Tuolumne River in excess of minimum requirements by a few days. After the initial delay, the releases to the river with the WSIP would follow the same pattern as under the existing condition and would be of a similar magnitude.

The pattern and magnitude of releases from La Grange Dam to the Tuolumne River with the WSIP in any particular year would depend on meteorological and operational circumstances, as they do under the existing condition. Under the existing condition, there would be no releases from the dam to the river in excess of the minimum required release in 31 years of the 82-year hydrologic record. With the WSIP, there would be no releases above the minimum required in 33 years of the hydrologic record. In years when a release above the minimum required is made, the WSIP would delay the release of water and reduce the total volume of releases to the river in the winter and spring compared to the existing condition.

Releases from Don Pedro Reservoir and La Grange Dam follow a different pattern than releases from Hetchy Hetchy Reservoir. Hetch Hetchy Reservoir typically receives most of its water from



SFPUC Water System Improvement Program ▪ 203287

SOURCE: SFPUC, HH/LSM (see Appendix H).

Figure 5.3.1-13
Don Pedro Reservoir Storage and Inflow,
Calendar Year 2000

snowmelt between early May and late July. Don Pedro Reservoir receives runoff over a longer period from both winter rainstorms and snowmelt. Furthermore, unlike Hetch Hetchy Reservoir, Don Pedro Reservoir is used to reduce downstream flooding. As a consequence, management of Don Pedro Reservoir is complex, and releases from the reservoir often occur in a series of pulses rather than in single episode as typically occurs at Hetch Hetchy Reservoir. In years when several pulse releases above the minimum required are made, the WSIP might eliminate one or more of the pulse releases and would delay others by several days or weeks.

After an unusual series of dry years, when Don Pedro Reservoir is drawn down substantially farther with the WSIP than under the existing condition, winter and spring releases above the minimum required would occasionally be eliminated or almost eliminated. This circumstance is illustrated by the sequence of hydrologic conditions that occurred between 1986 and 1993. Although the WSIP would commonly reduce winter and spring flow in the river below La Grange Dam, it would not affect very infrequent large peak flows produced primarily by rainstorms.

Impact Conclusions

The WSIP would not alter stream flow in the Tuolumne River below La Grange Dam such that it would be substantially outside the range experienced under the existing condition, nor would the flow alterations result in adverse hydrologic effects or be sufficient to change the character of the river. Large, infrequent peak flows under the existing condition and with the WSIP would be similar in magnitude. Minimum flows are the subject of an agreement with the FERC and would the same with the WSIP as under the existing condition.

Overall, the effects of the WSIP on flow along the Tuolumne River below La Grange Dam would be *less than significant*, and no mitigation measures would be required.

Impact 5.3.1-5: Effects on flow along the San Joaquin River and the Sacramento–San Joaquin Delta.

The Tuolumne River joins the San Joaquin River about 50 miles downstream of La Grange Dam. The reductions in flow in the Tuolumne River below La Grange Dam attributable to the WSIP are shown in Table 5.3.1-6. The WSIP would reduce flows in the Tuolumne River between La Grange Dam and its confluence with the San Joaquin River, and in the San Joaquin River from the confluence to the Delta. Most of the reductions in flow would occur from January through June in wet or above-normal years, when flow in the San Joaquin River is at its seasonal maximum. The greatest reductions would occur in years following extended droughts when storage in Don Pedro Reservoir is being replenished. For example, under hydrologic conditions that prevailed in February 1936, average monthly flow in the San Joaquin River between the Tuolumne and Stanislaus River confluences would be reduced from about 10,000 cfs to 7,500 cfs under the WSIP compared to existing conditions. Similarly, under June 1993 conditions, average monthly flows would be reduced from about 7,000 cfs to 3,500 cfs. Flow reductions of these magnitudes would be rare events occurring four or five times in the 82-year period of hydrologic record.

The SWRCB has established flow objectives for the San Joaquin River at Vernalis, just upstream of the Sacramento–San Joaquin Delta. Almost all of the time, the reductions in San Joaquin River flow attributable to the WSIP would not be sufficient to cause flow in the river at Vernalis to fall below the objective. Very infrequently, following protracted droughts, reductions in San Joaquin River flow attributable to the WSIP would be sufficient to cause flow in the river at Vernalis to fall below the objective. Under these circumstances, the USBR, the agency responsible for compliance with objectives for the San Joaquin River, would be expected to increase releases from New Melones Reservoir on the Stanislaus River to meet the flow objectives at Vernalis. Thus, the WSIP would not alter flow in the San Joaquin River below its confluence with the Tuolumne River such that it would be substantially outside the range experienced under existing conditions nor result in a violation of flow objectives.

The reductions in flow in the Tuolumne River below La Grange Dam attributable to the WSIP would also reduce inflow to the Sacramento–San Joaquin Delta. The SWRCB has established

objectives for Delta outflow as measured at Chipps Island, just upstream of Suisun Bay. Almost all of the time, the reductions in Delta inflow attributable to the WSIP would not be sufficient to cause Delta outflow to fall below the objective. Very infrequently, following protracted droughts, reductions in Delta inflow attributable to the WSIP would be sufficient to cause Delta outflow to fall below the objective. Under these circumstances, the USBR and DWR, the respective operators of the Central Valley Project and State Water Project, would be expected to decrease their diversions so that the Delta outflow objectives were met. Thus, the WSIP would not alter flow in the Sacramento–San Joaquin Delta such that it would be substantially outside the range experienced under the existing condition.

Overall, the effects of the WSIP on flow along San Joaquin River and in the Delta would be *less than significant*, and no mitigation measures would be required. Additional information on the effects of the WSIP on flows in the San Joaquin River and the Delta is provided in Section 5.3.4.

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5.3.2 Geomorphology

Channel morphology, or river form, reflects the interactions among watershed geology, flow, the supply of sediment and large woody debris, tectonic uplift and subsidence, and glacial advances and retreats. River channels are in a state of dynamic equilibrium with their watersheds. Although they may change each year, particularly in response to high flows, their characteristics remain stable in the medium term, provided conditions in the watershed also remain stable. When conditions in a watershed change, the dynamic equilibrium is disturbed, and river form will adjust to the new watershed condition (Knighton, 1984).

Over the last century, flow in the Tuolumne River between Hetch Hetchy Reservoir and Don Pedro Reservoir and below La Grange Dam has been progressively reduced by dam operations and the diversion of water for hydropower generation, flood control, and municipal and agricultural water supply. The WSIP would cause further changes in river flow over the next 25 years, as described in Section 5.3.1. Thus, WSIP-induced changes in river flow have the potential to further affect river channel characteristics.

5.3.2.1 Setting

The Tuolumne River drains a 1,960-square-mile watershed on the western slope of the Sierra Nevada range and is the largest of three major tributaries to the San Joaquin River. The river originates in Yosemite National Park and flows southwest to its confluence with the San Joaquin River, approximately 10 miles west of the city of Modesto. Deep canyons, granite river channels, and forested, mountainous terrain characterize the watershed between its crest and La Grange Dam. Near the town of La Grange, the river exits the Sierra Nevada foothills and flows through a gently sloping alluvial valley that is incised into Pleistocene alluvial fans.

Upper Tuolumne River and Tributaries

Upstream of Don Pedro Reservoir, the Tuolumne River and its tributaries flow through steep narrow valleys that confine the river channel. In most of this reach, the river channel is steep and alternates between bedrock chutes,[1] boulder cascades, and pools. Except in the Poopenaut Valley (a 2.5-mile reach below O'Shaughnessy Dam) and downstream of the Clavey River confluence, alluvial deposits are limited to small or medium-sized patches associated with flow obstructions (such as boulders and bedrock outcrops). For the first 2.5 miles below O'Shaughnessy Dam, the Tuolumne River flows through a U-shaped glaciated valley. The river channel is V-shaped and sinuous in the approximately 10 miles of river from the Poopenaut Valley to Early Intake. While the average channel gradient in this reach of the river is steep (averaging 2 percent), subreach-scale variation in channel gradient and valley confinement provides very diverse channel morphology. Channel morphology in this reach ranges from the low-gradient, sand-bedded channel and broad wetland meadow of the Poopenaut Valley to the steep, bedrock-confined channel found in most of the rest of the Tuolumne River (McBain & Trush and RMC, 2006).

[1] A chute in this context is an inclined trough or channel feature such as a waterfall or rapid.

From Early Intake, the river flows about 10 miles to its confluence with the South Fork of the Tuolumne River. The river is confined in a deeply incised, V-shaped canyon with steep, competent side slopes. Channel gradient in this reach also averages about 2 percent, but is as steep as 4 percent in one section. For most of its length, the channel consists of a series of pools separated by steep cascades over boulders. Alluvial bars and side-channels are present throughout the reach where the valley widens or where bedrock constraints reduce channel gradient.

From the South Fork confluence to the upper end of Don Pedro Reservoir, the average channel gradient decreases to less than 1 percent. In the upper section of this reach, from the confluence with the South Fork to the confluence with the Clavey River, the river channel consists of boulder cascades separated by medium-length pools. Downstream of the Clavey River confluence, the channel gradient decreases, and the channel becomes semi-alluvial. Large boulder bars are common.

Cherry Creek is a tributary to the Tuolumne River. From Cherry Dam, Cherry Creek flows about 12 miles to its confluence with the Tuolumne River (1.3 miles downstream of Early Intake). For most of this length, Cherry Creek is confined within a narrow bedrock canyon, and channel gradient is steep (5 percent). The bed consists primarily of boulders and bedrock, although a large volume of sand is stored in pools. Immediately downstream of the dam, however, the channel alternates between low-gradient, gravel-bedded reaches separated by steep, bedrock chutes. In the gravel-bedded reaches of the upper five-mile reach between the dam and the confluence with Eleanor Creek, riparian and upland vegetation has encroached onto formerly active alluvial bars since completion of Cherry Dam.

Eleanor Creek flows into Cherry Creek seven miles upstream of the Tuolumne River and extends 3.5 miles from Eleanor Dam to Cherry Creek. For most of its length, Eleanor Creek flows through a steep bedrock canyon, and the channel is a series of pools and falls. The average channel gradient is 6 percent.

A common perception is that bedrock channel morphology is static compared to alluvial channels and therefore relatively insensitive to flow and sediment supply changes (e.g., Montgomery and Buffington, 1997). Bedrock channels, however, are often highly dynamic depositional environments; though principally erosional, they also exhibit abundant depositional features. Large, geomorphically derived hydraulic controls, such as width constrictions or expansions and resistant bedrock outcrops, remain stable over decades or centuries and define an overall limit for coarse sediment deposition in each segment of the bedrock channel. These geomorphic controls induce coarse depositional features that in turn perform as smaller hydraulic controls to induce finer and more transitory secondary depositional features. The occurrence of smaller hydraulic controls within larger hydraulic controls gives rise to a complex, nested depositional channel morphology that provides diverse aquatic and riparian habitats (McBain and Trush, 2004).

Short channel segments where channel gradient decreases and/or valley width increases may support unique and/or more diverse aquatic and riparian communities. These atypical channel segments exhibit prominent depositional features, such as alluvial bars, side channels, and limited floodplains. While these alluvial subreaches and patches constitute a small portion of the channel

in this reach, they provide important establishment sites for riparian vegetation, habitat for aquatic flora and fauna and native amphibians, and low-velocity rearing habitat for juvenile fish.

Sediment is supplied to bedrock rivers primarily through "mass wasting." Hill-slope mass wasting, such as rock falls and bedrock shearing from canyon walls, episodically delivers coarse sediment of sufficient volume and/or caliber to create large depositional features in the channel or to function as large-scale hydraulic controls capable of generating other prominent depositional features. Bedrock rivers have a huge potential transport capacity for coarse sediment, but a small storage capacity for coarse and fine sediment. Hydraulic complexity and channel form, expressed as nested hydraulic controls in a variable flow regime, exert the greatest control on storage capacity. The annual coarse bedload[2] transported may fluctuate dramatically without significantly affecting the volume of coarse sediment stored in a channel segment. Although storage capacity is low, the ecological implications for maintaining these limited depositional features can be great.

In bedrock rivers, diverse erosional and depositional features are created and maintained by a broad range of floods. For example, sand patches are scoured and deposited during small floods, while boulder ribs are mobilized only during very large, infrequent floods. Flow thresholds that mobilize depositional features in bedrock rivers are not well understood. Recent, though limited, observations of the Clavey River (a tributary to the Tuolumne River) suggest that:

- Common small floods that occur every one to three years scour and deposit sand at pools and bars
- Moderate-sized floods that occur every 12 to 17 years move gravel and cobbles, reshape side channels, and may move large woody debris
- Very large floods that occur every 70 to 100 years erode large bars, remove and create side channels, and move large boulders over short distances

Tuolumne River from La Grange Dam to the San Joaquin River

Near the town of La Grange, the Tuolumne River exits the Sierra Nevada foothills and flows through a gently sloping alluvial valley incised into Pleistocene alluvial fans. The valley walls confine the river corridor to as narrow as 500 feet near Waterford, about 20 miles downstream of La Grange, whereas the river reaches downstream of Modesto are virtually unconfined. In some locations, bedrock outcrops control the gradient of the river; in others, the bedrock is up to 50 feet below the riverbed.

Within the alluvial valley, the river can be divided into two geomorphic units defined by channel slope and bed composition: the gravel-bedded reach, which extends about 28 miles from La Grange Dam to below Geer Road, and the sand-bedded reach, which extends about 24 miles from below Geer Road to the confluence with the San Joaquin River. The gravel-bedded reach has moderate slopes (0.03–0.15 percent), and extensive alteration of the channel and floodplain

[2] Refers to the amount of cobbles, gravel, and sand transported along the stream bottom (as opposed to suspended in the stream flow).

has occurred as a result of past gold dredging operations and past and current aggregate mining. Channel gradient decreases to less than 0.03 percent in the sand-bedded reach, and the channel is characterized by a meandering, alternate bar morphology. Under current conditions, coarse sediment sources are limited to tributaries downstream of La Grange Dam and to bed and bank erosion, so little coarse sediment enters the lower river. Most of the sediment that is currently contributed to the channel downstream of the dam consists of sand and finer-sized particles. While dams have eliminated upstream sediment supply, gold dredging and aggregate mining have removed sediment stored in the river channel and floodplain. Since sediment supply to the lower river has been cut off by upstream dams, the river cannot recover from past in-channel dredging and mining.

Operation of Don Pedro Reservoir has reduced the magnitude of peak flow in the lower river, and the reduction in peak flows has altered channel characteristics below La Grange Dam. Flood releases from the reservoir are dictated by three factors:

- Maximum releases through the dam outlet works (14,000 cfs)
- U.S. Army Corps of Engineers flood control rules, which limit flows to 9,000 cfs, as measured at the Modesto gauge (which includes inflows from Dry Creek)
- Maximum release capacity through the powerhouse turbines (5,500 cfs)

A number of agencies and nonprofit groups, including the SFPUC, TID, MID, U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), California Department of Fish and Game (CDFG), Friends of the Tuolumne, and the Tuolumne River Preservation Trust, are cooperating in efforts to restore the lower Tuolumne River corridor. In 2000, the Tuolumne River Technical Advisory Committee completed the *Habitat Restoration Plan for the Lower Tuolumne River Corridor* (McBain & Trush, 2000). The goal of the plan is to improve the river's value as fish and wildlife habitat. The plan recommends several measures to improve ecological function in the lower river, including increased frequency and magnitude of high flows, channel reconstruction, and coarse and fine sediment management. Recommended increases in flood flows, which would be achieved through revisions to operating criteria during flood control release periods, would increase the magnitude of bankfull[3] flows to more effectively move sediment. Of the 14 channel restoration projects identified in the plan, two have been constructed, two will be constructed in 2007, and three have complete designs and are in various stages of funding and implementation planning. Peak flows below La Grange Dam are usually in the range of 5,000 to 5,500 cfs as a result of reservoir releases for power generation purposes. Consequently, all of these restoration projects are designed to function based on a bankfull flow and two-year flood of 5,000 cfs (McBain *et al*., 2004).

[3] A bankfull channel conveys commonly occurring flows, with larger flows spilling over the banks and onto the floodplain.

5.3.2.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to geomorphology, but generally considers that implementation of the proposed program would have a significant impact if it were to:

- Substantially change the topography such that ecological, hydrologic or aesthetic functions are adversely affected, or substantially change any unique geologic or physical features of the site or area

- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of the stream or river, in a manner that would result in substantial erosion or siltation or adversely affect the ecological, hydrologic or aesthetic functions of the site or area

Although the "substantial change in topography" criterion is typically applied to upland areas, it is considered applicable to stream channel/bank topography in this instance because of the sensitivity of the resources that depend on the topography of those features (i.e., riparian vegetation and fisheries).

Approach to Analysis

This impact section presents a discussion of the potential changes in sediment transport and geomorphology that could result from WSIP-related changes in stream flow, reservoir storage, and reservoir water levels, as described in Section 5.3.1. A qualitative assessment of potential effects was conducted based on generalized channel bed/bank characteristics and a consideration of the program-induced changes in stream flow. No modeling or field measurements have been performed to estimate program-generated changes in sediment transport in the Tuolumne River system.

As indicated in Section 5.3.1, the WSIP would have no effect on flow in Cherry Creek or Eleanor Creek. Consequently, the impact analysis focuses on the Tuolumne River between Hetch Hetchy Reservoir and the confluence with the San Joaquin River, a reach of the river that would be affected by WSIP-induced changes in stream flow.

Impact Summary

Table 5.3.2-1 presents a summary of the impacts on sediment transport and geomorphology in the Tuolumne River system and downstream water bodies that could result from implementation of the proposed water supply and system operations.

TABLE 5.3.2-1
SUMMARY OF IMPACTS –
GEOMORPHOLOGY OF THE TUOLUMNE RIVER SYSTEM AND DOWNSTREAM WATERBODIES

Impact	Significance Determination
Impact 5.3.2-1: Effects on sediment transport and channel characteristics between O'Shaughnessy Dam and Don Pedro Reservoir	LS
Impact 5.3.2-2: Effects on sediment transport and channel characteristics below La Grange Dam	LS

LS = Less than Significant impact, no mitigation required

Impact Discussion

Impact 5.3.2-1: Effects on sediment transport and channel characteristics between O'Shaughnessy Dam and Don Pedro Reservoir.

Sediment transport and channel characteristics are primarily influenced by peak flows rather than by smaller common flows. As noted above, studies of the Clavey River indicate that peak flows that occur every one to three years produce enough energy to move sand; peak flows that occur every 12 to 17 years produce enough energy move gravel and cobbles; and peak flows that occur every 70 to 100 years produce enough energy to move boulders. Although the relationship between peak flows and the transport of sand, gravel, and boulders for the Clavey River cannot be directly applied to the main stem of the Tuolumne River, it provides an indication of the frequency of peak flows that mobilize depositional features in steep, mountain streams.

As discussed in Section 5.3.1 and illustrated in Figure 5.3.1-9, the WSIP would have little effect on the very large and infrequent floods in the Tuolumne River between O'Shaughnessy Dam and Don Pedro Reservoir that are capable of moving boulders and altering the characteristics of the bedrock channels. When the volume of runoff from the watershed above Hetch Hetchy Reservoir is great, the reservoir fills rapidly, after which all flow in excess of the capacity of the reservoir and Mountain Tunnel is released to the river. Under these conditions, the WSIP would extend the reservoir refill period and delay releases from the reservoir slightly (for a few days), after which releases to the river would follow the same pattern as they do under the existing condition. Because the WSIP would not affect the frequency or magnitude of large and infrequent floods, it would have a less-than-significant effect on the bedrock channel characteristics of the Tuolumne River below O'Shaughnessy Dam, and no mitigation measures would be required.

Flow in the Tuolumne River between O'Shaughnessy Dam and Early Intake consists predominantly of controlled releases from Hetch Hetchy Reservoir, except during large storms or snowmelt runoff. Under certain conditions (e.g., in normal hydrologic years that follow extended droughts), the WSIP could reduce the magnitude and duration of bankfull peak flows that are released from the reservoir every one to three years. As shown Figure 5.3.1-9, reductions in peak flows of this type occur infrequently in the 82-year hydrologic record. Thus, the WSIP could affect the rate and amount of sediment deposition and erosion in side channels and in the vicinity

of the few streamside meadows that exist in this reach of the river. However, because the changes in peak flow would occur infrequently, they would not be expected to result in a substantial change in erosion or siltation rates. The impact would be *less than significant*, and mitigation measures would not be required.

Impact 5.3.2-2: Effects on sediment transport and channel characteristics below La Grange Dam.

As noted above, the bankfull peak flows that occur every one to three years are the primary channel-forming events in the reach of the Tuolumne River below La Grange Dam, although larger floods are also important. The WSIP would have little effect on very large and infrequent floods within the Tuolumne River below La Grange Dam, such as the flood that occurred in 1997, but could affect the magnitude of the bankfull peak flows.

The WSIP would increase the drawdown of Don Pedro Reservoir by a small amount each year and by a considerable amount in an extended drought. To refill the reservoir in the winter and spring, TID and MID would capture a larger proportion of runoff than it does under the existing condition. In some years, when runoff is great compared to the storage deficit, the WSIP might extend the reservoir refill period and delay releases from Don Pedro Reservoir by several days, after which releases from the reservoir would follow the same pattern as they do under the existing condition. Under these conditions, the WSIP would have little or no effect on channel geomorphology. Occasionally, refilling the reservoir would require most or all runoff in excess of the minimum required fish release, and flows below La Grange Dam would be substantially reduced compared to the existing condition. In these years, sediment transport in the river below La Grange Dam would be reduced. However, because WSIP-induced changes in peak flow would occur infrequently, they would not be expected to result in a substantial change in erosion rates, siltation rates, or channel form. The impact would be *less than significant*, and mitigation measures would not be required.

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5.3.3 Surface Water Quality

The following setting section describes surface water quality in streams and reservoirs in the Tuolumne watershed and downstream water bodies that could be affected by the WSIP. The impact section (Section 5.3.3.2) provides a description of the changes in water quality in streams and reservoirs that would result from WSIP-induced changes in stream flow and reservoir water levels.

5.3.3.1 Setting

The Tuolumne River flows from the crest of the Sierra Nevada westward to its confluence with the San Joaquin River. The San Joaquin River flows north to the Sacramento–San Joaquin Delta. Water from the Delta discharges to the San Francisco Bay Estuary and the Pacific Ocean. The Tuolumne River system and downstream water bodies are shown in Figure 5.1-1.

The WSIP would affect flow in the Tuolumne River, the San Joaquin River, and the Sacramento–San Joaquin Delta as well as water levels in Hetch Hetchy Reservoir and Don Pedro Reservoir, as described in Section 5.3.1. WSIP-induced changes in flow and water levels could affect water quality in these streams and reservoirs. The WSIP would have minor effects on flow in Eleanor and Cherry Creeks and on water levels in Lake Eleanor and Lake Lloyd, but the changes would be too small to affect water quality.

The water supply and system operations components of the WSIP would not involve the discharge of pollutants into water bodies and therefore would have a limited potential to affect water quality. WSIP-related changes in water quality, such as changes in water temperature or dissolved oxygen, would stem from changes in stream flow and changes in water levels in reservoirs. Accordingly, the water quality data presented in this section are limited to those water quality characteristics that could be altered by elements of the proposed program or that are needed to provide a general understanding of potentially affected water bodies.

Tuolumne River

Water quality in the upper Tuolumne River basin is excellent. The Tuolumne River drainage above Hetch Hetchy Reservoir lies entirely within the less developed parts of Yosemite National Park. The combination of a high-altitude granitic drainage basin and minimal human influences results in river water that is cold, clear, and free of contaminants. Water quality in Hetch Hetchy Reservoir is also excellent. Plant nutrients such as nitrogen and phosphorus are typically near or below detection limits, and dissolved oxygen concentrations are typically at or near saturation. Total dissolved solids concentrations are less than 10 milligrams per liter (mg/L), and average total organic carbon concentrations are less than 2 mg/L. The SFPUC samples water quality at various depths in Hetch Hetchy Reservoir. As shown in **Table 5.3.3-1**, monthly water temperatures at a depth of 140 feet below the water surface for the period from 1997 to the present ranged between 6.5 and 13.8 degrees Celsius (°C). This depth, which is approximately the middle of the water column, is representative of water released to the Tuolumne River.

TABLE 5.3.3-1
SUMMARY OF TEMPERATURE DATA (°C), HETCH HETCHY RESERVOIR

Year	Flow Index[a]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1997	109.6	6.5	–	–	–	–	–	11.7	12.0	12.3	12.7	13.8	11.4
1998	119.7	8.0	7.1	6.6	6.7	7.1	–	10.6	12.0	12.2	12.7	12.8	–
1999	110.2	8.3	7.5	7.1	7.1	7.5	9.2	11.0	11.4	11.8	–	–	11.7
2000	107.4	9.8	8.9	7.6	7.7	8.5	9.8	11.2	11.6	12.0	12.4	12.3	11.1
2001	74.6	–	6.9	6.7	7.0	8.4	10.0	10.4	10.7	–	11.1	11.4	–
2002	93.4	8.2	6.5	6.5	7.3	8.0	–	10.8	11.1	11.5	11.7	–	11.7
2003	100.9	9.1	7.7	–	7.5	8.0	10.2	11.4	11.8	12.1	12.5	–	12.1
2004	89.7	9.1	–	7.1	7.4	8.9	10.6	11.1	11.4	11.7	11.9	12.1	9.6
2005	117.2	7.5	6.8	7.0	7.0	7.5	9.5	11.6	12.0	12.5	12.8	13.0	11.7
avg	–	8.3	7.3	6.9	7.2	8.0	9.9	11.1	11.6	12.0	12.2	12.6	11.3

[a] Flow Index is the year's total runoff as a percentage of the long-term average.

SOURCES: SFPUC (raw data); Merritt-Smith Consultants (data reduction).

Water quality in the reach of the Tuolumne River between Hetch Hetchy and Don Pedro Reservoirs is very good, but its dissolved mineral and plant nutrient content increases somewhat in a downstream direction. MID samples water from the outlet of Modesto Reservoir on the Modesto Canal. The samples are reasonably representative of water quality in the Tuolumne River at La Grange Dam. Total dissolved solids have been measured twice daily since 1997. These data show total dissolved solids concentrations that range from 15 to 26 mg/L, with an average of about 20 mg/L.

Below Don Pedro Reservoir, Tuolumne River water quality deteriorates somewhat as a result of agricultural irrigation return flow, urban and agricultural runoff, and recreation in and around the river and in Don Pedro Reservoir itself. In the warmer months, water temperature increases in a downstream direction as the river leaves the foothills of the Sierra Nevada and flows on to the floor of the San Joaquin Valley. Total dissolved solids content and turbidity also increase in a downstream direction.

Water temperature at several stations on the Tuolumne River downstream of La Grange Dam has been recorded for many years, but most intensively and reliably in the last decade in the course of a 2005 TID/MID study. La Grange Dam is located at river mile (RM) 52.2; that is, it is 52.2 miles upstream of the Tuolumne River's confluence with the San Joaquin River. Daily average water temperature at RM 51.8, about one-half mile below La Grange Dam, was usually in the range of 9 to 14 °C between 1996 and 2004. Daily average temperature at RM 36.7, about 15 miles below La Grange Dam, was usually in the range of 9 to 26 °C, and at RM 3.4, about 50 miles below La Grange Dam, was usually in the range of 9 to 29 °C. Daily average wintertime water temperature is similar for the entire river reach from La Grange Dam to the confluence with the San Joaquin River. The maximum temperatures experienced in the summer and fall from 1996 to 2004 at several locations are shown in **Table 5.3.3-2**. Seasonal variation at RM 43.4, about nine miles below La Grange Dam is shown in **Figure 5.3.3-1**.

TABLE 5.3.3-2
MAXIMUM SUMMER–FALL WATER TEMPERATURES IN THE TUOLUMNE RIVER FROM LA GRANGE DAM TO MODESTO[a]
1996–2004

Year	Water Year Type	Maximum Water Temperature (Summer–Fall) (°C rounded to nearest 0.5)				
		RM 49	RM 43.4	RM 36.7	RM 23.6	RM 3.4
1996	AN-W	18.5	**21**	**25**	NA	**29**
1997	AN-W	16	**20**	**23**	**26**	**28**
1998	W	14	16	17	**21**	**23**
1999	BN-AN	16	18	**23**	**27**	**29**
2000	BN-AN	NA	19	**23**	**27**	**28**
2001	D	**22**	**28**	**30**	**31**	NA
2002	D	**20**	**26**	**30**	**30**	**31**
2003	BN	16	19	**23**	**26**	**30**
2004	D	18	**24**	**27**	**30**	NA

[a] La Grange Dam is located approximately at RM 49 and Modesto at RM 3.4.

W = wet; AN = above normal; BN = below normal; D = dry; C = critically dry; RM = river mile
Temperatures ≥20 °C are shown in **bold** type.

The TID/MID study describes some general trends in water temperature:

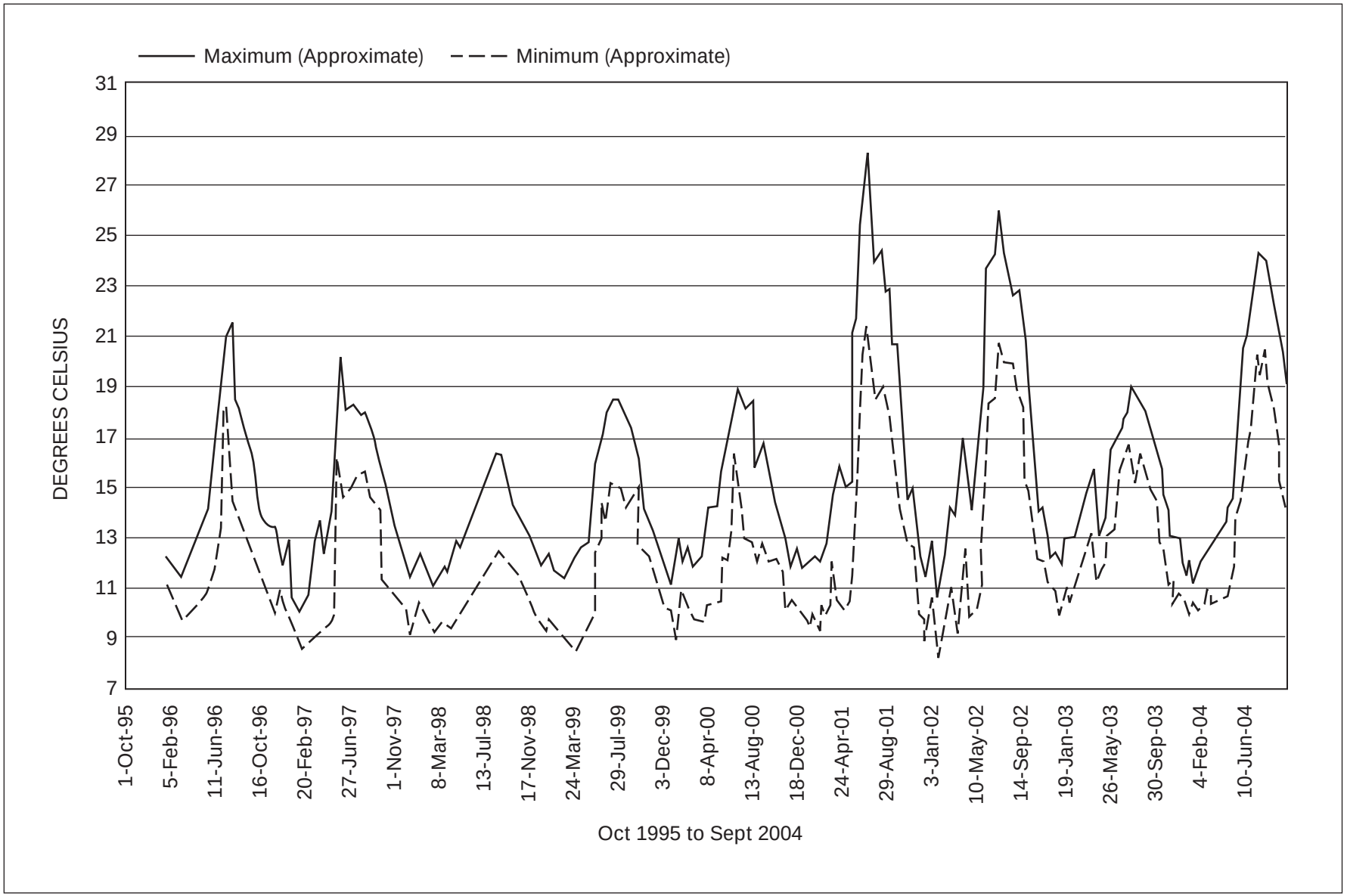
- In all year types from 1996 to 2004, releases from Don Pedro Reservoir varied seasonally from a low of about 8 °C to a high of about 16 °C, with low temperatures occurring during the spring snowmelt and the highest temperatures occurring in late summer.

- In the reaches below Don Pedro Reservoir and La Grange Dam (RM 51.8 to RM 36.7), there is a clear relationship between hydrologic year type (and thus flow) and river temperatures during the summer and fall. This probably reflects the influence of surface-area-to-volume relationships. The effect becomes increasingly pronounced from upstream to downstream due to high summer temperatures in the San Joaquin Valley (Table 5.3.3-2). Even in wet years, peak summer temperatures in the reach downstream of RM 23.6 are above 20 °C. In all but the summer of 1998 following the extremely wet 1997/1998 floods, peak water temperatures exceed 20 °C up to RM 36.7.

- In downstream reaches of the river (RM 23.6 and below), the period of average daily temperatures in excess of 21 to 23 °C is frequently two to four months long.

The water temperature data from TID/MID(2005) are generally consistent with those reported in a 1996 FERC study. The FERC report notes that water temperature in the river is probably affected by the lack of riparian shade, and that leakage of water from diversion reservoirs and upwelling of groundwater probably provide some pockets of cool water in the summer.

Some water quality characteristics in the Tuolumne River are affected by reservoir operations and by changes in river flow attributable to water supply and hydropower generation activities. Primary among them is water temperature, which in turn may affect dissolved oxygen content. Water temperature in flowing streams depends on the water source, air temperature, flow, surface area, and exposure to solar radiation. Reductions in stream flow when air temperature is high usually



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SOURCE: Turlock and Modesto Irrigation Districts

Figure 5.3.3-1

Tuolumne River Water Temperature at River Mile 43.4

result in increases in water temperature. Storage of water in reservoirs may increase or decrease water temperatures. Hetch Hetchy and Don Pedro Reservoirs fill with cool water in the winter and spring. During the summer, water near the surface is heated by solar radiation, but because the reservoirs are deep they retain a large volume of cool water nearer the bottom. The boundary between the warmer surface waters and cooler waters below is referred to as the thermocline. The portions of the reservoir above and below the thermocline are referred to respectively as the epilimnion and the hypolimnion. The thermocline is quite distinct in most deep reservoirs in the Sierra Nevada and is typically at a depth of 25 to 50 feet below the water surface. **Figure 5.3.3-2** shows typical August temperature profiles for Hetch Hetchy and Don Pedro Reservoirs in August. Typical summertime water temperatures in the epilimnion and hypolimnion at Hetch Hetchy Reservoir are 20 °C and 10 °C, respectively. Corresponding values for Don Pedro Reservoir are 27 °C and 12 °C.

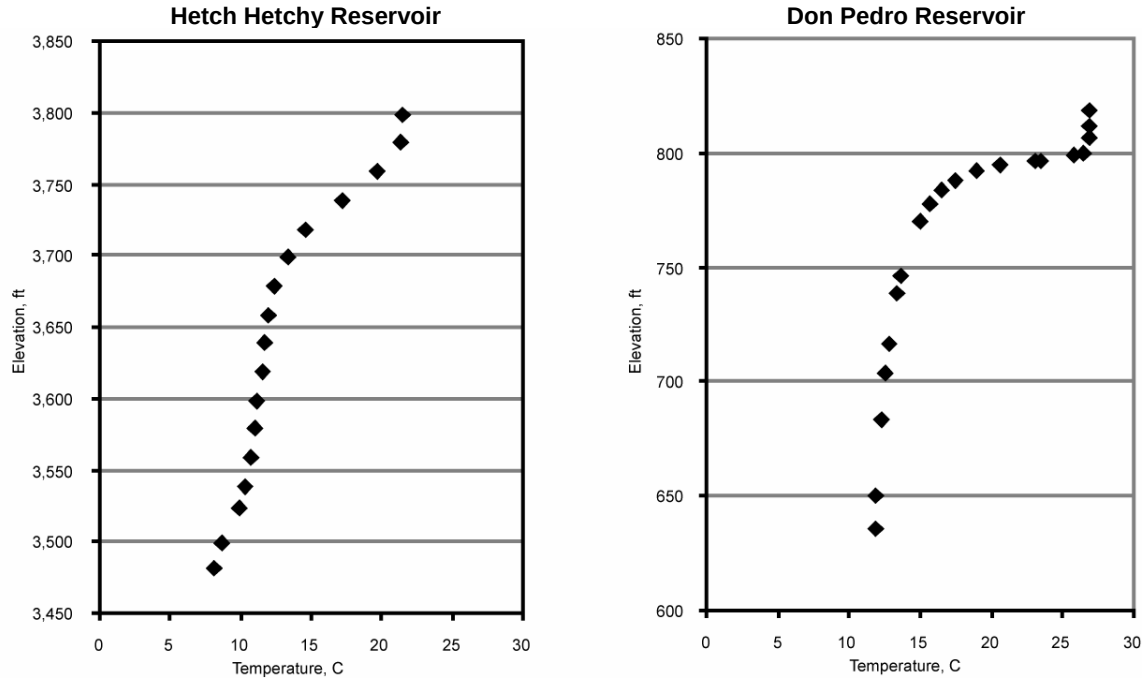

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Figure 5.3.3-2
Typical Summertime Water Temperature Gradient in Hetch Hetchy and Don Pedro Reservoirs

Water is typically released to streams from outlets near the bottom of reservoirs. If water is released from a reservoir in the summer from below the thermocline, it is typically cooler than stream water would be if the reservoir did not exist. When reservoirs are drawn down in the late summer and fall, the thermocline moves downward, closer to the reservoir outlet. Releases from reservoirs at such times may be a mixture of cool bottom water and warmer water from nearer the surface, with a consequent increase in water temperature in the stream below the reservoir.

San Joaquin River

Water quality in the San Joaquin River at Vernalis is shown in **Table 5.3.3-3**. Vernalis is located just upstream of the Sacramento–San Joaquin Delta and about 10 miles downstream of the San Joaquin River's confluence with the Tuolumne River. The total dissolved solids and total organic carbon concentrations in the San Joaquin River are high for natural waters and are considerably higher than for Tuolumne River water. The total dissolved solids concentration (a measure of dissolved minerals) averages 380 mg/L, and the total organic carbon concentration (a measure of dissolved and particulate organic matter) averages 3.6 mg/L. The total dissolved solids concentration in San Joaquin River water at Patterson, about 10 miles upstream from the San Joaquin River and Tuolumne River confluence, averages more than 600 mg/L. The improvement in San Joaquin River water quality between Patterson and Vernalis is attributable to mixing with higher quality water from the Tuolumne and Stanislaus Rivers.

TABLE 5.3.3-3
WATER QUALITY DATA SUMMARY, SAN JOAQUIN RIVER AT VERNALIS
ABOVE NORMAL (2000)/DRY (2002)

	Average Total Organic Carbon (mg/L)	Average Total Dissolved Solids (mg/L)	Average Nitrate (NO_3) (mg/L)	Average Total Phosphorus (mg/L)	pH
October	3.0/3.4	350/410	9.8/8.5	–	–
November	3.4/2.8	350/260	7.8/6.0	–	–
December	3.1/3.5	480/410	9.1/6.2	–	–
January	2.7/3.3	500/460	5.8/6.5	–	–
February	6.0/4.0	420/590	8.4/6.7	–	–
March	4.5/4.0	150/590	4.0/11.2	–	–
April	3.5/3.9	250/550	3.2/6.8	–	–
May	2.5/2.5	180/230	4.0/3.7	–	–
June	2.6/2.7	260/290	5.2/6.6	–	–
July	3.4/4.0	370/390	8.9/6.5	–	–
August	3.5/4.3	350/410	8.6/6.0	–	–
September	3.1/4.2	260/450	6.6/8.2	–	–
Average (1999–2003)	3.6	380	6.9	0.23	7.8

SOURCE: DWR 2003; 2005.

The primary causes of degraded water quality in the San Joaquin River are the unsolved agricultural drainage problem in the San Joaquin Valley, urban wastewater and stormwater discharges, discharges from wildlife refuges, and flow depletion in some months of some years. Inadequate drainage and accumulating salts have been persistent problems in parts of the San Joaquin Valley for more than a century. Farmers in arid areas must apply irrigation water to their crops in excess of crop needs to flush salts out of the root zone. In parts of the valley, this practice has caused shallow groundwater levels to rise close to the ground surface. To prevent land from becoming unproductive, farmers install tile drains under their fields in an effort to lower groundwater levels and remove salt from the soil. The tile drains convey saline water to perimeter ditches, which are typically routed to the nearest natural stream channel. In the San Joaquin Valley, the natural channels are tributary to the San Joaquin River or Tulare Lake. In

the 1960s and 1970s, the USBR attempted to solve the drainage problem in the San Joaquin Valley by constructing an agricultural drainage system for the valley that routed drainage water away from the San Joaquin River. The project was only partially built and failed to solve the problem (U.S. Department of the Interior/California Resources Agency, 1990).

Sacramento–San Joaquin Delta

Water quality in the Delta is governed by the Delta's complex hydrodynamics. Freshwater enters the Delta from its tributary rivers and, with the tides, saline water enters the Delta from Suisun Bay, the northern reach of the San Francisco Bay Estuary. When freshwater flow through the Delta is great, saline water is repelled and the waters of the Delta exhibit little salinity. When freshwater flow is small, tidal flow enables saline water to penetrate into the Delta. Under these circumstances, water quality in some parts of the Delta becomes brackish and unsuitable (or less suitable) for use as a source of potable and irrigation water. The reversal of flow in the lower San Joaquin River and many south Delta channels as a result of water diversion by the State Water Project and Central Valley Project increases the tendency for saline water to penetrate into the Delta.

Table 5.3.3-4 shows water quality characteristics at selected locations in the Delta. In general, water quality in the Delta declines in a southerly and westerly direction. This is illustrated by the pattern of chloride concentrations. For Sacramento River water entering the Delta from the north, the chloride content is low. Chloride, a constituent of seawater, enters the Delta from the west. The chloride concentration at the State Water Project's Banks Pumping Plant is higher than in the Sacramento River because low-chloride Sacramento River water mixes with saline water entering from Suisun Bay. Water quality at the Banks Pumping Plant, one of the two large pumping plants in the south Delta, is shown in **Table 5.3.3-5**.

The water quality parameters in Delta waters that are of greatest concern to municipal water supply agencies are total dissolved solids (salinity), bromide, and total organic carbon content. Elevated salinity levels in drinking water supplies may make it unpalatable. Farmers are also concerned about salinity because elevated levels may make water unsuitable for irrigating certain salt-sensitive crops.

Organic carbon compounds are present in water in the form of microscopic plants and animals and the products of bacterial degradation of plant and animal material. Total organic carbon levels rise in the Delta in the winter and spring primarily as a result of the drainage of peat soils on the Delta islands. Organic carbon reacts with chemicals used to disinfect drinking water to form trihalomethanes and other disinfection byproducts. Trihalomethanes are known to cause cancer in humans and are regulated under the Safe Drinking Water Act. Bromine also reacts with organic matter and disinfection agents to form trihalomethanes and other brominated disinfection byproducts. Saline water from San Francisco Bay is the main source of bromine in the Delta.

Diminution of flow and flow reversal in the lower San Joaquin River as a result of water diversions by the State Water Project and the Central Valley Project are harmful to migrating salmon. In 1990, DWR began installing temporary barriers in several waterways in the south Delta to improve conditions for migrating salmon. Temporary barriers have been placed across

TABLE 5.3.3-4
WATER QUALITY CHARACTERISTICS AT SELECTED STATIONS WITHIN THE DELTA

Location	Sacramento River at Green's Landing	North Bay Aqueduct at Barker Slough	Banks Pumping Plant	Contra Costa Intake at Rock Slough	San Joaquin River at Vernalis
Mean Total Dissolved Solids (mg/L)	100	192	258	305	459
Mean Electrical Conductivity (µS/cm)	160	332	482	533	749
Mean Bromide, Dissolved (mg/L)	0.018	0.015	0.269	0.455	0.313
Mean Total Organic Carbon (mg/L)	2.5	5.3	3.7	3.4	3.9
Mean Chloride, Dissolved (mg/L)	6.8	26	81	109	102

NOTE: Sampling period varies, depending on the location and constituent, but is generally between 1990 and 1998.

mg/L = milligrams per liter
µS/cm = microsiemens per centimeter

SOURCE: CALFED, 2000.

TABLE 5.3.3-5
WATER QUALITY DATA SUMMARY, BANKS PUMPING PLANT
ABOVE NORMAL (2000)/DRY (2002)

	Total Organic Carbon (mg/L)	Total Dissolved Solids (mg/L)	Nitrate (NO_3) (mg/L)	Total Phosphorus (mg/L)	pH
October	2.9/2.8	310/420	1.4/1.6	0.08/0.11	–
November	2.4/2.5	240/310	1.6/3.2	0.07/0.08	–
December	3.2/4.4	390/290	2.9/3.8	0.08/0.10	–
January	4.0/8.5	260/230	3.2/6.5	0.07/0.12	–
February	6.3/4.3	220/270	5.2/4.2	0.17/0.09	–
March	3.8/3.8	150/240	2.8/3.4	0.10/0.12	–
April	3.2/3.5	160/180	1.5/1.8	0.08/0.10	–
May	5.2/3.5	210/240	2.9/2.8	0.09/0.13	–
June	3.1/3.3	160/190	1.3/1.8	0.10/0.13	–
July	2.3/2.3	120/190	1.0/1.0	0.10/0.10	–
August	2.4/2.0	110/310	0.4/0.9	0.09/0.10	–
September	2.2/2.3	180/410	0.9/0.8	0.08/0.09	–
Annual Average (1999–2003)	3.5	233	2.5	0.11	7.4

SOURCES: DWR, 2003; 2005.

the Grant Line Canal, Middle River, and Old River. The purpose of the barriers is to control water levels for irrigators, improve water quality, and direct more water down the lower San Joaquin River for downstream migrating juvenile salmon in the spring and upstream migrating adults in the fall. It is expected that permanent operable barriers will replace the temporary barriers in the next few years.

Beneficial Uses and Water Quality Objectives

Water quality is regulated in California pursuant to the federal Clean Water Act and California's Porter-Cologne Water Quality Control Act of 1969. Responding to public concern in California, state legislators enacted a law designed to curb water pollution several years before passage of the Clean Water Act. The Porter-Cologne Act established regional water quality control boards and gave them defined responsibilities for water quality management.

The Porter-Cologne Act requires the regional water quality control boards to prepare regional WQCPs, often referred to as basin plans. The WQCPs must identify present and future beneficial uses of California's waters and establish water quality objectives to protect them. California's beneficial use designations and water quality objectives are the functional equivalent of the federal ambient water quality standards. After passage of the Federal Water Pollution Control Act Amendments in 1972, later known as the Clean Water Act, California's water quality objectives served as federal water quality standards, following review and approval by the U.S. Environmental Protection Agency (U.S. EPA).

WQCPs are adopted and amended by the regional water quality control boards and are subject to CEQA review. WQCPs, and amendments to WQCPs, do not become effective until approved by the SWRCB. Adoption or revision of surface water objectives/standards is subject to the approval of the U.S. EPA. The regional WQCPs complement statewide WQCPs adopted by the SWRCB, such as the WQCP for temperature control and the WQCP for ocean waters.

Two WQCPs govern management of surface and ground waters that could be affected by the WSIP. The Central Valley WQCP covers the Sacramento and San Joaquin River basins, including an area bounded on the east by the crests of the Sierra Nevada and Cascade Range and on the west by the Coast Ranges and Klamath Mountains. The San Francisco Bay/Delta WQCP covers those portions of Alameda, Contra Costa, Marin, Napa, San Mateo, San Francisco, Santa Clara, Solano, and Sonoma Counties that drain to the San Francisco Bay Estuary, including the Delta.

Each WQCP identifies existing and potential beneficial uses of surface waters and establishes water quality objectives within its part of California. Surface waters in the WQCP areas are in compliance with objectives, except for those waters contained in the SWRCB's Section 303(d) list of impaired water bodies.

Section 303(d) of the Clean Water Act requires that states periodically prepare a list of surface water bodies that do not meet ambient water quality standards after conventional water pollution control measures have been applied. The states must then establish the total maximum daily loads of pollutants that can be discharged to the water body without violating ambient water quality standards. Pollutant discharges must be cut back until they are in compliance with the total maximum daily loads.

Tuolumne River

Water quality objectives for the San Joaquin River Basin, including the Tuolumne River from the town of Waterford to La Grange Dam, are shown in **Table 5.3.3-6**. The only numerical water quality objective for the Tuolumne River is the objective for dissolved oxygen, which applies to

TABLE 5.3.3-6
PERTINENT WATER QUALITY OBJECTIVES FOR THE SAN JOAQUIN RIVER BASIN

Parameter	Water Body	Beneficial Use	Water Quality Objective
Dissolved Oxygen	San Joaquin River (Turner Cut to Stockton)	Chinook Salmon	6.0 mg/L (September 1 to November 30)
	Other Delta Waters	WARM COLD SPWN	5.0 mg/L 7.0 mg/L 7.0 mg/L
	Tuolumne River (Waterford to La Grange)		8.0 mg/L (or >95% saturation) (October 15 to June 15)
Salinity	San Joaquin River (Antioch Water Works)	MUN IND	Chloride: Maximum mean daily >150 mg/L Number of days per year <150 mg/L: Wet – 240 (66%) Above Normal – 190 (52%) Below Normal – 175 (48%) Dry – 165 (45%) Critical – 155 (42%)
	San Joaquin River (at Vernalis)	AGR	Electrical conductivity (maximum 30-day average): 0.7 (April 1 to August 31) 1.0 (September 1 to March 31)
Temperature	San Joaquin River (at Vernalis)	Chinook Salmon	April 1 to June 30 September 1 to November 3 Average daily water temperature may not be elevated by controllable factors above 68 °F.
	All	COLD WARM	Maximum 5 °F increase, as specified in Central Valley RWQCB objectives

Key: MUN (Municipal and Domestic Supply; AGR (Agriculture); IND (Industrial Use); WARM (Warm Freshwater Habitat); COLD (Cold Freshwater Habitat); SPWN (Fish Spawning).

SOURCE: SWRCB, 1995.

most of the river below La Grange Dam between October 15 and June 15. The objective is intended to protect spawning salmonids and their eggs.

Impaired water bodies on the Tuolumne River are shown in **Table 5.3.3-7**. Don Pedro Reservoir is listed under Section 303(d) for mercury. The elevated mercury concentrations are a result of past gold mining in the Tuolumne River watershed. The reach of the river below Don Pedro Reservoir is listed for pesticides and unknown toxicity.

San Joaquin River

Water quality objectives for the San Joaquin River are shown in Table 5.3.3-6. The objectives include dissolved oxygen and water temperature objectives designed to protect migrating Chinook salmon and salinity objectives designed to protect municipal, industrial, and agricultural water supplies. As shown in Table 5.3.3-7, the San Joaquin River is listed as impaired under Section 303(d) for mercury, boron, various pesticides, salinity, and unknown toxicity.

Sacramento–San Joaquin Delta

As noted above, the Sacramento–San Joaquin Delta lies at the heart of California's natural and manmade water systems. The Delta's physical complexity and competing interests for water

TABLE 5.3.3-7
SECTION 303(d) LIST OF IMPAIRED WATER BODIES

Segment Name	Pollutant	Potential Source	Total Maximum Daily Load Priority
Don Pedro Reservoir	Mercury	Resource Extraction	Low
Tuolumne River	Diazanon	Agriculture	Medium
(Don Pedro Reservoir to San Joaquin River)	Group A Pesticides	Agriculture	Low
	Unknown Toxicity	Source Unknown	Low
San Joaquin River	Boron	Agriculture	High
(Merced River to Vernalis)	Chlorpyrifos	Agriculture	High
	DDT	Agriculture	Low
	Diazinon	Agriculture	High
	Electrical Conductivity	Agriculture	High
	Group A Pesticides	Agriculture	Low
	Mercury	Resource Extraction	Medium
	Unknown Toxicity	Source Unknown	Low
Sacramento–San Joaquin River Delta	Chlorpyrifos	Agriculture/Urban Runoff	High
	DDT	Agriculture	Low
	Diazinon	Agriculture/Urban Runoff	High
	Electrical Conductivity	Agriculture	Medium
	Group A Pesticides	Agriculture	Low
	Mercury	Resource Extraction	Medium
	Unknown Toxicity	Source Unknown	Low
	Exotic Species (proposed)	Ballast Water	NA

SOURCE: SWRCB, 1995.

make management of the Delta difficult. Water quality and flow objectives for the Delta have been the subject of much controversy and have frequently been revised. Some issues remain unresolved, including the degree to which parties that divert water upstream of the Delta are responsible for meeting Delta objectives. Resolution of these issues could affect all upstream diverters, including the SFPUC, TID, and MID.

The San Francisco Region WQCP, published in the early 1970s, designated beneficial uses and water quality objectives for both San Francisco Bay and the Delta. In 1978, a WQCP for the Sacramento–San Joaquin Delta and Suisun Marsh was published. In 1991, a WQCP for salinity in the San Francisco Bay/Sacramento–San Joaquin Delta Estuary (Bay-Delta estuary) was published. When the Monterey Agreement was signed in December 1994, the beneficial uses and water quality objectives contained in the 1978 and 1991 WQCPs were in effect. In May 1995, as the first elements of the Monterey Amendment were being implemented, the SWRCB adopted a new WQCP for San Francisco Bay and the Delta that superseded both the 1978 and 1991 plans (SWRCB, 1995).

The SWRCB is responsible for issuing and administering water-rights permits in California. In 1978, the SWRCB adopted Water Rights Decision 1485 (D-1485), which established minimum flows in the Delta and limited exports of water by the State Water Project and Central Valley Project. The purpose of D-1485 was to ensure compliance with then-current water quality

objectives. D-1485 superseded all earlier water-rights decisions for State Water Project and Central Valley Project operations in the Delta. Various interests filed lawsuits challenging D-1485. In 1986, a ruling known as the Racanelli Decision affirmed the SWRCB's broad authority and obligation to establish water quality objectives and set water-rights permit terms that provide reasonable protection to the beneficial uses of Delta waters (DWR, 1998). In 1987, the SWRCB began hearings to adopt new Delta objectives and a new water-rights decision.

Although the SWRCB adopted new water quality and flow objectives in 1995 as part of the 1995 Bay-Delta WQCP, D-1485 remained in effect until 1999.

Water Quality and Flow Objectives. The WQCP for San Francisco Bay and the Delta, published in 1995, included water quality and flow objectives for the Delta. A draft EIR on the WQCP was published in 1997 (SWRCB, 1997). In the EIR, the SWRCB acknowledged that the flow objectives can only be achieved by limiting diversions of water in the Sacramento and San Joaquin River watersheds and within the Delta itself. The EIR noted that the SWRCB intended to implement the objectives, to the extent feasible, through amendments to the permits of water-rights holders in the Central Valley. However, the EIR also noted that some of the objectives cannot reasonably be achieved through changes to water-rights permits exclusively. Water quality and the health of aquatic resources in the Delta and San Francisco Bay are dependent on many factors outside the regulatory authority of the SWRCB. These factors include salt buildup in the San Joaquin Valley, introduction of non-native aquatic species, legal and illegal fishing, and degradation of upstream spawning habitat for fish that migrate through the Delta.

In the years following publication of the WQCP, most of the objectives of the WQCP were implemented through biological opinions issued by the USFWS and the NMFS pursuant to the Federal Endangered Species Act and through D-1485 and SWRCB Order WR 98-9. Under the biological opinions, D-1485, and WR 98-9, responsibility for meeting most of the objectives was assigned to the State Water Project and the Central Valley Project (SWRCB, 1999).

The SWRCB established separate Delta water quality objectives for municipal and industrial, agricultural, and fish and wildlife beneficial uses. The objectives for municipal and industrial beneficial uses require that certain chloride levels be maintained at certain locations in the Delta during certain hydrologic year types. The objectives for agricultural beneficial uses require that certain electrical conductivity levels be maintained at certain locations in the Delta during certain months of the year. The objectives for fish and wildlife beneficial uses require that certain electrical conductivity levels be maintained at certain locations in the Delta during certain months of the year. They also require that certain minimum levels of Delta outflow and maximum levels of export by the State Water Project and Central Valley Project be maintained during certain hydrologic year types.

5.3.3.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to surface water quality, but generally considers that implementation of the proposed program would have a significant impact if it were to:

- Substantially impair a water body's ability to support beneficial uses designated by the State Water Resources Control Board or Regional Water Quality Control Board
- Otherwise substantially degrade water quality

Approach to Analysis

This section describes the impacts of the WSIP on surface water quality in the Tuolumne River watershed. The changes in surface water quality would result from WSIP-induced changes in stream flow and reservoir water levels. The effects of the WSIP on stream flow and reservoir water levels are described in Section 5.3.1. In general, effects are found to be significant if they would frequently exceed water quality objectives. Very infrequent exceedances of water quality objectives would not be considered significant here because the exceedances would not substantially impair designated beneficial uses or substantially degrade water quality.

Changes in flow in rivers and streams and changes in reservoir storage and water levels attributable to WSIP implementation were estimated using the HH/LSM. An overview of the model is presented in Section 5.1. Detailed information on the model and the assumptions that underlie it is provided in Appendix H. A second model, VR_Temp, was used to assess the effects of the WSIP on water temperature in the Tuolumne River below La Grange Dam. It is also described in Appendix H.

Beth Neilson at Utah State University and Dr. Steve Chapra at Tufts University developed VR_Temp for application to the Virgin River in Utah. VR_Temp is a one-dimensional, surface heat balance and kinematic flow routing model developed based on the derivations found in Chapra (1997). The model is able to estimate maximum daily water temperatures and was constructed to allow different input time steps for meteorological data as well as point and distributed inflow sources. The model allows a single stream or river segment to be divided into computational cells or elements; stream networks are not modeled and tributaries are treated as a time-series input. VR_Temp was adapted for use on the Tuolumne River by Mike Deas for Merritt-Smith Consultants.

Impact Summary

Table 5.3.3-8 presents a summary of the impacts on surface water quality in the Tuolumne River system and downstream water bodies that could result from implementation of the proposed water supply and system operations.

TABLE 5.3.3-8
SUMMARY OF IMPACTS – SURFACE WATER QUALITY
IN THE TUOLUMNE RIVER SYSTEM AND DOWNSTREAM WATER BODIES

Impact	Significance Determination
Impact 5.3.3-1: Effects on water quality in Hetch Hetchy Reservoir and along the Tuolumne River below O'Shaughnessy Dam	LS
Impact 5.3.3-2: Effects on water quality in Don Pedro Reservoir and along the Tuolumne River below La Grange Dam	LS
Impact 5.3.3-3: Effects on water quality along the San Joaquin River and the Sacramento–San Joaquin Delta	LS

LS = Less than Significant impact, no mitigation required

Impact Discussion

Impact 5.3.3-1: Effects on water quality in Hetch Hetchy Reservoir and along the Tuolumne River below O'Shaughnessy Dam.

The primary water quality parameters of concern in Hetch Hetchy Reservoir and the Tuolumne River below the reservoir are water temperature and dissolved oxygen. Most fish species that inhabit the reservoir and the Tuolumne River below O'Shaughnessy Dam are adapted to cool temperatures and well-oxygenated water. Water entering Hetch Hetchy Reservoir in the spring is cold and well oxygenated. Rising air temperatures and solar radiation in the summer heat the surface waters of the reservoir, but deeper water (25 to 50 feet below the surface) remains cold. The oxygen content of deeper waters declines somewhat through the summer as a result of biochemical reactions, but oxygen depletion is limited by the lack of plant nutrients in Hetch Hetchy water. The reductions in storage and water levels in Hetch Hetchy Reservoir attributable to the proposed program under average (or even average dry) conditions would be too small to have much effect on water temperature or dissolved oxygen content. Because the WSIP would have little effect on reservoir water quality, it would have little effect on the quality of water released from the reservoir to the Tuolumne River below the reservoir.

However, reductions in storage and water levels could have a greater effect on reservoir water quality and the quality of water released to the Tuolumne River during extremely dry periods. As noted above and shown diagrammatically in Figure 5.3.3-2, deep reservoirs in the Sierra Nevada stratify in the summer. Normally, water released from Hetch Hetchy Reservoir to the Tuolumne River is drawn from the cool pool of water below the thermocline. If the reservoir is drawn down sufficiently, releases to the river could exhaust the pool of cool water, and warmer water from above the thermocline would be released.

Conditions that would result during droughts similar to those that occurred in 1923–1935, 1986–1993, and 1976–1977 were examined using the HH/LSM with the proposed program and under existing conditions. In a drought similar to the 1986–1993 drought, the water level in Hetch

Hetchy Reservoir would never be drawn down sufficiently to affect water temperature in the Tuolumne River below the reservoir. In a drought similar to the 1923–1935 drought, the water level in Hetch Hetchy Reservoir would be drawn down to very low levels in January through April of the tenth year of the drought. However, in these months the reservoir is not stratified and so the drawdown would have little or no effect on downstream water temperatures.

In a drought similar to the 1976–1977 drought, the water level in Hetch Hetchy Reservoir would be drawn down to very low levels in October through January of the second and third years of the drought with the WSIP, as shown in Figure 5.3.1-9. In October and November, the reservoir would normally be stratified; that is, water above the thermocline, which would be at a depth of about 60 to 80 feet, would be 10 or 12 °C warmer than water below the thermocline. The drawdown in September and October would destratify the reservoir and would result in an increase in the temperature of water released to the Tuolumne River, from about 8 °C to perhaps 14 to 18 °C. This phenomenon would occur in a drought similar to the 1976–1977 drought under the existing condition as well as with the proposed program. However, as shown in Figure 5.3.1-9, the drawdown in Hetch Hetchy Reservoir with the WSIP would be greater than under the existing condition, and thus the adverse water quality effects would likely last longer by several days or weeks.

The dissolved oxygen content of water released from Hetch Hetchy Reservoir varies depending on water temperature and the depth from which it is drawn. Most of the time, the water drawn from the reservoir is well oxygenated. Any water with depleted oxygen levels is rapidly reoxygenated as a result of its turbulent release to the Tuolumne River. The WSIP would have little or no effect on dissolved oxygen levels in water released to river.

Water quality in the Tuolumne River would occasionally be affected by WSIP-induced changes in the temperature of releases from Hetch Hetchy Reservoir, as described above. It could also be affected by WSIP-induced changes in stream flow in the Tuolumne River below Hetch Hetchy Reservoir. However, the effects of the two phenomena would not coincide because the former would occur in early fall and the latter in the late spring and early summer.

The proposed program would have little or no effect on flow below Hetch Hetchy Reservoir in most summer, fall, and winter months, as described previously, and consequently would have little or no effect on water temperature. Water temperature would only be affected if the WSIP resulted in a substantial reduction in flow at a time when air temperatures and solar radiation are sufficient to heat the diminished flowing stream. **Table 5.3.3-9** shows the five months in the 964-month hydrologic record during which the WSIP would reduce flows in the river substantially; as the table indicates, the proposed program would reduce flow by 50 percent or more compared to the existing condition and would reduce flows to below 200 cfs. All five occurrences would be in the month of May.

Even in the fairly extreme conditions shown in Table 5.3.3-9, it is questionable whether water temperatures in the Tuolumne River below Hetch Hetchy Reservoir would become elevated compared to the existing condition. In May, average daily air temperatures are moderate and accumulated snow is melting. Snowmelt runoff into the Tuolumne River, both directly and from

TABLE 5.3.3-9
AVERAGE FLOWS FOR CONDITIONS WHERE WATER TEMPERATURES COULD BE ADVERSELY AFFECTED (TUOLUMNE RIVER BELOW HETCH HETCHY)
(cubic feet per second)

Date	Existing Condition	Proposed Program	Difference
May 1962	777	100	-677
May 1978	857	100	-757
May 1981	413	144	-169
May 1992	530	50	-470
May 1999	383	164	-219

SOURCE: SFPUC, HH/LSM (see Appendix H).

tributaries (including Cherry Creek and the Clavey River) between Hetch Hetchy Reservoir and Don Pedro Reservoir would minimize any temperature increases resulting from WSIP-induced reductions in flow.

In general, the WSIP would have very little effect on water quality in Hetch Hetchy Reservoir or the Tuolumne River below the reservoir. WSIP-induced reductions in flow in the Tuolumne River below the reservoir would occur primarily in May and would not be expected to result in sufficient changes in water temperature to affect the river's ability to support its designated beneficial uses, including support of a coldwater fishery. On very rare occasions under existing conditions and during extreme droughts (once in the 82-year hydrologic record), warm water is released from Hetch Hetchy Reservoir to the Tuolumne River. At such times, the water quality objective that limits increases in water temperature to 5 degrees Fahrenheit (°F) to protect coldwater fish would likely be exceeded. With the WSIP, the release of warm water would continue to be a rare occurrence (once in the 82-year hydrologic record), but the period during which warm water would be released from Hetch Hetchy Reservoir, and the water quality objective exceeded, would be extended by several days or weeks.

Exceedances of the water quality objective that limits temperature changes have probably occurred very infrequently under the existing condition (modeling indicates that it may have occurred once in the 82-year period of hydrologic record). In the future with the WSIP, very infrequent exceedances of the water quality objective would continue to occur, but could last longer by several days or weeks than under the existing condition. Infrequent exceedances of the standard would not substantially affect the Tuolumne River's ability to support its designated beneficial uses, including support of a coldwater fishery. This is because, during times when an exceedance of the objective occurred, water temperatures would still remain within an acceptable range for coldwater fish (see Section 5.3.6). Thus, the impact of the WSIP on water quality in Hetch Hetchy Reservoir and the Tuolumne River would be *less than significant*, and no mitigation measures would be required.

Impact 5.3.3-2: Effects on water quality in Don Pedro Reservoir and along the Tuolumne River below La Grange Dam.

The primary water quality parameter of concern in Don Pedro Reservoir is water temperature. Like Hetch Hetchy Reservoir, Don Pedro Reservoir stratifies in the summer months. If the WSIP caused the reservoir to be greatly drawn down, then it would adversely affect water temperature in the Tuolumne River below La Grange Dam. Reservoir drawdown would be at its greatest during extended dry periods.

Conditions that would result in Don Pedro Reservoir during droughts similar to those that occurred in 1923–1935, 1986–1993, and 1976–1977 were examined using the HH/LSM. As indicated in Figure 5.3.1-12, although Don Pedro Reservoir would be drawn down greatly in each of the droughts, storage in the reservoir would never decrease much below 500,000 acre-feet. **Table 5.3.3-10** compares storage in Don Pedro Reservoir in the 1923–1935 and 1986–1993 droughts with the proposed program and under existing conditions. It also shows the elevation of the thermocline and the volume of the cool water pool under both conditions. Although the WSIP would lower the elevation of the thermocline when storage in the reservoir is at a minimum, the thermocline would still be considerably above the elevation of the outlet from Don Pedro

TABLE 5.3.3-10
COMPARISON OF STORAGE, COOL WATER POOL VOLUMES, AND DEPTH TO THERMOCLINE FOR DON PEDRO RESERVOIR UNDER EXISTING CONDITIONS AND WITH THE WSIP

Drought Conditions	Minimum Storage (acre-feet)		Cool Water Pool (acre-feet)		Thermocline Elevation (feet msl)	
	Existing	WSIP	Existing	WSIP	Existing	WSIP
1923–1935	680,066	623,932	360,000	320,000	614	604
1986–1994	823,654	695,955	450,000	370,000	636	616

SOURCE: Merritt-Smith Consultants (raw data).

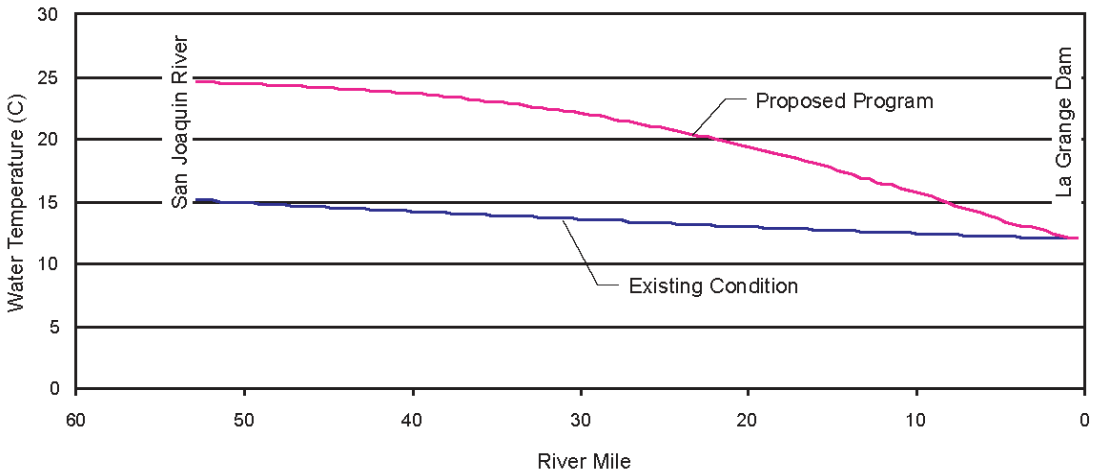
Reservoir. The outlet is an 18.5-foot-diameter tunnel with a crest elevation of 543.5 feet above mean sea level (msl). Releases from the reservoir with the WSIP in place would still be from the cool water pool below the thermocline. Thus, the changes in water level in Don Pedro Reservoir attributable to the proposed program would not increase the temperature of water released to the Tuolumne River below La Grange Dam.

Although water temperature in the Tuolumne River would not be affected by WSIP-induced changes in releases from Don Pedro Reservoir, it could be affected by WSIP-induced changes in stream flow. The proposed program would have little effect on flow below Don Pedro Reservoir in most summer, fall, and winter months, but it could cause reductions in flow of up to 95 percent compared to the existing condition under certain circumstances. For example, under hydrologic conditions similar to those that occurred in June 1999, the release to the Tuolumne River under the existing condition would be 523 cfs; with the WSIP it would be 250 cfs, a reduction of 52 percent.

Most of the large-percentage reductions in flow in the Tuolumne River below La Grange Dam would occur in April, May, and June following dry periods, when Don Pedro Reservoir would be drawn down. Reductions in flow in the late spring and early summer as a result of the proposed program could affect water temperatures under certain circumstances. These circumstances might include reductions in flow of 50 percent or more and flows of less than 400 cfs that result from WSIP-induced flow reductions. The results of the simulation of flows below La Grange Dam using 82 years of hydrologic data were examined to determine how frequently these circumstances occur. The analysis indicates that there are only three months over the 984-month hydrologic record when the circumstances would occur, and thus the condition has the potential to occur very infrequently.

The VR_Temp model was used to examine the effects on water temperature of WSIP-induced reductions in flow below La Grange Dam. Two conditions were simulated: the June 1993 and June 1999 events. The June 1993 event is an extreme event with over a 90 percent reduction in flow. Such a reduction only occurs once in the 82-year hydrologic record, as shown in Figure 5.3.1-12. The June 1999 event is less extreme than the June 1993 event, but it would still be rare. It involves a reduction in flow of 50 percent.

Water released from La Grange Dam in June is considerably cooler than the average daily air temperature. As water flows downstream, its temperature increases. The smaller the thermal mass of the water, the faster its temperature increases. **Figure 5.3.3-3** shows estimated mean daily water temperature in the Tuolumne River between La Grange Dam and the confluence with the San Joaquin River under June 1993 conditions with the proposed program and under existing conditions. Water temperature rises more rapidly with the proposed program than under existing conditions. Mean daily temperature in the Tuolumne River just upstream of the confluence with the San Joaquin River would be about 10 °C higher with the WSIP than under current conditions.

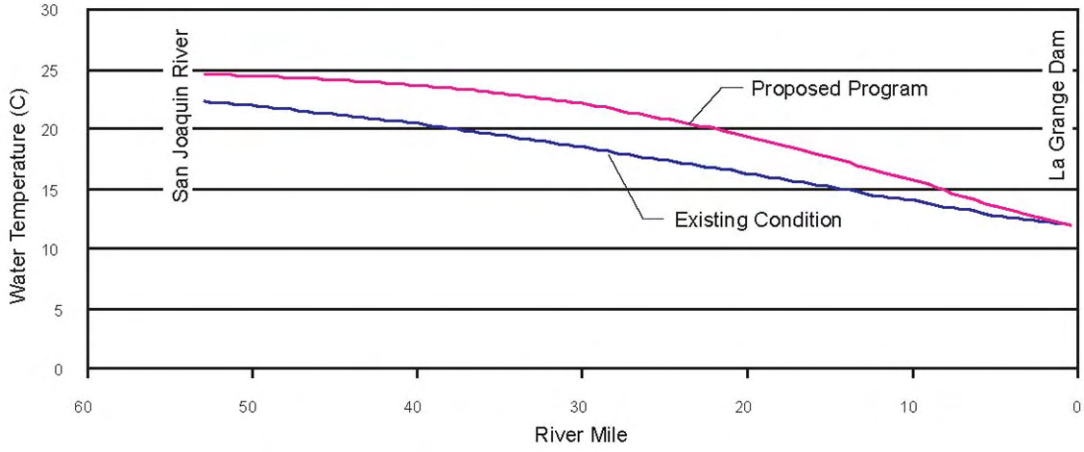


SFPUC Water System Improvement Program ▪ 203287

SOURCE: Merritt-Smith Consultants (raw data)

Figure 5.3.3-3
Longitudinal Profile of Simulated Mean Daily Water Temperature from La Grange Dam to the San Joaquin River, June 1993

Figure 5.3.3-4 shows similar information for June 1999 conditions. In this case, the temperature increase produced by the WSIP at the confluence with the San Joaquin River would be about 2°C.



SFPUC Water System Improvement Program ▪ 203287

SOURCE: Merritt-Smith Consultants (raw data)

Figure 5.3.3-4
Longitudinal Profile of Simulated Mean Daily Water Temperature from La Grange Dam to the San Joaquin River, June 1999

Almost all of the time, WSIP-induced flow reductions in the Tuolumne River below La Grange Dam would have no effect on water temperature. On infrequent occasions, 12 months in the 82-year period of hydrologic record, WSIP-induced flow reductions would cause mean daily temperature increases in the Tuolumne River of 1 or 2 °C. On very rare occasions, one month in the 82-year period of hydrologic record, WSIP-induced flow reductions would cause mean daily temperature increases of 10 °C.

Water quality objectives for the Tuolumne River require that water temperatures not be increased by more than 5 °F (2.8 °C). The WSIP would comply with this objective almost all of the time. On rare occasions, estimated at three or four months in the 82-year period of hydrologic record, there would be exceedances of the objective, but these rare exceedances would not impair the river's ability to support the designated beneficial uses that the objective is designed to protect, including coldwater fisheries. Consequently, this impact would be *less than significant*, and no mitigation measures would be required.

Impact 5.3.3-3: Effects on water quality along the San Joaquin River and the Sacramento–San Joaquin Delta.

The Tuolumne River joins the San Joaquin River about 50 miles downstream of La Grange Dam. The reductions in flow in the Tuolumne River below La Grange Dam attributable to the WSIP (as shown in Table 5.3.1-6) would reduce flows in the Tuolumne River between La Grange Dam and

its confluence with the San Joaquin River, and in the San Joaquin River from the confluence to the Delta. There is a potential for reductions in flow to affect water quality. However, most of the reductions in flow would occur from February through June in wet or above-normal years when flow in the San Joaquin River is at its seasonal maximum. As a consequence, most of the time, WSIP-induced changes in flow would have little effect on water quality in the San Joaquin River.

The SWRCB has established water quality objectives for the San Joaquin River at Vernalis, just upstream of the Sacramento–San Joaquin Delta. The objectives are expressed in term of electroconductivity, a measure of salinity. The salinity of river water at Vernalis becomes elevated when flow in the river is insufficient to repel saltwater entering from Suisun Bay. Almost all of the time, the reductions in San Joaquin River flow attributable to the WSIP would not be sufficient to cause salinity in the river at Vernalis to rise above the objective. Very infrequently, following protracted droughts, reductions in San Joaquin River flow attributable to the WSIP could be sufficient to cause salinity in the river at Vernalis to rise above the objective. Under these circumstances, the USBR, the agency responsible for compliance with objectives for the San Joaquin River, would increase releases from New Melones Reservoir on the Stanislaus River to meet the water quality objectives at Vernalis. Thus, the WSIP would not alter water quality in the San Joaquin River below its confluence with the Tuolumne River such that it would be substantially outside the range experienced under the existing condition. The impact would be *less than significant*, and no mitigation measures would be required.

The reductions in flow in the Tuolumne River below La Grange Dam attributable to the WSIP would also reduce inflow to the Sacramento–San Joaquin Delta. The changes in Delta inflow as a result of the WSIP would be too small to have much effect on water quality in the Delta, particularly as the changes would occur when flow through the Delta is at its seasonal maximum. The impact would be *less than significant*, and no mitigation measures would be required.

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5.3.4 Surface Water Supplies

The following setting section describes downstream water users whose water supply could be affected by the WSIP. The impact section (Section 5.3.4.2) provides a description of the changes in water availability and quality for downstream users resulting from WSIP-induced changes in stream flow.

5.3.4.1 Setting

The Tuolumne River flows from the crest of the Sierra Nevada westward to its confluence with the San Joaquin River. The San Joaquin River flows north to the Sacramento–San Joaquin Delta. Water from the Delta discharges to the San Francisco Bay Estuary and the Pacific Ocean. Because the WSIP would result in increased diversions of water from the Tuolumne River at Hetch Hetchy Reservoir, high in the Tuolumne River watershed, flow in the Tuolumne and San Joaquin Rivers and inflow to the Sacramento–San Joaquin Delta would be decreased in some months of some hydrologic year types. The changes in flow attributable to the WSIP are described in Section 5.3.1.

A number of water agencies and other diverters obtain their water supplies from the Tuolumne and San Joaquin Rivers and from the Delta. The water supplies of these agencies and other diverters could potentially be affected by the WSIP. Water agencies and others divert water from the rivers and the Delta in accordance with riparian water rights, pre-1914 appropriative water rights, and appropriative water-rights permits granted by the SWRCB.

In California, two doctrines govern surface water rights, the riparian doctrine and the doctrine of prior appropriation. A riparian water right is the right to use water for a reasonable and beneficial purpose as a result of the ownership of property that abuts a natural waterway. An appropriative water right is the right to use a specific quantity of water for a reasonable purpose at a specific location. The historical principle underlying the appropriation doctrine is “first-in-time, first-in-right.” An entity that first appropriates and uses water for a reasonable beneficial purpose has a right that is superior to the rights of later appropriators. When water is short and insufficient to meet the needs of all holders of appropriative water rights, the rights of senior water-rights holders must be satisfied before those of junior water-rights holders.

Prior to 1914, an entity followed certain procedures to obtain an appropriative water right but did not need to obtain a permit from the State of California. A change in state law in 1914 provided that all water within the state is the property of the people of the state and made it a requirement that appropriators obtain a permit to divert surface water. San Francisco holds pre-1914 rights to divert water from the Tuolumne River. The SWRCB does not regulate pre-1914 water rights.

Two of California’s largest water storage and conveyance projects, the federal Central Valley Project and the State Water Project, divert water from the Delta. The USBR, which operates the Central Valley Project, and the DWR, which operates the State Water Project, hold post-1914 appropriative rights to divert water from the Delta. These rights are junior to San Francisco’s Tuolumne River water rights.

Because of the size of the diversions made by the Central Valley Project and State Water Project, the nature of their authorizing legislation, and the priority of their water rights, the SWRCB assigned unique responsibilities to the USBR and DWR for compliance with Delta water quality and flow objectives. The USBR and DWR must operate the Central Valley Project and State Water Project in a manner that maintains compliance with Delta objectives. They are not permitted to fully exercise their water rights in the Delta if to do so would cause a violation of Delta water quality or flow objectives.

San Joaquin River and Sacramento–San Joaquin Delta

The San Joaquin River rises in the Sierra Nevada and drains an area of 13,500 square miles. After reaching the floor of the San Joaquin Valley near Fresno, the river flows westward towards the community of Mendota, then northwest for about 100 miles to the Sacramento–San Joaquin Delta. Some reaches of the river upstream and downstream of Mendota are dry, except when flood releases are made from Millerton Reservoir. The river begins to flow again generally downstream of the Mariposa Bypass as it gains water from agricultural irrigation, wildlife area management return flows, and tributaries. Major tributaries that join the San Joaquin River upstream of its confluence with the Delta include the Merced, Tuolumne, and Stanislaus Rivers. The San Joaquin River watershed is shown in Figure 5.3.1-7.

State Water Project

The State Water Project is California's second-largest water project; it operates Oroville Reservoir, with a capacity of about 3.5 million acre-feet, on the Feather River. Water from Oroville Reservoir is released to the Feather River and flows downstream to the Sacramento River and the Delta. Water is diverted from the south Delta at the State Water Project's Banks Pumping Plant and conveyed southward in the California Aqueduct to the State Water Project's contractors and to San Luis Reservoir, a joint-use facility of the Central Valley and State Water Projects. On average, the State Water Project delivers 2.4 million acre-feet each year for municipal and agricultural use, almost all of which is diverted from the Delta at the Banks Pumping Plant.

Central Valley Project

The Central Valley Project is California's largest water project. On average, the Central Valley Project delivers 5.6 million acre-feet of water each year for agricultural, wildlife management, and municipal use.

North of the Delta, the Central Valley Project operates reservoirs on the Sacramento, Trinity, and American Rivers. Shasta Reservoir, on the upper Sacramento River, has a capacity of 4.5 million acre-feet. Claire Engle Lake is located on the Trinity River, which flows to the Klamath River and to the Pacific Ocean near the California/Oregon border. Claire Engle Lake has a capacity of 2.4 million acre-feet. Water from the lake is diverted through a tunnel to the Sacramento River, where it combines with releases from Shasta Reservoir. Folsom Reservoir is located on the American River and has a capacity of 1 million acre-feet. Releases from all three reservoirs flow downstream to the Delta.

Water is diverted from the south Delta at the Central Valley Project's Tracy Pumping Plant and conveyed southward to Central Valley Project contractors on the western side of the San Joaquin Valley via the Delta-Mendota Canal and for delivery to San Luis Reservoir. The Central Valley Project's diversions at the Tracy Pumping Plant average about 1.7 million acre-feet per year. Smaller amounts of Central Valley Project water are diverted at the State Water Project's Banks Pumping Plant and conveyed southward in the California Aqueduct. The USBR supplies water to Central Valley Project contractors on the eastern side of the San Joaquin Valley from Millerton Reservoir on the San Joaquin River and several other reservoirs on tributaries of the San Joaquin River, including New Melones Reservoir on the Stanislaus River.

Flow and Water Quality Objectives for the San Joaquin River and the Delta

The SWRCB has established numerous flow and water quality objectives for the San Joaquin River at Vernalis and for the Sacramento–San Joaquin Delta. These objectives are prescribed in Decision 1641. Illustrative of these objectives are the flow and quality objectives for the San Joaquin River at Vernalis shown in **Table 5.3.4-1**. Outflow requirements from the Delta could be the specific flow objectives or the required flow to maintain salinity objectives at certain locations in the Delta. Specific flow objectives at Chipps Island are shown in **Table 5.3.4-2**.

TABLE 5.3.4-1
FLOW AND WATER QUALITY OBJECTIVES FOR SAN JOAQUIN RIVER AT VERNALIS

Year Type	Dates	Minimum Monthly Average Flow (cfs)[a]
Wet, above normal	February – April 14	2,130 or 3,420
Below normal, dry	February 1 – April 14	1,420 or 2,280
Critical	February 1 – April 14	710 or 1,140
Wet	April 15 – May 15	7,330 or 8,620
Above normal	April 15 – May 15	5,730 or 7,020
Below normal	April 15 – May 15	4,620 or 5,480
Dry	April 15 – May 15	4,020 or 4,880
Critical	April 15 – May 15	3,110 or 3,540
Wet, above normal	May 16 – June 30	2,130 or 3,420
Below normal, dry	May 16 – June 30	1,420 or 2,280
Critical	May 16 – June 30	710 or 1,140
All	October	1,000
All Years	April – August	0.7 mmhos/cm[b]
All Years	September – March	1.0 mmhos/cm[b]

[a] The higher flow objective applies when the 2 parts per thousand isohaline is required to be at or west of Chipps Island. An isohaline is a line drawn through places that have equal values of water salinity. The April 15–May 15 flow objective is currently replaced by the protocols of the San Joaquin River Agreement and the Vernalis Adaptive Management Program, which provides flows during this period ranging between 3,200 cfs and 7,000 cfs.

[b] The water quality objective is to be met on a 30-day running average of mean daily water electroconductivity, which provides a measure of water salinity. The units of electroconductivity are millisiemens per centimeter.

SOURCE: SWRCB, 1995.

TABLE 5.3.4-2
FLOW OBJECTIVES FOR SACRAMENTO–SAN JOAQUIN DELTA

Year Type	Dates	Minimum Monthly Delta Outflow (cfs)[a]
All	January	4,500[b]
All	February – June	7,100[c]
Wet, above normal	July	8,000
Below normal	July	6,500
Dry	July	5,000
Critical	July	4,000
Wet, above normal, below normal	August	4,000
Dry	August	3,500
Critical	August	3,000
All	September	3,000
Wet, above normal, below normal, dry	October	4,000
Critical	October	3,000
Wet, above normal, below normal, dry	November – December	4,500
Critical	November – December	3,500

[a] Flow as determined by the Net Delta Outflow Index. For the May–January objectives, if the value is less than or equal to 5,000 cfs, the 7-day running average shall not be less than 1,000 cfs below the value; if the value is greater than 5,000 cfs, the 7-day running average shall not be less than 80 percent of the value.
[b] The objective is increased to 6,000 cfs if the best available estimate of unimpaired Delta inflow for December is greater than 800,000 acre-feet.
[c] The minimum Delta outflow required may be reduced under certain conditions described in the San Francisco Bay–Delta Water Quality Control Plan.

5.3.4.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to water supplies, but generally considers that implementation of the proposed program would have a significant water supply impact if it were to:

- Result in substantial adverse changes in operations or substantial decreases in water deliveries for water users, as measured by significant changes in reservoir storage, timing or rate of river flows, or water quality
- Violate any water quality standards or otherwise substantially degrade water quality

Approach to Analysis

Changes in flow in rivers and streams and changes in reservoir storage and water levels in the Tuolumne River watershed attributable to the WSIP were estimated using the HH/LSM. An overview of the model is presented in Section 5.1. The HH/LSM simulates water deliveries, reservoir storage, and releases to rivers under different conditions using hydrologic data from the period 1920 to 2002. Detailed information on the model and the assumptions that underlie it is provided in Appendix H. Changes in stream flow were then used to estimate the effects on water availability and water quality for downstream users.

Impact Summary

Table 5.3.4-3 presents a summary of the impacts on the water supply of downstream users that could result from implementation of the proposed program.

TABLE 5.3.4-3
SUMMARY OF IMPACTS – SURFACE WATER SUPPLIES OF DOWNSTREAM USERS

Impact	Significance Determination
Impact 5.3.4-1: Effects on Tuolumne River, San Joaquin River, and Stanislaus River water users	LS
Impact 5.3.4-2: Effects on Delta water users	LS

LS = Less than Significant impact, no mitigation required

Impact Discussion

Impact 5.3.4-1: Effects on Tuolumne River, San Joaquin River, and Stanislaus River water users.

Like the CCSF, TID and MID hold pre-1914 rights to Tuolumne River water. When the federal government passed the Raker Act in 1913, it granted the CCSF the rights-of-way and public lands necessary to construct the Hetch Hetchy system. The Raker Act includes various conditions, one of which is that the CCSF must recognize TID's and MID's prior rights to water from the Tuolumne River. In the same year the Raker Act was passed, the CCSF reached agreement with TID and MID on the amount of water needed to satisfy their prior water rights. All of the SFPUC's existing water supply facilities are operated in compliance with the provisions of the Raker Act and would continue to be operated in compliance with the act after the WSIP has been implemented. Consequently, the WSIP would have no adverse effect on the availability of Tuolumne River water to TID and MID or on the quality of water available to them.

Changes in flow in the Tuolumne River below La Grange Dam attributable to the WSIP would affect flows in the San Joaquin River from its confluence with the Tuolumne River to the Delta. The Delta standards include flow and quality objectives for the San Joaquin River at Vernalis, just upstream of the point where the San Joaquin River flows into the Delta. Very infrequently, following protracted droughts, reductions in San Joaquin River flow attributable to the WSIP could make it necessary for the USBR, the agency responsible for compliance with water quality and flow objectives for the San Joaquin River, to increase releases from New Melones Reservoir to meet the objectives at Vernalis.

As described in Section 5.3.1, under existing conditions in the majority of years classified as below-normal or drier, almost all of the winter and spring runoff from the watershed upstream of Don Pedro Reservoir on the Tuolumne River is captured in the reservoir. Only the minimum required releases to the Tuolumne River below La Grange Dam are made. The WSIP would have no effect on flow in the Tuolumne River below La Grange Dam or the San Joaquin River under

these conditions. In years when the reservoir fills, usually wet or above-normal years, excess water is released in some months to the Tuolumne River. In the future with the WSIP, TID and MID would draw Don Pedro Reservoir down farther in most years than they would under the existing condition, and consequently a greater proportion of spring runoff would be needed to refill the reservoir. As a result, the volume of excess water released to the Tuolumne River would be reduced in some normal, above-normal, and wet years compared to the existing condition.

Table 5.3.4-4 shows the change in modeled releases from La Grange Dam attributable to the WSIP for the 82-year hydrologic simulation, by year type and descending order of wetness. The magnitudes of modeled releases with and without the WSIP are shown in Table 5.3.1-6. Flow in the Tuolumne River below La Grange Dam and flow in the San Joaquin River below its confluence with the Tuolumne River would reflect the changes. As shown in the table, most of the changes in releases and the greatest changes in releases would occur in wet and above-normal years following a series of dry years. Many of the changes are small in magnitude compared to the required minimum stream flow releases shown in Table 5.3.1-3. Furthermore, most of the changes in releases would occur from February through June of the affected years, with an occasional occurrence during other months. When they occur, the changes in average monthly flows are usually in the hundreds of cubic feet per second (an average monthly flow of 100 cfs is equal to a monthly volume of about 6,000 acre-feet). Occasionally, changes are in the range of 1,000 cfs to a little over 3,000 cfs. The greatest changes would potentially occur infrequently during wetter years following protracted droughts.

The changes in flow described above would affect the Tuolumne River below La Grange Dam and the San Joaquin River below its confluence with the Tuolumne River. **Table 5.3.4-5** shows measured flows in the San Joaquin River at Vernalis for the period 1969 through 2002, arranged by descending order of wetness. As can be seen by the record, average monthly flows in the San Joaquin River vary seasonally and by year type. During wet years in February through June (the period when WSIP effects would mostly occur), flows generally range from a low of 5,000 cfs to over 40,000 cfs. During the summer, flows can diminish to as low as 1,500 cfs. During above-normal years in February through March (the period when WSIP effects mostly occur within this year type), flows are generally in excess of 7,000 cfs. A comparison between Tables 5.3.4-4 and 5.3.4-5 indicates that, although flows would be reduced with the WSIP, they would still exceed the flow objectives during wet and above-normal hydrologic conditions. Typically, during wet and above-normal years, there is sufficient tributary flow in the San Joaquin River basin to meet water quality objectives at Vernalis. Under these conditions, the USBR does not need to release water from New Melones Reservoir on the Stanislaus River to meet flow or water quality objectives at Vernalis.

As noted above, if the WSIP caused flow in the San Joaquin River at Vernalis to fall below the flow objective or caused water quality at Vernalis to fall below objectives, the USBR would have to increase releases from New Melones Reservoir or other San Joaquin Valley Central Valley Project facilities to compensate. During wet and above-normal years, when most of the effects of the WSIP would be felt, flow and water quality objectives at Vernalis would be met and the USBR would not have to release extra water from the reservoir. Thus, the WSIP would have no

TABLE 5.3.4-4
AVERAGE MONTHLY CHANGES IN TUOLUMNE RIVER FLOW BELOW LA GRANGE DAM ATTRIBUTABLE TO THE WSIP
(cubic feet per second)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Year Type
1983	-48	-31	43	0	0	0	0	-94	-46	-37	0	-38	Wet
1969	0	0	0	-549	-129	-106	-130	-84	-84	-37	0	0	Wet
1995	0	0	0	0	-339	-132	0	-211	-62	-37	0	-38	Wet
1938	0	0	-306	0	0	0	-154	-295	-84	-37	0	0	Wet
1998	0	0	0	-327	0	-112	-149	-40	-63	-37	0	0	Wet
1982	0	0	0	-453	-244	-15	0	-46	-46	-37	0	-75	Wet
1967	0	0	0	0	0	-354	-168	-133	0	-37	0	-38	Wet
1952	0	0	0	0	-219	-133	0	-346	-84	-37	0	0	Wet
1958	0	0	0	0	-405	-148	-102	-252	-48	-37	0	0	Wet
1980	0	0	0	76	0	-139	-84	-84	-84	-37	0	0	Wet
1978	0	0	0	0	0	0	0	0	-1,583	0	0	0	Wet
1922	0	0	0	0	-157	-95	-124	-92	-245	0	-11	-27	Wet
1956	0	0	-1,350	0	0	-71	-47	0	-223	-37	0	0	Wet
1942	0	0	0	-61	0	-62	-93	-46	-46	-37	0	0	Wet
1941	0	0	0	2	-9	-5	-8	0	-121	0	-11	-27	Wet
1986	0	0	0	0	-291	-463	-190	-84	-84	0	0	0	Wet
1993	0	0	0	0	0	0	0	0	-3,159	0	-275	-659	Wet
1997	0	-38	0	-196	0	0	0	0	0	0	0	0	Wet
1996	0	0	0	0	-65	0	-114	-37	-37	0	0	0	Wet
1943	0	0	0	0	0	-159	-84	0	-170	0	0	-38	Wet
1937	0	0	0	0	-268	-213	-60	0	0	0	0	0	Wet
1974	0	0	0	-186	0	-139	-93	-93	-74	0	0	-38	Wet
1975	0	0	0	0	0	0	-139	0	-2	0	-11	-27	Wet
1965	0	0	0	-1,630	-110	-219	-29	0	0	0	0	150	Wet
1936	0	0	0	0	-2,702	-1,935	-85	0	0	0	0	0	AN
1984	-98	0	0	0	0	64	0	0	0	0	0	0	AN
1979	0	0	0	-110	0	-325	-37	-37	0	0	0	0	AN
1945	0	0	0	0	-394	-488	-3	0	0	0	0	0	AN
1999	0	0	0	0	0	-186	-52	0	-273	0	0	0	AN
1963	0	0	0	0	0	0	0	0	0	0	0	0	AN
1927	0	0	0	0	0	0	0	0	-737	0	-10	-161	AN
1935	0	0	0	0	0	0	0	0	0	0	0	0	AN
1946	0	137	0	0	0	-215	-64	0	0	0	0	0	AN
1973	0	0	0	0	0	-513	-63	0	-474	0	0	0	AN
1932	0	0	0	0	0	0	0	0	0	0	0	0	AN
2000	0	0	0	0	-205	0	0	0	-248	0	0	0	AN
1940	0	0	0	0	-464	-317	-74	0	0	0	0	0	AN
1923	0	0	0	0	0	0	-37	0	0	0	0	0	AN
1921	0	0	0	0	-2	-256	-62	0	0	0	0	0	AN
1970	0	0	0	352	-128	-262	0	0	0	0	0	0	AN
1951	0	0	-2,021	0	0	0	0	0	0	0	0	0	AN
1962	0	0	0	0	0	0	0	0	0	0	0	0	BN
1953	0	0	0	0	0	0	0	0	0	0	0	0	BN
1957	0	0	0	0	0	0	0	0	0	0	0	0	BN
1925	0	0	0	0	0	0	0	0	0	0	0	0	BN
1971	0	0	0	0	-159	-97	0	0	0	0	0	0	BN
1950	0	0	0	0	0	0	0	0	0	0	0	0	BN
1944	0	0	0	0	0	0	0	0	0	0	0	0	BN
1954	0	0	0	0	0	0	0	0	0	0	0	0	BN
1948	0	0	0	0	0	0	0	0	0	0	0	0	BN
1928	-112	-526	-557	0	0	-87	-181	0	0	0	0	0	BN
1949	0	0	0	0	0	0	0	0	0	0	0	0	BN
1966	0	0	-71	0	-38	-99	0	0	0	0	0	0	BN
1933	0	0	0	0	0	0	0	0	0	0	0	0	Dry
1981	0	0	0	0	0	0	0	0	0	0	0	0	Dry
1985	0	0	0	0	0	0	0	0	0	0	0	0	Dry
2002	0	0	0	0	0	0	0	0	0	0	0	0	Dry
1926	0	0	0	0	0	0	0	0	0	0	0	0	Dry
1955	0	0	0	0	0	0	0	0	0	0	0	0	Dry
1959	0	0	0	0	0	0	0	0	0	0	0	0	Dry
1968	0	0	0	0	0	0	0	0	0	0	0	0	Dry
1939	0	0	0	0	0	0	0	0	0	0	0	0	Dry
2001	0	0	0	0	0	0	0	0	0	0	0	0	Dry
1964	-182	-832	-255	-295	-294	0	0	0	0	0	0	0	Dry
1947	0	0	0	0	0	0	0	0	0	0	0	0	Dry
1972	0	0	0	0	-313	0	0	0	0	0	0	0	Dry
1994	0	0	0	0	0	0	0	0	0	0	0	0	Critical
1930	0	0	0	0	0	0	0	0	0	0	0	0	Critical
1929	0	0	0	0	0	0	0	0	0	0	0	0	Critical
1989	0	0	0	0	0	0	0	0	0	0	0	0	Critical
1991	0	0	0	0	0	0	0	0	0	0	0	0	Critical
1987	0	0	0	0	0	0	0	0	0	0	0	0	Critical
1960	0	0	0	0	0	0	0	0	0	0	0	0	Critical
1976	0	0	0	0	0	0	0	0	0	0	0	0	Critical
1992	0	0	0	0	0	0	0	0	0	0	0	0	Critical
1990	0	0	0	0	0	0	0	0	0	0	0	0	Critical
1988	0	0	0	0	0	0	0	0	0	0	0	0	Critical
1934	0	0	0	0	0	0	0	0	0	0	0	0	Critical
1924	0	0	0	0	0	0	0	0	0	0	0	0	Critical
1961	0	0	0	0	0	0	0	0	0	0	0	0	Critical
1931	0	0	0	0	0	0	0	0	0	0	0	0	Critical
1977	0	0	0	0	0	0	0	0	0	0	0	0	Critical

NOTES: Hydrologic year types were determined based on DWR's San Joaquin River Basin Index.
Year Types: Wet, AN – Above Normal, BN – Below Normal, Dry, and Critical

SOURCE: SFPUC, HH/LSM (see Appendix H).

TABLE 5.3.4-5
RECORDED SAN JOAQUIN RIVER FLOW AT VERNALIS (1969–2002)
(cubic feet per second)

Year	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	Year Type
1983	8,179	6,974	16,494	19,068	31,604	40,035	36,447	31,771	26,083	19,227	9,035	11,310	Wet
1969	1,384	1,604	2,533	13,815	32,554	30,874	22,117	24,613	27,887	5,803	2,325	3,255	Wet
1995	1,370	1,288	1,295	4,599	6,559	14,612	19,933	22,187	14,011	9,881	3,925	4,734	Wet
1998	2,706	1,981	2,116	6,025	28,121	19,352	21,937	17,948	17,760	13,193	5,442	5,758	Wet
1982	1,386	1,564	1,852	3,889	6,645	10,062	22,963	18,654	7,584	6,163	4,017	6,129	Wet
1980	2,790	2,311	2,487	13,069	18,776	25,297	10,249	9,912	5,305	3,384	1,969	3,802	Wet
1978	246	430	506	2,276	7,319	11,475	20,030	19,119	7,069	1,908	1,418	2,730	Wet
1986	2,072	1,929	2,205	2,060	8,744	25,035	19,590	8,764	6,233	2,894	3,183	4,181	Wet
1993	849	956	982	4,120	3,035	2,702	3,421	3,610	2,341	1,510	1,998	2,771	Wet
1997	2,691	2,715	12,192	30,377	35,057	13,035	4,728	4,785	2,647	1,756	1,875	2,069	Wet
1996	5,692	2,428	2,250	2,431	11,473	15,071	7,500	8,422	3,739	2,209	2,034	2,164	Wet
1974	2,546	2,281	3,586	7,781	5,094	4,817	5,850	4,106	3,860	1,636	1,615	2,846	Wet
1975	3,497	3,891	4,162	3,766	6,212	5,685	3,957	3,972	5,708	1,718	1,680	2,652	Wet
1984	13,316	10,675	19,126	25,632	10,833	7,502	4,285	3,240	2,297	1,904	2,179	2,917	AN
1979	3,327	3,498	2,812	5,233	7,138	8,652	3,506	2,524	2,254	1,334	1,451	1,841	AN
1999	6,153	3,290	4,331	4,730	11,696	8,332	6,437	5,551	3,016	2,094	1,969	2,037	AN
1973	1,992	2,216	2,502	4,059	7,988	7,611	4,203	2,937	2,576	1,082	1,067	1,471	AN
2000	2,532	2,158	1,688	2,136	7,559	12,098	5,013	4,814	2,772	1,898	2,171	2,330	AN
1970	4,462	4,628	4,012	11,116	9,191	7,180	1,673	2,393	2,704	1,330	1,044	1,319	AN
1971	1,466	1,655	5,044	5,204	4,391	2,589	1,961	1,833	2,322	1,066	892	1,097	BN
1981	4,072	3,278	2,949	3,251	2,879	3,122	2,532	1,967	1,499	1,265	1,269	1,181	Dry
1985	3,814	2,822	4,771	4,065	3,241	2,736	2,466	2,132	1,748	2,557	2,601	1,925	Dry
2002	2,003	2,096	2,064	2,662	1,898	2,134	2,598	2,739	1,407	1,227	1,116	1,175	Dry
2001	2,826	2,526	2,238	2,442	3,092	3,430	3,008	3,527	1,549	1,400	1,330	1,376	Dry
1972	2,253	1,646	2,398	3,117	2,701	1,380	1,037	744	587	481	543	1,563	Dry
1994	3,041	1,759	1,628	1,773	1,987	2,206	1,863	1,973	1,109	1,135	867	869	Critical
1989	1,127	1,274	1,372	1,255	1,234	2,023	1,915	1,949	1,583	1,284	1,169	1,353	Critical
1991	993	1,115	918	816	758	1,779	1,168	1,049	568	594	537	574	Critical
1987	3,741	2,808	3,706	2,305	2,136	3,415	2,867	2,178	1,990	1,632	1,627	1,597	Critical
1976	4,543	3,906	3,745	3,326	2,115	1,823	1,293	939	798	671	1,055	1,067	Critical
1992	788	1,084	895	959	2,091	1,470	1,418	892	481	447	483	635	Critical
1990	1,401	1,404	1,381	1,242	1,365	1,760	1,309	1,279	1,116	1,009	1,033	876	Critical
1988	1,370	1,548	1,278	1,483	1,389	2,241	2,146	1,781	1,711	1,357	1,557	1,452	Critical
1977	1,274	1,136	965	1,091	789	524	212	400	118	93	124	179	Critical

NOTES: Hydrologic year types were determined based on DWR's San Joaquin River Basin Index. Flows in some years do not meet current flow objectives, because the flow objectives did not come into effect until 1999.
Year Types: Wet, AN – Above Normal, BN – Below Normal, Dry, and Critical

SOURCES: U.S. Geological Survey (http://waterdata.usgs.gov/nwis/sw).

effect on the availability of Stanislaus River water to the USBR and the water supply agencies that receive water from New Melones Reservoir, except possibly on rare occasions following protracted droughts.

As indicated in Table 5.3.4-4, in many years and during certain seasons, the WSIP would not alter flow in the Tuolumne River below La Grange Dam and would, in turn, have no effect on flow in the San Joaquin River. Thus, under these conditions, the WSIP would have no effect on water availability or quality at the intakes of water agencies and diverters that use San Joaquin River water. In some wet and above-normal years, the WSIP would have an effect on flow in the San Joaquin River between the confluence with the Tuolumne River and the confluence with the Delta. Because the changes in San Joaquin River flow would be small in most wet and above-normal years, and because the changes would occur in periods when flow in the river is at its seasonal maximum, the effects of the flow changes on water quality would also be small. Water quality is at its seasonal best during the period when the WSIP-induced changes in flow would occur, and thus the quality of water at water agencies' and irrigators' diversion points would not change appreciably. All water quality objectives would be met, and specifically by releases from New Melones Reservoir or other San Joaquin Valley Central Valley Project facilities, if such action were necessary.

The WSIP would have a less-than-significant impact on water quality and the availability of water at water agencies' and irrigators' diversion points on the Tuolumne, Stanislaus, and San Joaquin Rivers. Therefore, WSIP impacts on Tuolumne, Stanislaus, and San Joaquin River water users would be *less than significant*, and no mitigation measures would be required.

Impacts 5.3.4-2: Effects on Delta water users.

Changes in flow in the Tuolumne River below La Grange Dam attributable to the WSIP would affect Sacramento–San Joaquin Delta inflow. The Delta standards include flow objectives for Delta outflow, and outflow at times is required for maintenance of water quality objectives within the Delta. Reductions in Delta inflow attributable to the WSIP could make it necessary for the DWR and USBR, the agencies responsible for compliance with objectives for the Delta, to increase reservoir releases and/or decrease diversions at the Banks and Tracy Pumping Plants to meet the objectives. At other times, the DWR and USBR could be limited in their export capacity by an objective that relates allowable export to Delta inflow.

Table 5.3.4-4 shows the changes in releases from La Grange Dam attributable to the WSIP. The changes would be reflected downstream as a change in Delta inflow. As shown in the table, most of the changes in releases and the greatest changes in releases would occur in wet and above-normal years. Furthermore, most of the changes in releases would occur from February through June of the affected years, with an occasional occurrence during other months. When they occur, the changes in average monthly flows are usually in the hundreds of cubic feet per second.

Occasionally, changes are in the range of 1,000 cfs to a little over 3,000 cfs. The greatest changes would potentially occur infrequently during wetter years following protracted droughts.

The WSIP would increase the SFPUC's diversions from the Tuolumne River almost every year, which would result in a decrease in inflow to Don Pedro Reservoir almost every year. During protracted droughts, WSIP-induced reductions in storage in Don Pedro Reservoir would accumulate for several years. When the drought ends, a large volume of water would be needed to refill or partially refill Don Pedro Reservoir. Much or all of the winter and spring runoff would be retained in Don Pedro Reservoir, and only minimum required releases would be made below La Grange Dam. Under these fairly rare conditions, WSIP-induced reductions in flow in the Tuolumne River below La Grange and in the San Joaquin River compared to the existing condition would be in the range 1,000 to 3,000 cfs.

Delta inflow varies widely from year-to-year and depends on hydrologic conditions and the magnitude of diversions upstream of the Delta. Delta outflow depends on hydrologic conditions, the magnitude of diversions upstream of the Delta, and the magnitude of diversions within the Delta, including diversions by the State Water Project and Central Valley Project.

Certain objectives for Delta outflow are shown in Table 5.3.4-2. The table is not an exhaustive compilation of all requirements for flow, nor does it specify the amount of flow needed to meet water quality objectives for the Delta.

Compliance with Delta outflow objectives is the responsibility of the DWR and the USBR and is achieved by releasing water from reservoirs upstream of the Delta or by limiting pumping at the Banks and Tracy Pumping Plants. When Delta inflow exceeds the sum of the Delta outflow objectives and the water needs of the State Water Project, Central Valley Project, and other diverters, the Delta is regarded as in "excess conditions." When the Delta is in excess conditions, there are no limits on pumping as a result of the export limits that are a part of D-1641. Exports are limited to 35 percent of Delta inflow from February through June and to 65 percent of Delta inflow from July through January. When Delta inflow is generally equal to the sum of the Delta outflow objectives and the water needs of the State Water Project, Central Valley Project, and other diverters, the Delta is regarded as in "balanced conditions."

The Delta is typically in excess conditions from December through May and balanced conditions from June through November. However, Delta inflow can vary by a factor of 10 or more, so there is considerable year-to-year variability in the periods of excess and balanced conditions.

The WSIP would typically reduce Delta inflow in wet and above-normal years when the Delta is in excess conditions and Delta outflow is so great that the export limits do not limit pumping by the State Water Project and Central Valley Project. Under these conditions, the WSIP would reduce Delta inflow and outflow by the same amount, but would have no effect on the State Water Project's and Central Valley Project's ability to pump water from the Delta. There could be rare occasions when the WSIP would reduce Delta inflow during excess conditions but when the export limits do affect pumping by the State Water Project and Central Valley Project. Under these conditions, the WSIP would reduce Delta outflow and could potentially reduce pumping by

the State Water Project and Central Valley Project by 35 percent of the WSIP-induced reduction in Delta inflow. However, the State Water Project and Central Valley Project may choose to comply with the export limits by releasing more water from upstream reservoirs rather than by limiting pumping.

In the winter and spring of wet and above-normal years, when the effects of the WSIP on Delta inflow would be felt, Delta outflow would typically be in the range of 13,000 to 63,000 cfs. In almost all cases, the reduction in Delta ouflow attributable to the WSIP would be less than 500 cfs, a small proportion of total outflow. In very rare circumstances, during a wetter year that follows a multi-year drought period (six or more years), the WSIP-induced reduction in Delta inflow would be greater than 500 cfs, in the range 1,000 to 3,000 cfs.

When the Delta is in balanced conditions, the DWR and USBR must balance reservoir releases and pumping at the Banks and Tracy Pumping Plants in order to meet the Delta objectives. There could be occasions between June and September during some wet and above-normal years when WSIP-induced reductions in Delta inflow would occur during balanced conditions in the Delta. Under these rare circumstances, the State Water Project and Central Valley Project would have to increase releases from upstream reservoirs or curtail pumping in order to meet flow objectives for the Delta.

WSIP-induced decreases in Delta inflow would not lead to violations of Delta objectives. The State Water Project and Central Valley Project, the parties responsible for compliance with Delta standards, would react to changes in Delta inflow and ensure that the standards were met. WSIP-induced decreases in Delta inflow would not necessarily lead to reductions in water deliveries by the State Water Project and Central Valley Project. Table 5.3.4-4 shows the reductions in flow below La Grange Dam attributable to the WSIP, which would also be reflected as WSIP-induced reductions in Delta inflow. The inflow difference that would occur when the Delta is in balanced conditions and when pumping might be curtailed to comply with export limits would typically amount to an annual volume of 20,000 acre-feet, a small fraction of the average annual Delta inflow of about 21 million acre-feet. A WSIP-induced reduction in Delta inflow would likely be compensated for by releases from upstream reservoirs. In any particular year, the Delta inflow difference attributable to the WSIP would contribute to an increase in risk to water deliveries in a subsequent year, and would only be realized in a series of dry years.

Given the very small magnitude and low frequency of potential effects on Delta flows, the impact of the WSIP on water availability and quality at water agencies' and other diverters' diversion points in the Delta would be *less than significant*, and no mitigation measures would be required.

References – Surface Water Supplies

State Water Resources Control Board (SWRCB), *Water Quality Control Plan for San Francisco Bay/Sacramento–San Joaquin Delta Estuary*, 1995.

5.3.5 Groundwater

The following setting section identifies groundwater bodies in the Tuolumne River watershed that could be affected by the WSIP; they include those that are hydraulically connected to the Tuolumne River and its tributaries. The impact section (Section 5.3.5.2) provides a description of the changes in groundwater levels and quality that would result from WSIP-induced changes in stream flow.

5.3.5.1 Setting

The Tuolumne River flows from the crest of the Sierra Nevada westward to its confluence with the San Joaquin River. The San Joaquin River flows north to the Sacramento–San Joaquin Delta. The Tuolumne River system and downstream water bodies are shown in Figure 5.3.1-1.

From Hetch Hetchy Reservoir to Don Pedro Reservoir, the Tuolumne River flows through a deep canyon in mountainous terrain. The hydrogeologic units underlying the river exhibit low permeability. There are no large groundwater bodies along this reach of the river. Below Don Pedro Reservoir, the Tuolumne River flows through the Sierra Nevada foothills and on to the floor of the San Joaquin Valley. Permeable hydrogeologic units of the San Joaquin Valley Groundwater Basin underlie the foothills and valley floor.

This section is focused on the effects of WSIP-induced flow and water quality changes on groundwater bodies along the reach of the Tuolumne River between La Grange Dam and the confluence with the San Joaquin River. As described in Section 5.3.1, the proposed program would alter flows and water quality in the Tuolumne River and, to a lesser extent, in the San Joaquin River and Delta. Because a dynamic balance exists between rivers and the groundwater basins they flow through, changes in river flow can affect groundwater levels and quality. The San Joaquin Valley Groundwater Basin is bounded on the west by the Coast Ranges, on the south by the San Emigdio and Tehachapi Mountains, on the east by the Sierra Nevada, and on the north by the Delta and Sacramento Valley. Within this basin, the Modesto Groundwater Subbasin lies between the Stanislaus River to the north, the Tuolumne River to the south, the San Joaquin River to the west, and the Sierra Nevada to the east. The Turlock Groundwater Subbasin shares the east and west boundaries with the Modesto Groundwater Subbasin, with the Tuolumne River forming the northern boundary and the Merced River forming the southern boundary (USGS, 2004).

Modesto Groundwater Subbasin

The Modesto Subbasin covers approximately 385 square miles, with lands primarily in the Modesto Irrigation District (MID), Oakdale Irrigation District, and the city of Modesto. The aquifer system is complex; primary hydrogeologic units include both consolidated and unconsolidated sedimentary deposits. The consolidated deposits lie in the eastern portion of the subbasin and include the Ione, Valley Springs, and Mehrten Formations; of these three, the Mehrten Formation is a high-yielding aquifer. Unconsolidated deposits include continental and alluvium deposits and are the main water-yielding units; Corcoran Clay separates older and

younger alluvium, with generally unconfined conditions above and confined conditions below.[1] Groundwater recharge is primarily from deep percolation of applied irrigation water, canal seepage from irrigation facilities, seepage from Modesto Reservoir, and precipitation. The primary groundwater discharge is from extensive pumping for agricultural and municipal uses. Groundwater flow is primarily to the southwest; on average, water levels within the subbasin declined nearly 15 feet from 1970 through 2000 (DWR, 2003).

In general, groundwater quality is suitable for most urban and agricultural uses but is subject to some impairment. Total dissolved solids levels typically range from 200 to 500 milligrams per liter, with substantially higher levels along the east side of the subbasin (DWR, 2003). Other water quality impairment results from elevated levels of radionuclides, pesticides (especially dibromochloropropane, or DBCP), volatile organic compounds, hardness, chlorides, boron, nitrate, iron, and manganese. Localized areas of contamination from gasoline and solvents are also present (Stanislaus and Tuolumne Rivers Groundwater Basin Association, 2005).

Groundwater wells provide approximately 60 percent Modesto's municipal water supply; the remainder is provided by treated surface water from the Tuolumne River. As of 2000, the City operated 118 municipal wells, although several wells had been taken out of service due to water quality concerns (City of Modesto, 2000). The City has calculated its municipal safe yield from the groundwater basin to be 50,000 acre-feet per year.

Turlock Groundwater Subbasin

The Turlock Subbasin covers an area of about 542 square miles and includes lands in the city of Turlock, the Turlock Irrigation District (TID), the Ballico-Cortez Water District, the Eastside Water District, and a small portion of the MID. In general, the characteristics of the Turlock Subbasin are similar to those in the Modesto Subbasin. On average, water levels in the subbasin declined nearly 7 feet between 1970 and 2000 (DWR, 2003).

The City of Turlock obtains its drinking water from the lower confined aquifer, beneath the Corcoran Clay, and presently meets all municipal demands from groundwater wells. The City plans to develop additional sources of supply in the future, which could include using recycled wastewater, withdrawing water from the shallow unconfined aquifer for sub-potable uses, constructing new wells, and purchasing treated water from TID for potable uses (City of Turlock, 2005).

Tuolumne River/Groundwater Interaction

Based on groundwater-level monitoring data, the Tuolumne River is generally a "gaining" river[2] for most of its length between La Grange Dam and its confluence with the San Joaquin River. However, this situation is reversed for an approximately five-mile-long reach near central

[1] The permeable materials that surround an unconfined aquifer allow the water table to fluctuate in response to recharge (precipitation in the wet season) and discharge (evapotranspiration in the dry season). A confined aquifer lies below impermeable materials and, as a result, is not recharged directly from above.

[2] A gaining river receives water from the groundwater.

Modesto, where a pumping depression has formed; and this reach is considered a "losing" reach[3] (Stanislaus and Tuolumne Rivers Groundwater Basin Association, 2005). The gaining and losing reaches likely change depending upon the season and hydrologic year type.

Beneficial Uses and Water Quality Objectives

The Central Valley Regional Water Quality Control Board, which has regulatory authority over water bodies in the Central Valley watershed, has prepared the *Water Quality Control Plan* (Basin Plan) to implement plans, policies, and other provisions for water quality management. The Basin Plan establishes beneficial uses for the groundwater basin; these include Municipal and Domestic Supply (MUN), Agricultural Supply (AGR), Industrial Service Supply (IND), and Industrial Process Supply (PRO) (SWRCB, 1995).

5.3.5.2 Impacts

Significance Criteria

The City and County of San Francisco has not formally adopted significance standards for impacts related to groundwater, but generally considers that implementation of the proposed program would have a significant groundwater impact if it were to:

- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of preexisting nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted)
- Substantially impair a water body's ability to support beneficial uses designated by the State Water Resources Control Board or Regional Water Quality Control Board
- Otherwise substantially degrade water quality

Approach to Analysis

Information on potentially affected groundwater bodies was obtained from published sources and through interviews with individuals who are knowledgeable about the hydrogeology of the area or involved with groundwater management in the potentially affected area. Impact assessments were performed by reviewing WSIP-induced changes in stream flow and examining their potential to affect groundwater levels or quality.

Impact Summary

Table 5.3.5-1 presents a summary of the impacts on groundwater bodies in the Tuolumne River watershed that could result from implementation of the proposed water supply and system operations.

[3] A losing river reach loses water to the groundwater.

TABLE 5.3.5-1
SUMMARY OF IMPACTS – GROUNDWATER BODIES IN THE TUOLUMNE RIVER WATERSHED

Impact	Significance Determination
Impact 5.3.5-1: Alteration of stream flows along the Tuolumne River, which could affect local groundwater recharge and groundwater levels	LS
Impact 5.3.5-2: Alteration of stream flows along the Tuolumne River, which could affect local groundwater quality	LS

LS = Less than Significant impact, no mitigation required

Impact Discussion

Impact 5.3.5-1: Alteration of stream flows along the Tuolumne River, which could affect local groundwater recharge and groundwater levels.

At present, the reach of the Tuolumne River below La Grange Dam generally gains flow for most of its length, except for the reach in the vicinity of Modesto, where a groundwater pumping depression exists, causing the river to lose flow. The proposed program would result in lowered stream flows in the Tuolumne River in the winter and spring, as compared to existing conditions and described in Section 5.3.1. This means that there could be a slight increase in groundwater discharge to the river in the areas where the river is gaining flow, due to the slight drop in surface water level. Correspondingly, there would be a slight reduction in the loss of stream flow to the groundwater basin in the vicinity of Modesto, where a pumping depression exists. This effect would be minor, and effects on groundwater levels would be limited to the shallow, unconfined aquifer in the vicinity of the river, which is not used as a source of municipal water supply. In addition, these effects could largely cancel each other out, as discharge of groundwater to the river would be increased in some reaches, and percolation to shallow groundwater would be increased in another. The WSIP would have little or no effect on groundwater levels and would not affect the production rate of existing wells in the vicinity. Overall, considering the scale of water resource development in the area, the withdrawals for agricultural and municipal supply, and variations in the hydrologic cycle, the effects of the WSIP on groundwater levels and groundwater recharge would be *less than significant*, and no mitigation measures would be required.

Impact 5.3.5-2: Alteration of stream flows along the Tuolumne River, which could affect local groundwater quality.

As described above, any effects on groundwater would be slight and would be limited to the shallow, unconfined aquifer in the vicinity of the bed of the Tuolumne River; this aquifer is not used as a source of municipal water supply, but rather for agricultural or other sub-potable uses. As such, any effects on groundwater quality are expected to be minimal, and no adverse effects

on any identified beneficial uses of the groundwater basin would occur. The effects of the WSIP on local groundwater quality in groundwater bodies adjacent to the Tuolumne River below La Grange Dam would be *less than significant*, and no mitigation measures would be required.

References – Groundwater

California Department of Water Resources (DWR), *Bulletin 118: California's Groundwater*, Updated October 2003.

City of Modesto, *2000 Urban Water Management Plan*, 2000.

City of Turlock, *Urban Water Management Plan*, 2005.

Stanislaus and Tuolumne Rivers Groundwater Basin Association, *Integrated Regional Groundwater Management Plan*, Final Draft, June 2005.

State Water Resources Control Board (SWRCB), *Water Quality Control Plan for San Francisco Bay/Sacramento–San Joaquin Delta Estuary*, 1995.

U.S. Geological Survey (USGS), *Hydrogeologic Characterization of the Modesto Area, San Joaquin Valley, California*, Scientific Investigations Report 2004-5232, 2004.

5.3.6 Fisheries

The following setting section describes the fisheries resources in the Tuolumne River watershed that could be affected by the WSIP. The impact section (Section 5.3.6-2) provides a description of the changes in fisheries resources that would result from WSIP-induced changes in stream flow and reservoir water levels.

5.3.6.1 Setting

The Tuolumne River flows from the crest of the Sierra Nevada westward to its confluence with the San Joaquin River. The San Joaquin River flows north to the Sacramento–San Joaquin Delta. Water from the Delta discharges to the San Francisco Bay Estuary and the Pacific Ocean. The Tuolumne River system and downstream water bodies are shown in Figure 5.3.1-1 in Section 5.3.1, Stream Flow and Reservoir Water Levels.

Because the WSIP would affect flows in the Tuolumne River (as discussed in Section 5.3.1), this section examines potential effects on the aquatic resources in the Tuolumne River between Hetch Hetchy Reservoir and the San Joaquin River, the San Joaquin River itself, and the Sacramento–San Joaquin Delta. This analysis examined the aquatic habitats of the three tributary streams (Cherry, Eleanor, and Moccasin Creeks) as well as water storage in several reservoirs (Hetch Hetchy Reservoir, Lake Lloyd, Lake Eleanor, and Don Pedro Reservoir) that feed the Tuolumne River; hydrologic and operational modeling indicates that the WSIP would not affect Moccasin or Eleanor Creeks, and that the effects on Cherry Creek would be minimal to none.

The headwaters of the Tuolumne River are at an elevation of approximately 13,000 feet above mean sea level. As the river moves downstream from the headwaters, it flows westerly across the Tuolumne Meadows in Yosemite National Park and into Hetch Hetchy Valley. The upper Tuolumne River in the reach downstream of Hetch Hetchy Reservoir is a high-elevation, relatively steep-gradient river located on the western slope of the southern Sierra Nevada mountains.

Tuolumne River Between Hetch Hetchy and Don Pedro Reservoirs

General Description of Aquatic Habitat

In 1923, the Hetch Hetchy Valley was dammed by O'Shaughnessy Dam, which created Hetch Hetchy Reservoir. Downstream of O'Shaughnessy Dam, the Tuolumne River is characterized by a series of pools, cascades, riffles,[1] and pocket water (USFWS, 1992a). The river passes through an extremely deep gorge downstream of Poopenaut Valley and flows to the upper reaches of Don Pedro Reservoir.

Flow in the Tuolumne River is regulated, to a large extent, by operations of Hetch Hetchy Reservoir and minimum stream flow releases from O'Shaughnessy Dam. The hydrology of the river downstream of Hetch Hetchy Reservoir is characterized by relatively stable releases

[1] A stretch of choppy water caused by stones or other objects in a river or stream.

between the fall and spring, followed by a substantial increase in flow during the late spring and summer months (May–July) in response to snowmelt runoff. The SFPUC makes minimum releases from Hetch Hetchy Reservoir to support resident fisheries downstream of O'Shaughnessy Dam (see Table 5.3.1-2, Section 5.3.1). The SFPUC has initiated a fishery monitoring program within the river to assess potential effects of project operations on habitat quality and availability for resident trout and other fish species that over time will provide additional site-specific information on the effects of seasonal and interannual variation in stream flows on fishery populations inhabiting the river (Hanson, 2007).

Flows in the Tuolumne River downstream of its confluence with Cherry Creek are manipulated during the summer months to provide sufficient flow for whitewater rafting. The SFPUC releases pulses of water from Lake Lloyd via Holm Powerhouse to support rafting for several hours on most summer days. Short-duration increases and decreases in flows associated with whitewater rafting influence habitat conditions for resident trout and may affect the vulnerability of trout and other fish to stranding and habitat displacement as flows quickly change within the reach. Because the releases for whitewater rafting would be the same with and without the proposed program, this section does not evaluate the effects of flow fluctuations on habitat selection, habitat quality, growth, and survival, or associated effects on the macroinvertebrate community that trout rely on as a primary food resource.

Resident Fish and their Habitat

The Tuolumne River downstream of Hetch Hetchy Reservoir supports a resident community of fish, including rainbow trout, brown trout, California roach, sculpin, and suckers (USFWS, 1992b). The USFWS (1990; cited in USFWS, 1992b) conducted fishery surveys within the river and estimated that approximately 7,000 adult rainbow and brown trout inhabited the 12.1-mile reach between O'Shaughnessy Dam and Early Intake. Field observations within the river made at various times between October 20, 1987 and June 14, 1990 have confirmed successful reproduction, rearing, and maintenance of adult populations of both rainbow and brown trout.

The USFWS (1992b) documented the preliminary results of an instream flow field study designed to provide information on the relationship between habitat and instream flows for various life-history stages of rainbow and brown trout. Rainbow trout spawning within the Tuolumne River downstream of Hetch Hetchy Reservoir occurs primarily between mid-February and mid-June, with juvenile emergence occurring from about mid-March to early July. Juvenile and adult rearing occurs within the river throughout the year. Brown trout spawning occurs primarily in November and December, with juvenile emergence between April and September followed by juvenile and adult rearing throughout the year. In developing release recommendations, the USWFS considered the seasonal timing of spawning activity and other life-history stages within the river as well as the effects of seasonal water temperatures on habitat suitability for trout.

As part of the stream flow study, the USFWS identified 12 habitat types within the river reach extending from O'Shaughnessy Dam downstream to Early Intake, which included deep pools, shallow pools, pocket waters, cascades, cascades/deep pools, cascades/pocket waters, chutes,

riffles, runs, glides, side channels, and backwaters. Among the habitat types, deep pools, shallow pools, pocket waters, runs, riffles, and cascades/pocket water represented 93.9 percent of the total habitat surveyed. Steep-gradient, high-velocity cascades, chute habitats, and a combination of cascades/deep pool habitats represented 4.6 percent of the river reach surveyed. Low-gradient glides, side channels, and backwater habitats represented 1.5 percent of the river habitat area. The results of habitat typing are characteristic of high-gradient, high-elevation Sierra streams and rivers that support populations of trout and other resident species. Among the habitat types observed within the river, deep pools, runs and riffles, and pocket waters are typically the most suitable for resident trout, and these habitat types were present in a majority of the reaches surveyed. The stream flow study did not identify physical habitat as a major limiting factor, although seasonal water temperatures were identified as a factor affecting both brown and rainbow trout within the river.

The quality and suitability of habitat for resident trout depend on various environmental factors, including seasonal stream flow, stream gradient, stream cover, habitat diversity and complexity, water depths, water velocities, and water quality. Trout are coldwater fishes; therefore, seasonal water temperatures within many stream and river systems in California affect habitat suitability. Optimum water temperatures for juvenile and adult trout growth are typically 13 to 21 °C. Trout experience increasing levels of stress, reduced growth rates, increased susceptibility to disease, and, under severe conditions, mortality within the temperature range of 21 to 28 °C. Water temperatures in excess of 28 °C are unsuitable for trout. Incubating trout eggs are more sensitive to elevated water temperatures than either juvenile or adult trout; suitable temperatures for trout egg incubation are approximately 8 and 18 °C, with mortality increasing rapidly at higher temperatures.

Water temperatures within the Tuolumne River between Hetch Hetchy and Don Pedro Reservoirs during the summer months (June–July) have been observed to exceed the maximum daily temperatures of 21 °C, although nighttime temperatures during the summer months are lower. Winter water temperatures are typically low and may be limiting successful egg incubation and hatching for brown trout, which spawn during the winter. The recommended instream flows developed by the USFWS (1992b) therefore included consideration of both physical habitat and seasonal water temperatures.

Tuolumne River Tributaries and Lakes: Hetch Hetchy Reservoir to Don Pedro Reservoir

The rivers, lakes, and reservoirs within the Sierra Nevada provide habitat for a diverse assemblage of native and introduced fish species. Moyle et al. (1996) report that 40 species of native fish inhabit the range, of which 22 are reported for the Sacramento–San Joaquin drainage. The abundance, species composition, and geographic distribution of fish within the watersheds have been influenced by a number of factors. The construction and operation of water impoundments designed for water supply, flood protection, and hydroelectric power generation have affected hydrologic conditions within many of these watersheds as well as modified fishery habitat and limited migration and movement of fish from one part of the watershed to another. The introduction of non-native species, many of which were planted in watersheds to support

recreational fisheries, has resulted in substantial changes to the fishery communities. The production and planting of fish, such as various species of trout, to support local recreational fisheries has also affected the aquatic communities within many areas of the upper Tuolumne River watershed and elsewhere within the range. Inventories of fish species inhabiting the water bodies between Hetch Hetchy and Don Pedro Reservoirs have been fairly limited in recent years; the fish surveys that were conducted have been primarily limited to direct visual observations (Knapp and MSI, 1996). Fish species found in the Tuolumne River watershed above La Grange Dam are listed in **Table 5.3.6-1**.

Hetch Hetchy Reservoir, Lake Lloyd, and Lake Eleanor

Although a variety of fish inhabit the Tuolumne River upstream of and within Hetch Hetchy Reservoir, various species of trout that support local recreational fisheries have received the greatest attention. Rainbow trout, brown trout, and eastern brook trout have been reported to inhabit Hetch Hetchy Reservoir (Johnston, 1985). Resident trout within the upper watershed and reservoir include fish planted from hatchery production to support local recreational fisheries. The condition of the trout populations upstream of Hetch Hetchy Reservoir prior to the completion of O'Shaughnessy Dam is unknown, except that the populations are thought to have included both hatchery plantings and native stocks (Snyder, 1993). It is unclear whether or not anadromous[2] salmon or steelhead historically migrated upstream through the Hetch Hetchy reach of the river prior to the construction of the dam, since a number of natural impediments and barriers to passage exist within the watershed that are thought to have prevented access to upstream habitats (Snyder, 1993).

Similarly, it is unclear whether rainbow trout were native to the Hetch Hetchy Reservoir area prior to the construction of O'Shaughnessy Dam. While historical literature suggests that rainbow trout are native, other sources indicate that trout planting during the 19th century resulted in a population that would otherwise not exist (Moyle, 1976). It is also possible that impediments to passage may have prevented the migration of steelhead/rainbow trout upstream to the Hetch Hetchy Reservoir site on the Tuolumne River but that such impediments were not present on the Merced River, thus enabling rainbow trout to establish themselves in Yosemite (Moyle, 1999; cited in Cherrigan, 1999). Waterfalls just below the Hetch Hetchy Reservoir site would have prevented the upstream migration, and other sources have noted that this reach of the Tuolumne River was fishless (Muir, 1902).

Lake Eleanor, which was completed in 1917, is located on Eleanor Creek and is hydraulically connected to Lake Lloyd. Surveys of the lake conducted by the CDFG in the 1960s and 1970s indicated the presence of suckers, brown trout, rainbow trout, and sunfish, among other species. The fish population within Lake Eleanor probably parallels that at Cherry Lake due to its hydraulic connection (CDFG, 2006b), although recent published data on fisheries at these reservoirs are limited (Knapp and MSI, 1996).

[2] Anadromous fish species migrate from the ocean to spawn in freshwater streams and rivers.

TABLE 5.3.6-1
FISH SPECIES KNOWN TO INHABIT TUOLUMNE RIVER TRIBUTARIES, HETCH HETCHY AND DON PEDRO RESERVOIRS, LAKE LLOYD, AND LAKE ELEANOR[a]

			Reservoirs				Tributaries (Upper Tuolumne River)		
Common Name	**Scientific Name**	**Native (N) Introduced (I)**	**Don Pedro Reservoir**	**Hetch Hetchy Reservoir**	**Lake Lloyd**	**Lake Eleanor**	**Cherry Creek**	**Moccasin Creek**	**Eleanor Creek**
Rainbow trout/steelhead	*Oncorhynchus mykiss*	?[b]	x	x	x	x	x	x	x
German brown trout	*Salmo trutta*	I	x	x	x	x		x	x
Eastern brook trout	*Salvelinus fontinalis*	I	x	x	x	x		x	
Golden trout[c]	*Oncorhynchus aguabonita*	I			x	x			
Lake trout	*Salvelinus namaycush*	I			x	x			
Largemouth bass	*Micropterus salmoides*	I	x						
Smallmouth bass	*Micropterus dolomieu*	I	x						
Sacramento sucker	*Catostomus occidentalis*	N			x	x	x	x	x
Green sunfish	*Lepomis cyanellus*	I	x						
Black crappie	*Pomoxis nigromaculatus*	I	x						
Bluegill	*Lepomis macrochirus*	I	x						
Golden shiner	*Notemigonus crysoleucas*	I	x		x	x			
Threadfin shad	*Dorosoma petenense*	I	x						
Riffle sculpin	*Cottus gulosus*	N					x		
California roach	*Lavinia symmetricus*	I					x		
Coho salmon	*Oncorhynchus kisutch*	I	x						
King (Chinook) salmon	*Oncorhynchus tschywstcha*	I	x[d]						
Kokanee salmon	*Oncorhynchus nerka*	I	x		x	x			
Channel catfish	*Ictalurus punctatus*	I	x						

NOTE: Fish populations in the interconnected Lake Lloyd and Lake Eleanor are known to be the same (CDFG, 2006b).

[a] This table is principally based on unpublished CDFG data.
[b] It is not clear whether the California-native steelhead/rainbow trout was introduced to the area or planted early on to establish a fish population.
[c] Among the fish species present in the watershed, only golden trout has been identified by the CDFG as a species of special concern.
[d] Don Pedro Reservoir is regularly planted with hatchery-reared Chinook salmon.

SOURCES: Bacher, 1999; CDFG, 2006a, 2006b; USDA, 2007.

Lake Lloyd is located on Cherry Creek. The principal fish species found in Lake Lloyd include rainbow trout, brown trout, and brook trout (CDFG, 1987; Dirksen and Reeves, 1990; DWR, 1993). Golden shiner, green sunfish, and an abundance of Sacramento sucker also inhabit the lake. Salmon are probably not present in Lake Lloyd today—previous populations of salmon were a product of hatchery planting that occurred until the 1970s to support local recreational fisheries in the lake. Salmon were documented in the lake during gillnet surveys conducted by the CDFG in the 1960s and 1970s (CDFG, unpubl. data; CDFG, 2006b).

Eleanor and Cherry Creeks

Cherry Creek, a tributary to the main stem Tuolumne River about one mile below Early Intake, has a fishery population comprised mostly of rainbow trout (CDFG, 2006a). It has been hypothesized that Cherry Creek may have provided habitat for historical populations of steelhead and/or spring-run Chinook salmon. Major dams and reservoirs downstream within the Tuolumne River currently prevent anadromous fish such as steelhead and salmon from accessing the upper parts of the watershed. Sacramento sucker, riffle sculpin, and California roach have been observed during stream surveys between Early Intake and Preston Falls and have been observed within Cherry Creek as well, particularly in the reaches closest to the confluence of the Tuolumne River where water temperatures become warmer (CDFG, 2006a).

Eleanor Creek fish populations are mostly comprised of brown trout and rainbow trout (CDFG, 2006a). The creek is not stocked, although a hatchery was operated on Frog Creek until the 1950s. The trout raised in the hatchery originated from Lake Eleanor (CDFG, 2006a). Suckers, sculpin, and roach may also be present in Eleanor Creek and would be expected to occur in greater abundance farther downstream towards the confluence of Cherry Creek, where water temperatures become slightly warmer.

Moccasin Creek

Moccasin Creek, a tributary located downstream from the confluence of the Tuolumne River and Cherry Creek, has a fishery community consisting of California roach, Sacramento sucker, sculpin, and rainbow trout (CDFG, unpubl. data). Moccasin Creek is stocked with hatchery-reared rainbow trout on a weekly basis during trout season to support a local recreational fishery, and is considered a popular angling location (CDFG, 2006a). Each year this hatchery raises more than 1 million catchable rainbow trout, which are then planted in 40 heavily fished lakes and streams in the region. This hatchery also produces more than 1 million trout fingerlings for aerial planting in alpine lakes (Moyle et al., 1996).

Don Pedro Reservoir

The principal fish species in Don Pedro Reservoir are game fish, including trout (e.g., rainbow, brown, and brook trout), catfish, bluegill, crappie, sunfish, coho salmon, king and kokanee salmon, and largemouth and smallmouth bass (CDFG, 1987; Dirksen and Reeves, 1990; DWR, 1993). The salmon fishery population supports a local recreational fishery within the reservoir based on annual stocking conducted by the CDFG. Salmon species such as kokanee salmon (landlocked sockeye salmon) have proven sustainable through ecosystem management, including successful

reproduction by the reservoir population. Threadfin shad and plankton also exist in abundant quantities in the lake. No special-status species are known to inhabit the reservoir (TID, 2005).

Species Life Histories

Steelhead/Rainbow Trout (*Oncorhynchus mykiss*).[3] Anadromous trout populations can convert to the resident form when drought events or the damming of rivers block their access to the ocean. Conversely, resident trout populations can become anadromous if ocean access becomes available. It is typical for both life-history patterns to occur in the same stream, and anadromous parents can produce offspring of both varieties. It has been speculated that a food-availability-related trigger determines whether a particular fish will emigrate to the ocean or remain in the stream; according to this hypothesis, if there is abundant food in the stream and a fish is growing at a rapid rate, it may remain in the stream. If food is limited and growth is slow, the fish will have a tendency to emigrate. A variety of biological and environmental factors, in addition to food supply, affect the migratory patterns and life history of steelhead/rainbow trout within a river.

This dual life-history pattern of steelhead and rainbow trout makes the species more adaptable to changing environmental conditions. At the southernmost limits of steelhead distribution, this adaptability is particularly important due to the unstable, variable climatic and hydrologic conditions.

Most steelhead spawn from December through April in small streams and tributaries where cool, well-oxygenated water is available year-round. The female selects a site with gravel substrate where there is good flow through the gravel. She digs a nest, called a redd, and deposits eggs, which the male then fertilizes. These eggs are covered by gravel and cobbles when the female excavates another redd slightly upstream.

The length of time it takes for eggs to hatch is heavily dependent on water temperature. In hatcheries with carefully controlled conditions, steelhead eggs hatch after 30 days at a temperature of 11 °C. The optimal temperature for egg incubation is between 7 and 10 °C. Eggs hatch sooner in warmer water, but the young fish are smaller and generally have lower survival rates. If the temperature goes too high, eggs will not hatch at all. After hatching, the developing steelhead (called “alevins”) remain in the gravel for another four to six weeks. During this time, they obtain nutrients from a yolk sack attached to their body. When they emerge from the gravel, they are called fry, and are able to catch their own food.

Newly emerged fry move to shallow, protected areas of the stream (usually in the stream margins). They establish and defend feeding areas. Most juveniles can be found in riffles, although larger ones will move to pools or deep runs.

Resident rainbow trout support one of the most popular recreational fisheries within lakes and streams in the higher elevation areas of California. Because of the popularity of this species, the

[3] Rainbow trout and steelhead are the same species of trout (*Oncorhynchus mykiss*). Rainbow trout spend their whole life in freshwater; steelhead spend much of their life in the ocean but return to freshwater to spawn.

CDFG produces juvenile, sub-catchable, and catchable rainbow trout in hatcheries and plants them in lakes, reservoirs, and streams, primarily during the spring, summer, and fall. Rainbow trout are also able to successfully reproduce in many of the streams and lakes where water temperatures and other environmental conditions are suitable.

German Brown Trout (*Salmo trutta*). Brown trout live in cold or cool streams, rivers, lakes, and impoundments and are known to be more tolerant of siltation and higher water temperatures than a species such as brook trout. They are also somewhat tolerant of acidity and are adaptable to stream changes.

Brown trout prefer temperatures similar to those preferred by rainbow trout, with upper tolerance limits of about 24 to 27 °C. Lower critical levels for trout are not as well known and tend to vary based on acclimation, exemplified by studies showing that hatchery-reared salmon tend to prefer warmer temperatures, perhaps due to hatchery conditions.

Brown trout spawn in the fall and early winter, a little later than brook trout, when water temperatures are in the mid- to high 40s. Eggs are deposited in a stream gravel depression that the female prepares with swimming actions of her fins and body. Large females produce 4,000 to 12,000 eggs. Several males may accompany the female during spawning. The eggs hatch the following spring, with no parental attention. Brown trout eat aquatic and terrestrial insects, crayfish and other crustaceans, and especially fish. The big ones may also eat small mammals (like mice), salamanders, frogs, and turtles. Large brown trout feed mainly at night, especially during the summer. Their life span in the wild can be 10 to 12 years. Brown trout support a popular recreational fishery.

Eastern Brook Trout (*Salvelinus fontinalis*). Brook trout, an introduced species in California, originated from northeastern America (Knapp and MSI, 1996). Brook trout range in size from 5 to 8 inches in length and usually spawn between September and December. The females lay eggs in the gravel of coldwater streams, such as in the mountains. After hatching, young brook trout feed on zooplankton, while adult fish feed mainly on insects and aquatic invertebrates. Adults also tend to eat small frogs, fish, and snails. Brook trout generally do not live past the age of four. Brook trout are a popular recreational species.

Golden trout (*Oncorhynchus aguabonita*). Wild naturally reproducing populations of golden trout inhabit the Sierran streams. Golden trout are also raised in hatcheries, and most fish are released in selected water bodies during the spring. Some fish are kept in the hatcheries for broodstock. Anglers fishing for golden trout typically use bait such as worms small spinner baits and flies.

Largemouth Bass (*Micropterus Salmoides*). Largemouth bass (commonly known by anglers as black bass) eat minnows, carp, and practically any other available fish species including their own. Young largemouth fall prey to larger bass, crappie, bluegill, and other predatory fish. Both largemouth and smallmouth bass are parasitized by the bass tapeworm, black spot, and yellow grub, none of which pose a threat to human health.

Largemouth bass live in shallow water habitats among reeds, water lilies, and other vegetation; they are adapted to warm waters of 27 to 28 °C and are seldom found deeper than 20 feet. They prefer clear waters with no noticeable current and do not tolerate excessive turbidity and siltation. In winter they dwell on or near the lake bottom, but stay fairly active throughout the season.

Like smallmouth bass, largemouth bass spawn in late spring or early summer. The male constructs a nest on rocky or gravelly bottoms, although occasionally the eggs are deposited on leaves and rootlets of submerged vegetation. The eggs, which are smaller than those of the smallmouth bass, hatch in three to four days. The fry rise up out of the nest in five to eight days and form a tight school. This school feeds over the nest and later the nursery area while the male stands guard. The school breaks up about a month after hatching, when the fry are about an inch long. Largemouth bass support an active recreational fishery in lakes and reservoirs.

Smallmouth Bass (*Micropterus dolomieu*). Smallmouth bass prefer deep, cool water lakes, cool streams, and gravel substrate habitat. Smallmouth bass spawn in spring; when water temperatures approach 16 °C, males move into spawning areas. Nests are usually located near the shore in lakes, or downstream from boulders or some other obstruction that offers protection against strong currents in streams. Hatching time is typically about 10 days if water temperatures are around 10 °C, but fish can hatch in two to three days if temperatures are warmer. Males guard the eggs for about a month, until fry begin to disperse. Like largemouth bass, fry begin to feed on zooplankton, switching to insect larvae and finally fish and crayfish as they grow.

Golden Shiner (*Notemigonus crysoleucas*). Golden shiners are a deep-bodied minnow species with a distinctive golden-olive/silvery color. Their fins may appear from golden brown to orange-reddish in hue. Older fish have a more golden color than their younger, silvery counterpart. This species has a distinctive scaleless strip on its underside between the pelvic fin and the bottom. Golden shiners are common in medium to large bodies of slow-moving or standing water, including reservoirs, and require good water quality and aquatic vegetation to thrive. They prefer quiet, clear water over sand-, gravel-, or organic-debris-covered bottoms. They spawn over a variety of materials, including sand, gravel, vegetation, and other objects. Anglers do not target golden shiners, although shiners are considered effective bait for a wide variety of species and are easy to keep alive. Golden shiners are collected with a dip net or seine.

Kokanee Salmon (*Oncorhynchus nerka*). Also known as sockeye, these fishes are unique in that they require a lake to rear in as fry, which means that the river system they choose to spawn in must have a lake. They can adapt to a range of water velocities and substrates. Juveniles rear for one or two years in a lake, although they are also found in the inlet and outlet streams of the lake. The fry are often preyed on by resident lake fish, and because they use freshwater year-round, the fry are susceptible to low water quality. Sockeye salmon feed on zooplankton within the lake. Because of the popularity of sockeye salmon as a recreational sport species in cooler mountain lakes and reservoirs, the CDFG plants hatchery-produced young sockeye salmon in a number of Sierran lakes each year. In many of the lakes, sockeye salmon are not able to successfully reproduce, so some populations are supported by annual juvenile plantings from the hatcheries.

Green Sunfish (*Lepomis cyanellus*). Native to the eastern United States, these fishes inhabit quiet pools and backwaters of sluggish streams, lakes, and ponds. Green sunfish spawn in spring and summer, hatching in about two days. They deposit their eggs in a single or colonial nest made by the male, often on fine gravel or sandy silt in shallow water near cover. They prefer warm streams and slow-moving to sedentary waters, ponds, and shallow weedy margins of lakes. They can usually be found in the vicinity of weed beds (Moyle, 1976).

Threadfin Shad (***Dorosoma petenense*).** This non-native fish species occurs mainly in freshwater in large rivers, reservoirs, lakes, and swamps, although it is also found in estuarine waters. Threadfin shad are typically found within the top 5 feet of the water column and spawn at approximately 7 °C. This species breeds in the spring and autumn in freshwater, near or over plants or other objects, and their eggs adhere to aquatic vegetation. Anglers also use threadfin shad as baitfish (Moyle, 1976).

California Roach (*Lavinia symmetricus*). Considered a minnow, this species prefers lower elevation streams, particularly sections that dwindle to seasonal pools. Roaches are usually the most abundant fish in the middle-elevation zones of local creeks. California roaches feed on invertebrates and filamentous (threadlike) algae (Moyle, 1976).

Riffle Sculpin (*Cottus gulosus*). This species spawns mostly in small streams with sandy to rocky bottoms. Riffle sculpin tend to inhabit sand and gravel riffles of headwaters and creeks and are also found in sand-gravel runs and backwaters of small to large rivers. They demonstrate resiliency and can withstand substantial changes in habitat. Within California, riffle sculpin are an abundant species (Moyle, 1976).

Sacramento Sucker (*Catostomus occidentalis*). Sacramento suckers prefer tributary streams with gravel or cobble. Foothill streams usually have two subpopulations: a resident one and one that migrates into the creek to spawn in the spring then returns to the river, although some may strand in low-water years. Suckers use their specialized mouths to scrape aquatic insects from the substratum. Spawning typically occurs in waters with temperatures ranging from approximately 6 to 10 °C in February to June, although the species is tolerant of a wide range of temperature conditions.

Bluegill (***Lepomis macrochirus*).** Originally introduced into California waters in 1908, bluegill have become a favorite of many anglers, and populations exist in mountain lakes as high as 5,000 feet. They breed in large colonies in which big, dark-colored males vigorously defend nests, embryos, and young against predators and other males. One problem for nesting males of this species is that small males often hang out near the nests and sneak or streak in to spawn (Moyle, 1976). Bluegill support a popular sport fishery, particularly in low- to mid-elevation lakes and reservoirs.

Coho Salmon (*Oncorhynchus kisutch*). Coho salmon, commonly known as silver salmon, occur naturally only in the Pacific Ocean and its tributary drainage, although it can also be found in some freshwater areas, including the Great Lakes. Adult coho salmon are usually 18 to 24 inches long and weigh 8 to 12 pounds. Adults in the ocean are steel blue to slightly green in color, with

silver sides, white bellies, and small black spots on the back. Historically, coho salmon (along with other species) was a staple in the diet of several Native American tribes, which would also trade it with tribes farther inland. Coho salmon produced in hatcheries have been planted as juveniles in a number of coldwater lakes and reservoirs to support local recreational fisheries.

Black Crappie (*Pomoxis nigromaculatus*). Spawning varies according to latitude. In the northern states this species usually spawns in May and June. In the South, spawning takes place earlier in the year, beginning as early as March. Favorable spawning temperatures range from 18 to 20 ºC. The male sweeps out a nest in sand or fine gravel and guards the nest and defends the young until they start to feed.

Channel Catfish (*Ictalurus punctatus*). Channel catfish are freshwater fish, native to the central and eastern United States and southern Canada. In California, they were planted in Stockton in about 1874. These fish are readily distinguished by their scaleless bodies; broad, flat heads; sharp, heavy pectoral and dorsal spines; and long, whisker-like barbels[4] around the mouth. They are mostly nocturnal and use their barbels to locate food in the dark recesses of deep water. They prefer water temperatures of about 21 °C. Although this catfish does well in many muddy, dirt-bottom lakes, it prefers a clear, warm-water lake with a sandy bottom.

Lake Trout (*Salvelinus namaycush*). Lake trout prefer deep, coldwater lakes. They spawn in the fall, but the time varies among lakes and depends on such factors as latitude, weather, and the size and topography of the lake. Spawning most often occurs over a large boulder or rubble lake bottom at depths of less than 40 feet, and sometimes as shallow as 1 foot for inland lakes. Spawning takes place at night when the trout scatter their eggs over a rocky lake bottom; the eggs remain among the rocks for weeks and hatch the following spring. Lake trout support an active recreational fishery in a number of lakes and reservoirs.

King (Chinook) Salmon (*Oncorhynchus tshawytscha*). Fall-run Chinook salmon are anadromous, with spawning and juvenile rearing occurring within freshwater rivers and streams and juvenile and adult rearing occurring within coastal marine waters; however, Chinook salmon that are landlocked and/or hatchery-reared are not anadromous and not capable of natural reproduction. (Anglers commonly refer to landlocked, hatchery-reared salmon as king salmon). Native, non-hatchery-reared adult fall-run Chinook salmon migrate from the coastal marine waters upstream through San Francisco Bay, Suisun Bay, and the central Delta during late summer and early fall (approximately late July through early December). Adult fall-run Chinook salmon then migrate upstream to areas characterized by suitable spawning conditions, which include the availability of clean spawning gravels, cold water (considered to be less than 13 °C, and relatively high water velocities. Fall-run Chinook salmon spawning is similar to that described for other Chinook salmon, including the creation of redds where eggs are deposited and incubate. Fall-run Chinook salmon spawning occurs between October and December, with the greatest spawning activity typically in November and early December.

[4] A long, thin, fleshy growth projecting from the mouths or nostrils of some fishes.

The lower Tuolumne River supports a population of anadromous fall-run Chinook salmon. These fish support an active recreational fishery within both ocean and inland waters. Juvenile Chinook salmon produced in fish hatcheries are also planted in mid- to high-elevation lakes and reservoirs to support recreational fisheries.

Tuolumne River Below Don Pedro Reservoir

Aquatic Habitat

Aquatic habitats in the Tuolumne River downstream of La Grange Dam are influenced by a number of factors, many of them related to former gold mining and gravel mining. From La Grange Dam to RM 25, a distance of about 25 miles, the river flows through the Sierra foothills into the alluvial San Joaquin Valley. In the first 10 miles downstream of the dam, the channel is constrained by extensive fields of dredge tailings that include large cobbles to finer sediments. These tailings, which extend to Roberts Ferry (approximately RM 40), restrict river meander and access to alluvial sediments, thus reducing the delivery of gravel to the river. Some sections of the river are armored by cobbles, and replenishment of smaller gravels is necessary. Riparian vegetation in this reach is also limited by the dredge tailings. In some reaches upstream of Roberts Ferry, the interaction of modified flow regimes and areas of dredge tailings has altered channel characteristics and flow regimes, creating areas of lake-cascade habitat instead of the pool-riffle habitat typical of the pre-mining channels.

Downstream of Roberts Ferry, the lower gradient river meanders through low hills and valleys bordered by grazing land, tree crops, and irrigated row crops. In this reach, the river passes through several large gravel-mining pits, in part due to failure of the levees separating the river from these pits during the floods of 1997 (TID/MID, 2005). At approximately RM 25, the river is generally channelized and flows through sandy loam soils. In this lower reach, the channel is characterized by slow-velocity run habitat with a sandy-silty bottom and no riffles; the area is not suitable for salmonid spawning, and no spawning was observed during the 1996–2005 survey period.

Substantial habitat restoration has occurred in the lower Tuolumne River under the FERC Settlement Agreement (FSA) (see Chapter 2 for a description of the agreement). In 2000 the Tuolumne River Technical Advisory Committee completed a report titled “Habitat Restoration Plan for the Lower Tuolumne River Corridor” that provides guidance on the priorities and design of habitat enhancement projects to benefit salmon and other aquatic resources (McBain and Trush 2000). The plan identifies several measures to improve the ecological functions of the lower river including increasing the frequency of periodic high flows, channel reconstruction, and gravel and sediment management. A total of 14 channel restoration projects have been identified in the plan. Two of the projects have been completed and two additional projects will be constructed in 2007. Other planned restoration actions under the FSA include:

- Additional riffle cleaning to remove fine sediments from potential salmon spawning habitats
- Construction of a sedimentation basin on Gasburg Creek upstream of La Grange Dam

- Placement of up to 300,000 cubic yards of screened aggregate in the reach between La Grange Dam and Roberts Ferry

- Rehabilitation of pool-riffle habitats in areas now characterized as lake-cascade habitat

The effectiveness of recent riparian restoration has not been fully evaluated, in part because the restoration at such sites as the pool downstream of Fox Grove County Park is relatively immature.

Chinook Salmon

General Description. Chinook salmon are present in the major San Joaquin River tributaries, including the Tuolumne River, which supports a fall run of Chinook salmon. Based on a literature review for the 1996 FERC report, adults begin to arrive in the Tuolumne River in October, and the spawning run continues into January; spawning occurs primarily in October through January but can extend into March. Most egg incubation occurs from October through March but can extend into May. Juveniles begin to emerge from spawning gravels in December. The period of juvenile rearing ranges from January through June (FERC, 1996).

There is no fish hatchery on the Tuolumne River, but Tuolumne River Chinook salmon stocks have been influenced by fish straying from other Central Valley hatcheries and by releases of large quantities of hatchery juveniles and smolts in the river for smolt survival tests. Tuolumne River Chinook salmon are probably not a unique stock (FERC, 1996). Recovery of coded-wire-tagged fish indicates that Chinook salmon stocked in the Tuolumne River are contributing to the ocean commercial and recreational fishery and to adults returning to the river to spawn.

The general trends in the life history of Tuolumne River Chinook salmon are subject to substantial variation, probably depending on flow and water temperature (FERC, 1996), ocean rearing conditions, recreational and commercial harvest, and other factors. The extent of this variation is shown in the *2005 Ten Year Summary Report for the Don Pedro Project* (TID/MID, 2005). From 1998 to 2002, sampling of juveniles using rotary screw traps was extended to cover the period from late January through as late as June 30. This sampling found that the peak period of juvenile migration at the lower rotary screw traps varied by year:

Year	Period of Peak Juvenile Catch in Rotary Screw Traps at River Mile 5
1998	February 15 – March 15
1999	January 25 – February 15
2000	February 15 – March 1
2001	February 15 – March 18
2002	April 15 – May 10

Variable juvenile migration times may reflect variability in spawning and incubation times and/or variation in the duration of juvenile rearing based on flow and temperature conditions. In 2000 and 2001, juveniles were captured at RM 5 over a period of more than three months. In other years, juvenile emigration appears to have occurred over a shorter period of time. At various life-history stages, Chinook salmon may therefore be found in the Tuolumne River from October

through May, although there is also some potential for a small number of juveniles to oversummer in cooler reaches of the river (FERC, 1996). In 1994, the USFWS (FERC, 1996) evaluated habitat availability by life-history stage and determined that:

- For spawning, habitat was optimized at flows of about 150 to 350 cfs, which optimized depth over spawning riffles.
- For juvenile rearing, habitat was optimized at low flows (50 to 150 cfs), which optimized low-velocity habitat.
- For egg rearing, habitat was optimized at flows from about 100 cfs to 800 cfs, which defined the optimal amount of riffle and run habitat and minimized the conversion of runs to pools.

Population Trends. TID/MID (2005) summarizes 1971–2004 population trends for adult Chinook salmon in the Tuolumne River and notes that the return of adult salmon to the river follows the general pattern observed in other major San Joaquin River tributaries:

- From 1971 through 2004, the estimated number of adult salmon returning to the Tuolumne River ranged from a low of 77 fish to a high of 40,332 fish (see **Table 5.3.6-2**).
- During the period of record, there were two periods when the CDFG carcass counts built up to peaks of over 5,000 carcasses, with intervening periods where runs declined to below 100 carcasses.
- Estimates of adult escapement based on carcass counts begin to build during years characterized by higher precipitation and flow (and the associated somewhat cooler water temperatures), and to decline with the onset of drought conditions and warmer water temperatures.
- Tagged carcasses (hatchery fish) accounted for 6.4 to 65 percent of the total carcass count, with an average of about 38 percent of carcasses carrying hatchery tags.
- The percentage of females ranged from 25 to 67 percent, with an average of 51 percent. Females made up less that 35 percent of the total carcass count in only 4 of 33 years (all of which were dominated by two-year-old fish).
- Based on redd (salmon nests) counts from 1981 to 2003, spawning is concentrated in the reaches between RM 34 and La Grange Dam (RM 52.2), with the density of redds greatest between RM 47 and La Grange Dam. In this reach, the average redds per mile was about 85, while in the reaches downstream, average redd count over the 24-year period of record was 18.5 redds per mile.
- Reach 2, from RM 47.4 to 50.5 (3.1 miles), contributed from 17 to 42 percent of the total run during 1981 to 2003, while the longer Reach 3 (RM 42.0 to 47.4; 5.4 miles) contributed from 13 to 36 percent of the total run during the same period.
- There was virtually no spawning activity below Fox Grove (RM 24.1), except in 1988 and 1989 when 30 redds were counted in this downstream reach.

TABLE 5.3.6-2
TUOLUMNE RIVER SPAWNING SURVEY SUMMARY

Year	Carcass Count	% Female	Estimated Run
1971	2,283	58	21,885
1972	537	52	5,100
1973	351	59	1,989
1974	90	55	1,150
1975	130	60	1,600
1976	336	51	1,700
1977	45	62	450
1978	116	67	1,300
1979	305	51	1,184
1980	248	61	559
1981	5,819	44	14,253
1982	2,135	60	7,126
1983	1,280	25	14,836
1984	3,841	34	13,689
1985	11,651	56	40,322
1986	2,463	48	7,288
1987	5,280	31	14,751
1988	3,011	60	6,349
1989	625	52	1,274
1990	37	32	96
1991	30	45	77
1992	55	43	132
1993	187	61	431
1994	215	50	513
1995	461	54	928
1996	1,301	35	4,362
1997	1,520	59	7,548
1998	2,712	51	8,967
1999	3,980	46	7,730
2000	6,884	63	17,873
2001	5,400	54	9,222
2002	4,702	54	7,125
2003	1,489	60	2,961
2004	1,224		1,900

SOURCE: TID/MID, 2005.

The TID/MID (2005) data are generally consistent with data from FERC (1996) in that they indicate a majority of spawning occurs in the 15-mile reach below La Grange Dam. Although the nine-year data set from 1996 through 2004 is too small to be the basis for long-term trend analysis, it is noteworthy that the dry years from 2001 to 2005 do not show the dramatic declines in carcass counts and estimated runs that characterized previous dry periods—possibly a function of the minimum release provisions of the FSA, ocean rearing conditions, or other factors.

Spawning. The distribution of Chinook salmon spawning and rearing is strongly influenced by the availability of spawning gravels, with spawning often concentrated in areas at the head of riffles where subsurface flows increase water flows and oxygen through the gravel (FERC, 1996).

Chinook salmon spawning takes place in a variety of habitats that vary in terms of depth, velocity, and substrate (Healey, 1991; cited in FERC, 1996). Spawning can occur within substrates ranging from fine to coarse gravel, as well as over a wide range of water temperatures; however, optimum spawning temperatures are probably in the 8 to 16 °C range. In the Tuolumne River, this temperature range occurs most consistently in the 15-mile reach below La Grange Dam. The distribution and quality of spawning habitat changes in response to flow, as evidenced by major shifts in the distribution of spawning gravels during the 1997 flood, which involved flood-control releases of over 50,000 cfs. TID/MID (2005) compared the estimated area of riffles in the reaches of the river below La Grange Dam for the years 1988 and 2000. In the three upper reaches of the river, the total area of riffle habitat decreased by over four acres (a loss of 15 percent), much of which was attributed to scour during the 1997 floods. However, the general distribution of riffle habitat was not substantially altered. The area of lost riffle habitat was replaced in 2002 and 2003 when the CDFG placed approximately 27,000 cubic yards of gravel in the reach below La Grange Dam. Further riffle restoration activities are projected to restore approximately 70 to 100 additional acres of riffle habitats.

Restoration activities, such as construction of pool-riffle habitats, incidentally reduce the total area of wetted channel, thus reducing the total area of juvenile rearing habitat while likely increasing food production (insects and other macroinvertebrates) and usable rearing floodplain habitat during higher flows (TID/MID, 2005). Post-restoration monitoring of spawning and juvenile rearing suggests that, based on redd counts, spawning has doubled on reconstructed riffle areas.

Juvenile Rearing. When juveniles emerge from the gravel they initially prefer pool habitats, with the distribution in pools affected by fish size (and thus dominance relationships). Habitat selection appears to be determined by food availability and other habitat characteristics, and dominant juveniles tend to select rearing locations at the head of pools where feeding is optimized (Chapman and Bjornn, 1969; cited in FERC, 1996). Larger juveniles can adapt to greater depth and higher velocity flow, and thus juveniles may move into riffle habitats as they grow. Juveniles can rear successfully over a wide range of temperatures, depending on food availability. Optimal rearing temperatures are generally considered to be 12 to 18 °C, but juveniles can thrive at warmer temperatures when food supplies are abundant enough to offset the increased metabolic rates associated with rearing in warmer water. Optimal temperatures are generally found in the 25 miles immediately downstream of La Grange Dam, but in very wet years may extend to the confluence with the San Joaquin River, at least into the late spring (TID/MID, 2005).

From 1986 to 2004, juvenile rearing was evaluated at 12 Tuolumne River seining locations, from the Old La Grange Bridge (RM 50.5) to the Shiloh Bridge (RM 3.4), with some sites monitored for only a portion of the 19-year period. The TID/MID data do not show any clear trend in the number of juveniles captured by seine netting before and after implementation of the FSA, although densities (fish per unit of seined volume) were marginally higher following FSA implementation. The 1986–1995 studies and 1996–2004 FSA monitoring data show expected trends in juvenile rearing and behavior:

- Young juveniles (fry typically less than approximately 45 millimeters) make up a majority of juveniles captured in January and February, with larger juveniles in excess of 65 millimeters (fingerlings and smolts) beginning to dominate captures by April.

- There are moderately strong relationships between the peak salmon juvenile density and average January 15 to March 15 salmon juvenile density and the estimated number of female spawners.

The seining data suggest a relatively stable egg-to-juvenile survival rate over a wide range of returning adult salmon abundances. The calculated relationship would be stronger if data from the very dry year of 1994 (pre-FSA) and the very wet year of 1997 were omitted from the analysis, which may indicate that egg-to-juvenile survival rates are not generally affected by variable flow. The survival of incubation eggs and juveniles is sensitive to very high flows that scour and erode spawning redds, as occurred in 1997.

The timing of juvenile movement downstream (based on rotary-screw-trap operations at lower screw traps) varied considerably from year to year; TID/MID noted that high variability in trap results makes it difficult to estimate juvenile production, and production estimates from the 1995–2004 monitoring vary by two orders of magnitude. Some preliminary mark-recapture studies of juvenile survival by river reach suggest that survival is substantially higher in the upstream spawning areas than it is in the lower reaches. Predation[5] by adult striped bass and other fish has been identified as one of the factors affecting juvenile survival within the river.

TID/MID also addressed the potential for juvenile stranding as a result of flow fluctuations, an issue of some importance since one goal of restoration is to increase areas of floodplain that may be accessed for rearing. The post-FSA stranding surveys indicated that stranding was a complex phenomenon, probably related to:

- Salmon density

- Flow reduction and the minimum flow in the fluctuation cycle, which determines the amount of potential stranding area exposed

- Salmon use of particular low-lying locations

- Slope and substrate of the channel

However, monitoring in 2005 found little post-FSA stranding and noted that restoration areas have been designed to minimize the potential for stranding (primarily by manipulating the slope of the accessible floodplain).

5 The act of preying on another animal or animals.

Steelhead/Rainbow Trout

Steelhead/rainbow trout oversummer in natal streams and require relatively cooler water temperatures than Chinook salmon. Water temperatures in the lower Tuolumne River are in the 25 to 30 °C range for an extended period of time during the summer in many locations (TID/MID, 2005) and are unsuitable for steelhead. Only in the reach immediately downstream of La Grange Reservoir are water temperatures suitable for steelhead rearing. Temperatures in the San Joaquin River during the spring and summer are consistently higher than temperatures farther upstream in the Tuolumne River (see Figure 5.3.1-4) (TID/MID, 2005) and may preclude successful out-migration of juveniles. FERC (1996) concluded that no significant populations of steelhead/rainbow trout are present in the lower Tuolumne River system.

The results of rainbow trout surveys from 1982 to 2004 show rainbow trout were not found below RM 38 during this period (TID/MID, 2005). In addition, only 10 of the fish identified in this extended period of snorkel survey were in excess of 400 millimeters in length, suggesting that large anadromous steelhead probably occur in the system very infrequently. A vast majority of rainbow trout observed during snorkel surveys were found above RM 45. Nevertheless, post-1995 monitoring suggests that the range of rainbow trout in the Tuolumne River has been moderately extended downstream as a result of the FSA flow regimes. Prior to 1998, rainbow trout had not been found below RM 47. Following implementation of the FSA flow regimes, the species was found with greater frequency downstream in the reach from RM 47 to RM 38, even in the dry 2001–2004 period.

Other Fish Species

The lower Tuolumne River supports a number of native and non-native fish species, as shown in **Table 5.3.6-3**. From the perspective of salmon management, the most important are largemouth and smallmouth bass and striped bass due to the potential for predation, particularly on outmigrating juveniles (Orr, 1997; Cohen and Moyle, 2004).

Largemouth and Smallmouth Bass. Non-native largemouth and smallmouth bass have colonized the lower Tuolumne River, taking advantage of the low-velocity, and pond-like habitats of the river that are particularly found below RM 25. In these reaches, bass are present in relatively high abundance and feed actively during the spring out-migration of juvenile Chinook salmon. Both the low flow and high water temperatures in this reach stress juvenile salmon and enhance predation by the bass. Typical of centrarchids, smallmouth and largemouth bass are thick-bodied fish that rely on an ambush strategy for foraging. Their swimming speed over distance is low, and their ability to sustain speed is limited by their metabolism and body configuration.

TID/MID (2005) monitored largemouth and smallmouth bass in the Tuolumne River system from 1996 to 2004 and concluded:

- The population was depleted during the 1997 floods, but recovered slowly until 2003 when it reached its previous level.
- Largemouth bass are more abundant than smallmouth bass.

TABLE 5.3.6-3
NON-SALMONID SPECIES PRESENT IN THE LOWER TUOLUMNE RIVER

Species	Scientific Name	Native (N) or Introduced (I)	Observed in 1996–2004 Surveys			
			Snorkel	Upper RST	Lower RST	Seine
Pacific lamprey	*Lampetra tridentata*	N	X	X	X	X
River lamprey	*Lampetra ayresi*	N		X		
White sturgeon	*Acipenser transmontanus*	N				
American shad	*Alosa sapidissima*	I		X	X	
Threadfin shad	*Dorosoma petenense*	I		X	X	X
Common carp	*Cyprinus carpio*	I	X	X	X	
Goldfish	*Carassius auratus*	I		X	X	
Golden shiner	*Notemigonus crysoleucas*	I		X	X	X
Hitch	*Lavinia exilicauda*	N		X	X	
Sacramento blackfish	*Orthodon microlepidotus*	N			X	
Splittail	*Pogonichthys macrolepidotus*	N			X	
Hardhead	*Mylopharodon conocephalus*	N	X	X	X	X
Sacramento pikeminnow	*Ptychocheilus Grandis*	N	X	X	X	X
Red shiner	*Cyprinella Lutrensis*	I		X	X	X
Fathead minnow	*Pimephales promelas*	I				X
Sacramento sucker	*Catostomus occidentalis*	N	X	X	X	X
White catfish	*Ictalurus catus*	I	X			X
Brown bullhead	*Ictalurus nebulosus*	I		X	X	
Black bullhead	*Ictalurus melas*	I		X	X	
Channel catfish	*Ictalurus punctatus*	I		X	X	X
Wagasaki	*Hypomesus nipponensis*	I			X	
Inland silversides	*Menidia beryllina*	I			X	X
Western mosquitofish	*Gambusia affinis*	I	X	X	X	X
Prickly sculpin	*Cottus asper*	N		X	X	X
Riffle sculpin	*Cottus gulosus*	N	X	X	X	X
Striped bass	*Morone saxatilis*	I		X	X	X
Black crappie	*Pomoxis nigromaculatus*	I		X	X	
White crappie	*Pomoxis annularis*	I		X	X	
Warmmouth	*Lepomis gulosus*	I		X	X	
Green sunfish	*Lepomis Cyanellus*	I		X	X	X
Bluegill	*Lepomis macrochirus*	I	X	X	X	X
Redear sunfish	*Lepmois microlopus*	I	X	X	X	X
Largemouth bass	*Micropterus salmoides*	I	X	X	X	X
Smallmouth bass	*Micropterus dolomieui*	I	X	X	X	X
Bigscale logperch	*Percina macrolepida*	I		X	X	X
Tule perch	*Hysterocarpus traski*	N				

RST=rotary screw traps.

SOURCE: TID/MID, 2005.

- The restoration of pool-pond area downstream of Fox Grove County Park did not reduce largemouth bass density and may have increased smallmouth bass density at the site.
- Habitat modeling indicated that velocity is the key factor limiting bass habitat.
- Habitat modeling indicated that a flow of 300 cfs or higher would create limiting velocities for bass in the reach downstream of Fox Grove County Park after restoration, compared to a limiting velocity of 2,000 cfs for pre-project conditions.

Bass density could thus be reduced by recontouring the channel to enhance riffle and run habitats, combined with manipulation of flow to increase velocities. Restoration that increases the area of riffle habitat would therefore be expected to benefit out-migrating juvenile salmon.

Other Species. Based on surveys conducted from 1981 to 2004, including the TID/MID surveys conducted from 1996 to 2004 (Table 5.3.6-3), the lower Tuolumne River supports a relatively complex assemblage of fish, only 14 of 38 being native to the region. The non-natives were introduced for a variety of commercial and sport purposes, beginning in 1871 with the introduction of American shad and continuing into the 1970s with the introduction of the inland silversides as a mosquito-control fish. A majority of the introduced species are warmwater fish that thrive in the lower reaches of the rivers and in the Sacramento–San Joaquin Delta.

As the table indicates, many of the introduced fish species are more widely distributed in the lower Tuolumne River than some of the native species. TID/MID (2005) notes that warmwater introduced species were particularly well distributed in the lower 31 miles of the river, and that native species were dominant only in the short reach upstream of RM 50. The distribution of species responded to flow, with native fish whose life history involves use of riffles for spawning becoming more abundant in the year following a high-flow year.

San Joaquin River and Sacramento–San Joaquin Delta

General Ecological Description

The Sacramento–San Joaquin Delta is a 600-square-mile area of channels and islands at the confluence of the Sacramento and San Joaquin Rivers. Freshwater draining from a 41,300-square-mile watershed enters the Delta from the Sacramento and San Joaquin Rivers and several smaller rivers. Some of the water is diverted from the Delta channels for municipal and agricultural purposes. The remainder flows through the Delta to the San Francisco Bay Estuary.

The Delta is a tidal region. Every 12.4 hours, the tides cause water to move in and out of the Delta. Most of the time, tides cause a five- to eight-mile back-and-forth movement of water in the western part of the Delta. The movement of freshwater through the Delta is superimposed on the tidal flows. Typical freshwater flows are much smaller than tidal flows, usually in the range of 5 to 15 percent of the tidal flows (see Section 5.3.1).

The Bay-Delta estuary is a complex estuarine ecosystem (i.e., a transition zone between inland sources of freshwater and saltwater from the ocean). Along the salinity gradient extending from the Golden Gate upstream into the Delta, the species composition of the aquatic community

changes dramatically, although the basic functional relationships among organisms (e.g., predator/prey, etc.) remain similar throughout the system. The primary energy input to the system is solar radiation, which is used, along with nutrients, by the primary producers (phytoplankton, vascular plants, and macroalgae) to convert inorganic carbon to organic matter through photosynthesis. Zooplankton (e.g., copepods, cladocerans, and mysid shrimp) prey on the phytoplankton. The vascular plants and macroalgae are grazed on and also produce detritus, which is decomposed by microbes and consumed by detritivores (e.g., polychaete worms, amphipods, cladocerans, and a diverse group of other fish and macroinvertebrates). The primary consumers are in turn preyed on by secondary consumers, consisting mainly of invertebrates (e.g., polychaete worms, snails, copepods, mysid shrimp, bay shrimp, and crabs) and fishes (northern anchovy, Pacific herring, topsmelt, white croaker, flatfish, gobies, sculpin, shad, juvenile Chinook salmon, and a variety of other resident and migratory fish species). These species in turn are preyed on by top consumers such as fish (striped bass, catfish, sturgeon, halibut, sharks, and rays), marine mammals, birds, and man. The role of a species in the food web may be different at different lifestages, or a species may utilize various levels of the food web simultaneously.

Fishery sampling within the Bay-Delta estuary has shown that 55 fish species inhabit the estuary (Baxter et al., 1999), of which approximately one-half are non-native, introduced species. Many of the fish species inhabiting the estuary, such as striped bass and American shad, were purposefully introduced to provide recreational and commercial fishing opportunities. A number of the fish species have been introduced accidentally to the estuary through movement among connecting waterways (e.g., threadfin shad and inland silversides). In recent years, a number of fish and macroinvertebrate species have been accidentally introduced into the estuary, primarily from the Orient, through ballast water discharges from commercial cargo ships (e.g., yellowfin and chameleon gobies). In addition, an estimated 100 macroinvertebrates have also been introduced, primarily through ballast water discharge, into the estuary (Carlton, 1979). These introductions of non-native fish and macroinvertebrates have contributed to a substantial change in the species composition, predator/prey interactions, and competitive interactions affecting the population dynamics of native species. Many of the introduced fish and macroinvertebrates have colonized and inhabit the lower San Joaquin River and Delta.

The lower San Joaquin River and Delta provide habitat to a diverse assemblage of resident and migratory estuarine organisms. The biological environment is a complex community of plants and animals inhabiting the saltwater, estuarine (brackish water), and freshwater habitats within the Bay-Delta estuary. This section provides a brief summary of information available on the aquatic plants, phytoplankton, zooplankton, bottom-dwelling macroinvertebrates, and common fish populations inhabiting the Bay-Delta estuary.

Fish

Fish species may utilize the estuary for any or all of their life-history stages. They may have planktonic, bottom-dwelling, and open-water life histories. The majority of fish species inhabiting the estuary have planktonic larval stages; as plankton they feed on zooplankton and in some cases phytoplankton. Many of these species forage on plankton during the larval and early juvenile lifestages, and then as juveniles and adults become more selective predators and feed on large

invertebrates and fish. Bottom-dwelling fish such as sturgeon, flatfish, gobies, sculpin, and croaker are planktivorous as larvae but begin to feed on invertebrates as juveniles. Many smaller fish, including smelt, silversides, northern anchovy, and Pacific herring, are planktivorous throughout their lives.

Some estuarine fish do not rely on plankton as a major food source at any lifestage. Live-bearing surfperch, for example, predominantly feed on invertebrates such as mollusks, crustaceans, and polychaetes throughout their life. Sturgeon and sharks feed on invertebrates by shoveling through the substrate, and also feed on fish and large invertebrates in the water column. Many freshwater fish prey primarily on bottom-dwelling and drifting insect larvae and crustaceans, because zooplankton abundance is low in the swifter flowing freshwater sloughs and rivers.

The abundance and species composition of fish inhabiting the estuary vary in response to salinity gradients (Baxter et al., 1999). The most abundant fish inhabiting the high-salinity areas of the Central Bay include the schooling, bottom-dwelling forage fish such as northern anchovy, Pacific herring, topsmelt, jacksmelt, and true smelt (whitebait, surf smelt, and night smelt). Other members of the Central Bay fish community include flatfish, rockfish, surfperch, gobies, and sharks. In the low-salinity areas of Suisun Bay and the Delta, the most abundant fish include striped bass, prickly sculpin, staghorn sculpin, threadfin shad, yellowfin goby, and starry flounder. Anadromous fish species such as Chinook salmon, steelhead, American shad, striped bass, and sturgeon utilize the entire estuarine system as a migration corridor and foraging habitat.

Factors affecting the abundance and geographic distribution of fish within the estuary include water velocities, substrate, salinity gradients, water temperature, and food availability. Many of the fish species that inhabit the estuary reside in coastal marine waters and enter the estuary on a seasonal basis for foraging or reproduction. The seasonal cycles of fish abundance vary in response to migration patterns, reproductive cycles, foraging patterns, and environmental conditions occurring within both the estuary and coastal marine waters.

The fish community inhabiting the estuary is diverse and dynamic. The abundance of species can fluctuate substantially within and among years (Baxter et al., 1999) in response to both population dynamics and environmental conditions. Life-history strategies and habitat requirements also vary substantially among species within the fish community. Information on the fish community in the Delta is available from monitoring conducted by the CDFG and USFWS in addition to fish salvage monitoring at the State Water Project and Central Valley Project export facilities in the south Delta. The following sections briefly describe the species composition of the fish community in the lower San Joaquin River and Delta in the vicinity of the WSIP facilities. Information is also presented on habitat types that occur within the estuary, and habitat functions that affect species composition and habitat use. Information on habitat functions and analysis of the available fishery information was used to assess the potential adverse impacts of proposed program operations (e.g., changes in Delta hydrology) on the fish community inhabiting the lower San Joaquin River and Delta.

In recent years, the bottom-dwelling fish community, including delta and longfin smelt and other species, has experienced a significant decline in abundance. State and federal resource agencies are currently evaluating various factors that could be contributing to the decline. Hypotheses

include the effects of losses at water diversions, changes in Delta hydrology, the effects of pollutants on survival, and the effects of introduced species on the Delta food web. The importance of these factors in the decline in fish abundance has not been determined.

Among the seasonal inhabitants, many species use the Bay-Delta estuary as a spawning area and/or juvenile nursery habitat on either an obligatory or nonobligatory basis (Baxter et al., 1999). For obligate species, reproduction and rearing of juveniles occurs almost exclusively within a bay or estuarine environment. Nonobligate species may or may not inhabit the estuary during any given year. The occurrence of nonobligate species varies substantially from one year to the next within the Bay-Delta estuary. These species are typically found in the more marine areas of the estuary and are not generally abundant upstream within Suisun Bay or the marsh. Opportunistic species use the Bay-Delta estuary as an extension of their habitat based on the suitability of environmental conditions. Many species that inhabit coastal marine waters, such as northern anchovy, may opportunistically move into the estuary when conditions are favorable for reproduction, juvenile rearing, and foraging. Several freshwater or low-saline species, such as white catfish and threadfin shad, may opportunistically use habitats within Suisun Bay, San Pablo Bay, or Central Bay during periods of high freshwater outflow from the river systems that results in lower salinity and more suitable habitat conditions for these species farther downstream within the system (Baxter et al., 1999).

Anadromous species such as Chinook salmon and steelhead spawn within freshwater portions of rivers and creeks tributary to the Bay-Delta estuary, including the Tuolumne River. Juvenile rearing habitat for these species is also present primarily within the freshwater or low-saline portions of the system. Juvenile Chinook salmon and steelhead emigrate from freshwater habitat and move downstream through the estuary, which is used primarily as a migratory corridor and short-term foraging habitat as the fish move into coastal waters for rearing. Adult Chinook salmon and steelhead subsequently migrate back upstream to spawn, again using the Bay-Delta estuary as a migratory corridor. Other anadromous species such as striped bass may inhabit freshwater, estuarine, and marine waters over an extended period of time as both juveniles and adults.

The open waters of the lower San Joaquin River and Delta serve as a migratory route for several species of anadromous fish whose adults migrate to the freshwater reaches of the tributary rivers to spawn and whose juveniles migrate downstream to return to the ocean. These fish include steelhead, Chinook salmon, white and green sturgeon, and striped bass. In addition, the main channel and adjacent areas support populations of resident species, including Sacramento pikeminnow, white catfish, and threadfin shad.

Regulatory Setting

Special-Status Species

A variety of special-status fish species, several of which have been listed for protection under the Federal and/or California Endangered Species Acts, are present in the Delta and the San Joaquin and Tuolumne Rivers. Special-status fish species that occur in the lower San Joaquin River and Delta include steelhead, green sturgeon, delta smelt, Chinook salmon, Sacramento splittail, and

longfin smelt. Several special-status species use the Delta as a migratory corridor. The winter-run Chinook salmon is federally and state-listed as endangered. The spring-run Chinook salmon is federally and state-listed as threatened. The fall/late-fall-run Central Valley Chinook salmon is a federal candidate species and California species of special concern. The Distinct Population Segment of Central Valley steelhead is federally listed as threatened. Fall/late-fall-run Central Valley Chinook salmon use the lower San Joaquin River as a migratory corridor and spawn in the Tuolumne River below La Grange Dam. In addition, delta smelt, a federally and state-listed threatened species, and Sacramento splittail, a California species of special concern and formerly a federal threatened species, have been documented within the lower San Joaquin River and Delta (USFWS, 2003). The NMFS recently listed green sturgeon as a threatened species. Although the distribution of green sturgeon in the lower San Joaquin River is poorly understood, the species is known to reside within the Delta.

Essential Fish Habitat

The Pacific Fisheries Management Council has designated Central San Francisco Bay, Suisun Bay, and the Delta as Essential Fish Habitat (EFH) to protect and enhance habitat for coastal marine fish and macroinvertebrate species that support commercial fisheries. The major rivers tributary to the Delta, including the San Joaquin and Tuolumne Rivers, have also been identified as EFH for Pacific salmon. The amended Magnuson-Stevens Fishery Conservation and Management Act, also known as the Sustainable Fisheries Act (Public Law 104-297), requires all federal agencies to consult with the Secretary of Commerce on activities or proposed activities authorized, funded, or undertaken by that agency that may adversely affect EFH of commercially managed marine and anadromous fish species (Office of Habitat Conservation, 1999). The EFH provisions of the Sustainable Fisheries Act are designed to protect fishery habitat from being lost due to disturbance and degradation. The act requires that EFH must be identified for all species that are federally managed by the Pacific Fisheries Management Council.

5.3.6.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to fisheries, but generally considers that implementation of the proposed program would have a significant fisheries impact if it were to:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFG, NMFS, or USFWS

- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites

- Have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below

self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of an endangered, rare or threatened species

Approach to Analysis

The effects of the WSIP on river flow and reservoir water levels were determined using the HH/LSM. An overview of the model is presented in Section 5.1; detailed information on the model and the assumptions that underlie it is provided in Appendix H. The effects of the WSIP on stream flow and reservoir water levels are evaluated in Section 5.3.1 and were used as the basis for assessing the WSIP's effects on fisheries and aquatic resources. In addition, the effects on water temperature due to WSIP-induced changes in flow in the Tuolumne River below La Grange Dam were determined using a temperature model and are described in Section 5.3.3.
A professional fish biologist assessed the effects of flow, reservoir level, and water temperature changes on aquatic life.

Impact Summary

Table 5.3.6-4 presents a summary of the impacts on fisheries in the Tuolumne River system and downstream water bodies that could result from implementation of the proposed water supply and system operations.

TABLE 5.3.6-4
SUMMARY OF IMPACTS –
FISHERIES IN TUOLUMNE RIVER SYSTEM AND DOWNSTREAM WATER BODIES

Impact	Significance Determination
Impact 5.3.6-1: Effects on fishery resources in Hetch Hetchy Reservoir	LS
Impact 5.3.6-2: Effects on fishery resources along the Tuolumne River between Hetch Hetchy Reservoir and Don Pedro Reservoir	LS
Impact 5.3.6-3: Effects on fishery resources in Don Pedro Reservoir	LS
Impact 5.3.6-4: Effects on fishery resources along the Tuolumne River below La Grange Dam	PSM
Impact 5.3.6-5: Effects on fishery resources along the San Joaquin River	LS

LS = Less than Significant impact, no mitigation required
PSM = Potentially Significant impact, can be mitigated to less than significant

Impact Discussion

Impact 5.3.6-1: Effects on fishery resources in Hetch Hetchy Reservoir.

Hetch Hetchy Reservoir provides habitat for resident fish, including trout. Rainbow, brown, and eastern brook trout support a popular recreational fishery. Operational modeling (presented in Section 5.3.1) indicates that increased water demand under the WSIP would result in a general reduction in water storage elevations in Hetch Hetchy Reservoir of 1 to 10 feet in most months,

and to a larger degree in some months of a severe drought. Hetch Hetchy Reservoir typically undergoes a substantial change in storage volume throughout the year, with a general declining trend during the fall and winter followed by a substantial increase in storage during the spring and summer in response to snowmelt runoff (Figure 5.3.1-8). The fish community inhabiting the reservoir typically experiences a wide range of habitat conditions under both existing and proposed future operations. Given the range of natural variation in seasonal storage within the reservoir under existing conditions and the incremental changes predicted to occur under the WSIP, impacts on resident fish habitat within the reservoir under future conditions would be *less than significant*, and no mitigation is required.

Impact 5.3.6-2: Effects on fishery resources along the Tuolumne River between Hetch Hetchy Reservoir and Don Pedro Reservoir.

The Setting section describes the aquatic habitat and fishery resources in the Tuolumne River below Hetch Hetchy Reservoir; the resident fish species present in the river include rainbow trout, brown trout, California roach, sculpin, and suckers. Instream habitat conditions for resident trout and other fish species inhabiting the Tuolumne River downstream of Hetch Hetchy Reservoir are supported through the maintenance of minimum stream flows. The minimum flow requirements below Hetch Hetchy are described in Section 5.3.1.1 and shown in Table 5.3.1-2. The SFPUC operates all facilities such that these release requirements are met.

Hydrologic modeling (see Section 5.3.1) shows that WSIP operations would have little or no effect on average monthly flow in most summer, fall, and winter months in all hydrologic year types. In these months, the required fishery release would be made under the existing condition and with the WSIP. With the WSIP, the number of months in which only the required fishery release would be made would increase slightly. The modeling analysis indicates that, under the existing condition, the minimum flow release would be made 84.2 percent of the time (837 months in the 987-month hydrologic record), while under the WSIP the minimum flow release would be made 85.4 percent of the time (in 6 more months, or 843 months in the 987-month hydrologic record). Minimum release requirements would be maintained under all conditions. The WSIP would have a less-than-significant effect on river flows and, in turn, on fisheries in these months.

In spring months (April, May, and June), however, operation of the regional water system under the WSIP would reduce average monthly flows between 4 and 30 percent as the SFPUC refills Hetch Hetchy Reservoir with snowmelt. The greatest percentage reduction would occur in normal, below-normal, and dry years because, in these year types, a greater proportion of the snowmelt currently released by the SFPUC to the river would be needed to refill the reservoir. Actual flow reductions in any single spring month during the different hydrologic year types would vary widely. As discussed previously, the modeling tool used for this analysis reports information in a monthly time-step; it cannot provide weekly or daily information about flow releases. In reality, the flow reduction would not occur evenly over a month, but instead would be

the result of SFPUC reservoir operators delaying the start of spring flow releases from Hetch Hetchy Reservoir by a few days in an effort to gauge and balance reservoir refill with releases of excess snowmelt. After the initial delay of releases from the reservoir under WSIP operations, and once the SFPUC determined that adequate reservoir refill would be achieved by July, the SFPUC would resume releases for the remainder of the spring and early summer, following a similar pattern of frequency and magnitude as under existing conditions.

Many of the resident fish spawn during the spring months, but the delayed rise in flow would not be expected to have a significant effect on rainbow trout and other resident fish during the spring spawning season. The delay in spring flow releases under the WSIP would typically be on the order of days and would be within the natural interannual variation that has occurred in the past. Resident rainbow trout, and other fish species, have evolved and adapted to short-duration variation in environmental conditions. The short-duration delay in increasing stream flows above the minimum flows would be a less than significant impact on habitat conditions and the biological response of resident trout and other fish species. Adverse impacts on fishery habitat quality and availability for resident rainbow trout related to the minor delay in increased flows would be less than significant.

With respect to potential water quality and temperature effects on fisheries (as discussed in Section 5.3.3), the WSIP would have no effect or a less-than-significant effect on temperature and dissolved oxygen in Hetch Hetchy Reservoir and downstream on the Tuolumne River in most months and year types. During some extremely dry periods under both existing conditions and with the WSIP, reductions in storage in Hetch Hetchy Reservoir might result in the release of warmer water from the reservoir at times when the reservoir is stratified (warmer water at the top and colder water below). Analysis of the droughts that occurred in 1923–1935, 1976–1977, and 1986–1993 indicates that this situation could occur in a drought similar to the 1976–1977 drought, but did not occur in the two other extended drought scenarios.

Under conditions similar to those of the 1976–1977 drought, with reduced water in storage during the dry period, water released downstream to the river in September and October could eventually come from the warmer water layer on the surface of the reservoir, which could be 10 to 12 °C warmer than the colder water initially released from the lower level of the reservoir. Release of this warmer water could increase the temperature in the river from about 8 °C to perhaps 14 to 18 °C. This situation would occur in a drought similar to the 1976–1977 drought under existing conditions as well as with the WSIP. However, since reservoir drawdown in Hetch Hetchy Reservoir would be greater with the WSIP than under existing conditions, the adverse water quality effects would be similar to those under the existing condition but would last longer under the WSIP.

This potential temperature effect would result in a less-than-significant impact on the fisheries in this reach of the river for several reasons. First, it would occur very infrequently; review of the historical hydrology indicates that this situation would not occur in all drought periods but only those, such as the 1976–1977 drought, where reservoir drawdown reaches levels low enough in September and October (when the reservoir would be stratified) to result in the release of the warmer surface water. Over the modeled 82-year hydrologic record this condition occurred only

once. Although this temperature increase would exceed the 5 °F limit for temperature change specified in the Central Valley RWQCB objectives for coldwater fishery beneficial uses, the resulting temperatures of 14 to 18 °C would not exceed the suitable temperature range for juvenile and adult trout (13 to 21 °C). The rainbow trout fishery would be the most sensitive to the temperature increase. Also, this temperature effect would not occur during the spawning months of the year (a sensitive stage in the fishery life cycle), but rather during the adult and juvenile rearing period. This very infrequent temperature effect would not result in a significant impact on fishery populations.

Potential impacts to resident fish population inhabiting the river are *less than significant*, and no mitigation is required.

Impact 5.3.6-3: Effects on fishery resources in Don Pedro Reservoir.

Don Pedro Reservoir supports a diverse assemblage of resident fish (Table 5.3.6-1), including rainbow, brown, and brook trout, largemouth and smallmouth bass, sunfish, shad, and several species of fish such as Chinook salmon, coho salmon, and kokanee that are reared in hatcheries and planted in the reservoir to support recreational fisheries. Operational modeling (presented in Section 5.3.1) indicates that reservoir storage under the WSIP would be reduced year-round (Figure 5.3.1-11). As a result of increased deliveries under the WSIP, inflows to Don Pedro Reservoir would be reduced, causing a reduction in storage elevations within the reservoir of 1 to 10 feet in most months, and to a larger degree in some months of a severe drought. Don Pedro Reservoir typically undergoes a substantial change in storage volume throughout the year, with a general increasing trend during the fall, winter, and early summer followed by a substantial decline in storage during the late summer and early fall (Figure 5.3.1-11). The typical variation in reservoir conditions within a year is substantially greater than the change expected to occur under WSIP operations. The fish community inhabiting the reservoir typically experiences a wide range of habitat conditions under both existing and proposed future operations. Given the range of natural variation in seasonal storage within the reservoir under existing conditions and the incremental changes predicted to occur under the WSIP, impacts on resident fish habitat within the reservoir under future conditions would be *less than significant*, and no mitigation is required.

Impact 5.3.6-4: Effects on fishery resources along the Tuolumne River below La Grange Dam.

Changes in reservoir operations, coldwater pool availability, and instream flow releases have the potential to affect the quality and availability of habitat for resident and anadromous fish species. Chinook salmon is the species of most concern in this reach of the river. On the Tuolumne River downstream of La Grange Dam, fall-run Chinook salmon use the river for migration, spawning, egg incubation, and juvenile rearing. Steelhead, which is a federally listed threatened species, may inhabit the river in low abundance. These two are the more sensitive fish species in this

reach of the river and thus are the focus of this impact analysis; impacts on these species are representative of potential effects on the other species present in this reach. Potential mechanisms for adverse effects on fishery habitat include:

- Reductions in adult salmon attraction and migration flows
- Reductions in stream flows resulting in dewatering of incubating eggs
- Reductions in stream flows resulting in reductions in physical habitat for juvenile rearing
- Reductions in reservoir storage volume and coldwater pool availability resulting in elevated downstream water temperatures
- Reductions in stream flows and/or increases in seasonal water temperatures affecting juvenile emigration

The potential for each of these mechanisms to adversely affect fishery habitat as a result of proposed operations was assessed based on the reservoir storage information and monthly instream flows presented in Section 5.3.1 and the water quality/temperature effects assessment presented in Section 5.3.3.

The potential flow changes on the lower Tuolumne River under the WSIP, as discussed in Section 5.3.1, can be summarized as follows. Under existing conditions, in most below-normal or drier years, almost all of the winter and spring runoff from the watershed upstream of Don Pedro is captured in the reservoir. In years when the reservoir fills, usually wet or above-normal years, excess water is released to the Tuolumne River. In the future with the WSIP, Don Pedro Reservoir would be drawn down farther in most years than it would under the existing condition. Consequently, TID would have to capture a greater proportion of spring runoff to refill the reservoir with the WSIP. As a result, the volume of water released to the Tuolumne River would be reduced compared to the existing condition. The flow reductions that would occur under WSIP operations would primarily take place during the December to June period, when TID fills Don Pedro Reservoir.

The WSIP would have little or no effect on average monthly flow in the lower river in most summer, fall, and winter months in all hydrologic year types. The WSIP would have no effect on average monthly flow in any months of critically dry years or in most summer months of dry, below-normal, and above-normal years (see Table 5.3.1-6). Only the required fishery releases are made in these months under the existing condition, and this would remain the case under the WSIP. The WSIP would result in reductions in average monthly flow in the Tuolumne River below La Grange Dam in the November through June period in non-critically dry years. As shown in Table 5.3.1-6, reductions in flow would occur in some months of all year types except for critically dry years. Looking at monthly flows averaged by year type, the greatest average monthly reduction would be a 25 percent flow reduction in June of an above-normal year. The analysis of the 82-year hydrologic record indicates that reductions of 30 percent or more could occur in some months of 18 years out of 82, or about once in every four springs on average. A

maximum flow reduction ranging from 80 to 95 percent was projected to occur once in the 82-year hydrologic simulation.

As discussed previously, the modeling tool used for this analysis reports information on a monthly time-step. As a result, while the model describes the nature and magnitude of monthly flow changes that could occur under the WSIP compared to existing conditions, it does not show the specific daily or weekly changes in reservoir operations made by the operators. The predicted flow changes would not occur uniformly over an entire month. The flow reductions on the lower Tuolumne River under the WSIP would result from Don Pedro Reservoir operators adjusting the timing and duration of reservoir releases by a matter of days as they balance reservoir refill objectives with flood control and fishery release requirements.

Adult fall-run Chinook salmon migrate upstream from September through December. Minimum instream flows in the Tuolumne River were established as part of the FSA to provide suitable habitat conditions for adult Chinook salmon migrating upstream. Minimum instream flows would continue to be maintained under the WSIP. Although flows in the lower river would be reduced in some months, the remaining flows are suitable for adult migration. Flow reductions under the WSIP would have a less-than-significant effect on adult migration.

Chinook salmon spawning and egg incubation typically occurs from approximately mid-October through March. If there were a substantial reduction in flows during egg incubation, the redds could be dewatered, resulting in mortality. During the spawning season, average monthly flows generally show an increasing trend throughout the egg incubation period under both existing conditions and with the WSIP. Although the WSIP would reduce flow relative to existing conditions, the flow reductions would not be expected to result in an increased risk of redd dewatering. Since flows during the egg incubation period are increasing under both existing and future WSIP conditions, it is expected (based on the monthly average flow estimates) that impacts on egg incubation, hatching, and fry emergence would be minor. Instream flows under existing conditions are managed on a daily basis to reduce the risk of redd dewatering. It is assumed they would be managed in the same way with the WSIP. Thus, it flow reductions under the WSIP are not anticipated to have a significant effect on incubating eggs.

Juvenile Chinook salmon rearing occurs in the lower Tuolumne River from January through May. WSIP-induced changes in river flow that are projected to occur during the juvenile Chinook salmon rearing are typically less than 10 percent of the existing baseline flows (Table 5.3.1-6), with some exceptions where a higher-percentage flow reduction could occur. Instream flow studies have been conducted on the lower river to identify the relationship between stream flow and juvenile salmon rearing habitat (USFWS, 1994). The results of these analyses were used to identify minimum instream flow requirements. The minimum instream flows would be maintained under both existing and proposed operations. In some years, the projected flow reductions would not substantially reduce rearing habitat (based on an examination of the predicted changes in stream flow during the juvenile rearing period and the flow/habitat relationships for the river), and the WSIP would have a less-than-significant effect on the salmon

fishery. However, in some years, when the flow reductions are more substantial, the WSIP changes would adversely affect juvenile fall-run Chinook salmon rearing habitat.

Fall-run Chinook salmon juvenile out-migration occurs during February and March (fry) and April and May (smolts). The predicted stream flows under existing and proposed operations during the juvenile emigration period show that stream flow reductions are typically less than 10 percent when compared to the existing baseline flows. As noted above, minimum stream flow requirements identified for the river would continue to be met under both existing and proposed operations. Based on the magnitude of the stream flow changes, it is not expected that flow reductions under the WSIP would result in significant adverse impacts on juvenile fall-run Chinook salmon migration.

The largest percentage reductions in Tuolumne River stream flow downstream of La Grange Dam under WSIP operations are expected to occur in June (Table 5.3.1-6). Flow reductions in June would likely result in seasonally elevated water temperatures and a corresponding reduction in the linear extent of suitable habitat for steelhead/rainbow trout rearing. Steelhead/rainbow trout rear within the river system throughout the year. Seasonally elevated water temperatures affect habitat suitability during summer months. Although steelhead are not abundant in the Tuolumne River, these changes in stream flow and water temperature could affect habitat quality and availability for summer rearing. Changes in flow in June of average wet years (-7 percent) would have a minor effect on steelhead/rainbow trout because river flow under both existing and proposed conditions would be in excess of 1,000 cfs. The average monthly flow reduction in June of above-normal hydrologic years (-25 percent) represents a change in flow from 408 cfs under existing conditions to 306 cfs with the WSIP. A reduction in average monthly flow in June of approximately 102 cfs would cause a moderate change in habitat conditions, potentially affecting oversummering steelhead/rainbow trout as well as reducing physical habitat within the river for other aquatic species.

As discussed in Section 5.3.3 regarding water quality and temperature, the proposed program would not result in changes in reservoir storage that would adversely affect the extent of the coldwater pool available for release to the lower river. Based on the results of these analyses, it was concluded that the WSIP would not affect seasonal temperatures in water released to the river from Don Pedro Reservoir. Almost all of the time, WSIP-induced flow reductions in the Tuolumne River below La Grange Dam would have no effect on water temperature. As described in Section 5.3.3, on infrequent occasions, WSIP-induced flow reductions could cause temperature increases in early summer (June) in the Tuolumne River downstream near the confluence with the San Joaquin River. Water released from La Grange Dam in June is considerably cooler than the average daily air temperature. As water flows downstream, its temperature increases. Water temperature modeling projected that mean daily temperature increases of 1 or 2 °C could occur infrequently in the Tuolumne River downstream near the confluence with the San Joaquin River (see Section 5.3.3). On very rare occasions, WSIP-induced flow reductions would cause mean daily temperature increases of 10 °C downstream near the San Joaquin River confluence. This occurred in only one month in the modeled simulation of WSIP operations over the 82-year hydrologic record.

Overall, the flow reductions coupled with the projected infrequent water temperature increases that could result under the WSIP would have an adverse impact on habitat conditions for juvenile salmonids. The flow reductions would reduce available habitat in the entire reach of the river used by juvenile salmonids below La Grange Dam. The elevated temperatures, although infrequent, would truncate the length of the river reach suitable for juvenile salmonids. These adverse effects on flows and temperature in the river under the WSIP would not substantially alter or degrade fishery habitat or jeopardize the continuation of the fishery populations in the lower Tuolumne River in most years. However, WSIP effects on flow and temperature would infrequently contribute to potentially significant effects on the fishery resources. The *Habitat Restoration Plan for the Lower Tuolumne River Corridor* (McBain and Trush, 2000) establishes goals for fishery habitat restoration, and the NMFS and others have identified goals for fishery enhancement on the lower river. The WSIP's small but incremental contribution to adverse effects on the lower river would make planned restoration of habitat and fishery resources more difficult. As a result, the impact of the WSIP on these fishery resources in the lower Tuolumne River would be *potentially significant*. Implementation of Measure 5.3.6-4a, Avoidance of Flow Changes By Reducing Demand for Don Pedro Reservoir Water, would reduce this impact to less than significant. This measure involves some uncertainty because its implementation depends on the SFPUC reaching agreement with MID/TID and possibly other water agencies. If this measures proves to be infeasible, the SFPUC will implement Measure 5.3.6-4b, Fishery Habitat Enhancement, to enhance fishery habitat in the lower Tuolumne River. Implementation of Measure 5.3.6-4a or 5.3.6-4b would reduce these adverse impacts to a *less-than-significant* level.

Impact 5.3.6-5: Effects on fishery resources along the San Joaquin River.

The lower San Joaquin River provides habitat for a diverse assemblage of fish, including catfish, largemouth bass, striped bass, shad, and many others. The lower river also serves as the migratory corridor for the upstream passage of adult salmon and steelhead and the downstream passage of juveniles. Although water quality (e.g., electrical conductivity, dissolved oxygen, etc.) and other factors affect habitat for these species within the San Joaquin River, seasonal flow and water temperatures have been identified as important environmental parameters affecting the health and survival of migrating salmonids.

For the San Joaquin River and its tributaries, a relationship has been established between spring flow and the subsequent survival and contribution of adults to the salmon population (USFWS, 1994). A reduction in river flow during the spring rearing and juvenile emigration period would result in an incremental contribution to reduced juvenile survival and a small incremental contribution to the cumulative reduction in juvenile survival and subsequent adult population abundance. Increased water temperatures, particularly during the late spring juvenile salmonid migration period (April–May), would also be expected to adversely affect juvenile salmon survival.

Hydrologic modeling has shown that the WSIP would affect habitat conditions within the lower San Joaquin River as a result of changes in Don Pedro Reservoir storage. This potential adverse effect of WSIP operations on fishery habitat within the lower river would be greatest during the summer months (e.g., June, July, etc.) at the end of a prolonged drought, when the reservoir storage volume would be lowest and water temperatures greatest. Inflow to the lower San Joaquin River from the Tuolumne River would not be less than the minimum stream flow specified in the FERC license for the Don Pedro Project. As a result of this minimum flow requirement, the WSIP would not have a significant impact on flows, particularly during drought conditions.

WSIP operations (as discussed above) would reduce inflow to the reservoir and, as a result, increase the seasonal (summer) temperatures in water released from the reservoir, which would also affect water temperature within the lower San Joaquin River. Under low-flow summer conditions, particularly during a drought, water temperatures increase rapidly with distance downstream of a dam and reach thermal equilibrium with ambient air temperatures. As discussed in Measure 5.3.6-4a, the SFPUC would attempt to enter into a water transfer agreement with MID/TID or other water provider that would reduce the potential for adverse impacts on habitat conditions within the Tuolumne River that would also extend downstream to the San Joaquin River. The effectiveness of increased storage in reducing water temperatures is greatest during the spring, but is reduced during the summer as air temperatures increase. As a result, water temperatures in the lower San Joaquin River could increase during the summer months in years following an extended drought, although these conditions are expected to occur infrequently. Increased water temperatures during the summer of an extended drought would not be expected to result in significant adverse impacts on salmon or steelhead migrating downstream within the San Joaquin River, since the migration would occur earlier in the year and ambient water temperatures within the river might already be elevated to a level that is highly stressful or potentially lethal to juvenile salmonids. To the extent that infrequent reductions in flow and corresponding increases in water temperature occur during the spring (April-June) WSIP operations would contribute to adverse impacts on habitat conditions for downstream migrating Chinook salmon and steelhead. However, this potential impact would occur so infrequently that it does not represent a significant impact to fishery resources. Other fish species inhabiting the river, such as largemouth bass and striped bass, are tolerant of elevated water temperatures and would not likely be affected. As a result, the impacts of WSIP operations on habitat conditions for fish within the lower San Joaquin River would be *less than significant*, and no mitigation would be required.

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5.3.7 Terrestrial Biological Resources

The following setting section describes terrestrial biological resources in the Tuolumne River watershed that could be affected by the WSIP. The impact section (Section 5.3.7-2) provides a description of the changes in terrestrial biological resources that would result from WSIP-induced changes in stream flow and reservoir water levels.

5.3.7.1 Setting

Riparian and wetland habitats form an important element in the ecology of most landscapes, whether in the Sierra Nevada or the Central Valley. This analysis deals only with those species and communities that have an essential requirement for stream or meadow conditions and whose range includes the Tuolumne River. Approximately 17 percent of Sierran plant species, 21 percent of vertebrate species, and, by definition, all aquatic invertebrate species in streams are closely associated with or dependent on riparian or wet areas (Sierra Nevada Ecosystem Project, 1996a). While Tuolumne River water does reach the San Joaquin River and the Delta, at that distance it is subject to so many other inputs and impacts, and at such larger scales, that an assessment of the biological impacts due to the WSIP alone would be speculative. As a result, this discussion focuses on the Tuolumne River from Hetch Hetchy Reservoir downstream to the confluence with the San Joaquin River, and the Tuolumne's two major mountain tributaries, Cherry Creek and Eleanor Creek.

In Chapter 4, the term "key special-status species" is used to indicate those species (principally but not exclusively those listed under the California or Federal Endangered Species Acts) that would be subject to a significant impact at the programmatic level. For all proposed WSIP projects analyzed in Chapter 4, separate, project-level CEQA review would be performed. This chapter (Chapter 5) uses a slightly expanded set of groupings. The term "sensitive habitats" has the same definition throughout this PEIR, although in Chapter 5 the term refers mainly to riparian, wetland, and associated upland habitats that could be affected by WSIP-induced changes in reservoir water levels. Because the analysis in Chapter 5 must sometimes address project-level impacts of the WSIP and no further CEQA review would be performed, two additional categories were developed to ensure that no impact category is left unaddressed: "other species of concern," which is the broader suite of species appearing on the CDFG's Special Animals or Special Plants list (CDFG, 2007) or the California Native Plant Society's (CNPS) Lists 1 or 2 (CNPS, 2001). All other biological resources are included in the widest category, "common habitats and species." This latter category evaluates project-level impacts that are great enough in scale to potentially affect species and habitats of widespread distribution (e.g., annual grasslands).

The sections that follow describe the existing conditions for terrestrial riparian resources associated with the Tuolumne River portion of the Hetch Hetchy system. Section 4.6, Biological Resources, Figure 4.6-1 shows the habitat types found along the Tuolumne River within the WSIP program area. Habitat types are broader groupings than natural communities, but are useful when describing both wildlife and vegetation resources together.

Hetch Hetchy Reservoir, the Tuolumne River, and its Tributaries from O'Shaughnessy Dam to Don Pedro Reservoir

O'Shaughnessy Dam is located in a glacial valley dominated by walls of smooth, mostly unvegetated granite. Essentially no marsh or meadow habitat has formed around the perimeter of Hetch Hetchy Reservoir because of the steep granite slopes and annual fluctuations in reservoir water levels. The vegetation around the reservoir is generally mapped as foothill woodland and lower montane coniferous forest (NPS, 2007).

The Tuolumne River below O'Shaughnessy Dam flows through the transition from a glacially carved, U-shaped valley to a river-incised, V-shaped canyon. The stairstep morphology typical of formerly glaciated streams is evident for several miles below the reservoir; there are long reaches of low relief, sometimes with extensive gravel bars, punctuated by short, steeper sections with boulders and exposed bedrock channel. The Tuolumne River below O'Shaughnessy Dam represents the lowest-elevation evidence of glaciation found anywhere in the western Sierra (NPS, 2006). The stairstep morphology combined with exceptional water quality, a seasonal flood regime, and a largely undisturbed river corridor sustains systems that are remarkable in their size and diversity (NPS, 2006). Upslope from the narrow riparian zone, the Tuolumne River canyon has a largely unvegetated section of bare granite rock scoured during high flows following rain-on-snow precipitation events. The most recent of these events took place in 1982 and January 1997. The Tuolumne River below O'Shaughnessy Dam contains extensive sections of bedrock channel confined in a narrow canyon, with a riparian zone consisting of interrupted bands of white alder (*Alnus rhombifolia*) and dusky willow (*Salix melanopsis*) with very limited understory. The riparian strip is wider and contains more extensive stands along gravel bars found on the larger river bends. Alternating with the low-diversity bedrock channel portions of the river are areas of higher species diversity on alluvial fans and terraces where tributary streams with a natural hydrograph[1] empty into the river (McBain and Trush, 2007).

The Poopenaut Valley, about two miles below the dam, represents a low-elevation limit of glaciation. The substrate in the Poopenaut Valley is primarily decomposed granite with a high proportion of sand and gravel particles. The Poopenaut Valley supports stands of tule bulrush, wet and dry meadow, willow and woodland habitats, hanging ponds, and seasonal pools (NPS, 2006). The National Park Services considers the low-elevation meadow and wetland complex of the Poopenaut Valley to be an "outstandingly remarkable value" of the Tuolumne Wild and Scenic River (NPS, 2006). The presence of hanging ponds suggests that less-pervious, possibly fine-textured layers may be present in the valley alluvium.

Lake Lloyd is situated in a steep-sided valley and has little meadow development around its perimeter. Lake Eleanor is similarly situated, but contains some gradual slopes around the periphery that support seasonal wetland vegetation. These reservoirs are also bordered by foothill woodland and lower montane coniferous forest. Lake Lloyd and Lake Eleanor are similar in that their annual fluctuations expose a broad, essentially unvegetated strip below the maximum reservoir elevation.

[1] The pattern of flow in a stream over time.

Cherry Creek is a steep, rapidly flowing tributary to the Tuolumne River. Cherry Creek has experienced riparian encroachment because of diversions at Lake Lloyd. Montane black cottonwood (*Populus trichocarpa*) forest with frequent Jeffrey pines (*Pinus jeffreyi*) now occupies most of the former stream channel. Eleanor Creek is a major tributary of Cherry Creek. It supports a narrow band of riparian habitat typical of mid- to high-elevation streams, with minimal riparian vegetation encroachment into the channel (McBain and Trush, 2007).

The Tuolumne River above Don Pedro Reservoir supports a diverse assemblage of Great Valley mixed riparian forest and scrub with species similar to those found in the riparian systems of the valley floor, although the habitat in this area is confined to rather narrow canyons.

Don Pedro Reservoir and Tuolumne River below La Grange Dam

Don Pedro Reservoir is situated in the lower Sierra Nevada foothills at an elevation of 900 to 1,000 feet. The surrounding area consists of foothill woodland typically dominated by gray pine (*Pinus sabiniana*) and blue oak (*Quercus douglasii*) with a grass understory. Due to the sloping terrain and large seasonal drawdown, very little wetland habitat is present on the margins of this reservoir.

This discussion of the current setting for the lower Tuolumne River draws heavily from the *Habitat Restoration Plan for the Lower Tuolumne River Corridor* (McBain and Trush, 2000). The restoration plan was developed after the 1995 FERC Settlement Agreement (FSA) to help the parties select and design restoration projects (see Chapter 2 for a description of the original FERC license for the New Don Pedro Project and the subsequent settlement agreement related to instream flows in the lower river).

The lower Tuolumne River extends for 52 river miles, from La Grange Dam to the confluence with the San Joaquin River. Its floodplain terraces extend up to several miles in width. Backwater channels and old oxbows are evidence of channel-forming processes that characterized historical, unimpaired flows. Prior to flow and sediment regulation, the stream flows of the Tuolumne River downstream of La Grange Dam within a given year and between years varied from 100 cfs in summer months to peak winter floods exceeding 100,000 cfs; these flows created variable and complex local channel morphologies and regularly occupied the full width of the floodplain.

Today, about 67 percent of the lower Tuolumne River water is diverted. Low flows are maintained at regulated levels, but the high flows have been greatly diminished and are dictated by flood control requirements. The lower Tuolumne River has experienced substantial encroachment from agriculture, grazing, and gravel mining

The previous alteration of physical and ecological characteristics of the lower Tuolumne River has changed the ability of the floodplain to support and sustain riparian habitat and ecological processes. The lower Tuolumne River is currently unable to mobilize its bed particles as a result of reduced flow magnitudes, among other factors. In most alluvial rivers with unimpaired flow regimes, floods with recurrence intervals of 1.5 to 2.5 years typically inundate floodplains. In the lower Tuolumne, the 1.5-year recurrence flood at the La Grange gaging station (RM 51.6)

decreased from 8,600 cfs to 3,000 cfs following construction of Don Pedro Reservoir, with a consequent reduction in the frequency and amplitude of bed mobilization. McBain and Trush (2000) noted that the reduction in flows has prevented the formation of any distinct post-FSA floodplains.

Historically, willow scrub occupied the actively accumulating gravel beds and sandbars of river meanders. Broad riparian forests dominated by Fremont cottonwood (*Populus fremontii*) occupied the lower floodplain terraces. Backwater channels and oxbows (river meanders cut off from the main channel) supported a variety of seasonal and perennial wetlands dominated by shrubs, grasses, grasslike plants, and forbs. Valley oak (*Quercus lobata*) woodlands occupied the upper floodplain terraces (Conard et al., 1977).

The total historical acreage of riparian vegetation in the Tuolumne River corridor between La Grange Dam and the San Joaquin River has diminished from approximately 13,000 or more acres to less than 2,200 acres. Fremont cottonwood is commonly observed within the lower Tuolumne River corridor, but nearly all stands and individuals are old and dying, with little or no natural regeneration. Valley oaks are also found throughout the Tuolumne River corridor. Because valley oaks are not as dependent on fluvial processes for regeneration, their regeneration in the river corridor is more successful. McBain and Trush observed that where the floodplain has not experienced land use encroachment, relict riparian vegetation fragments of a much larger ecosystem are detectable.

McBain and Trush attributed the change of dominant tree species at the channel margins to the decrease in channel slope and transition from gravel-bedded to sand-bedded substrate. They concluded that, on the lower Tuolumne River, riparian regeneration (particularly Goodding's black willow (*Salix gooddingii*) and Fremont cottonwood) depends on a migrating channel that creates floodplain surfaces, flood inundation every 1.5 to 5 years, and gently receding flows following the spring snowmelt. The elimination of post-FSA floods exceeding 10,000 cfs has allowed narrow-leaf willow (*Salix exigua*), box elder (*Acer negundo* var. *californicum*), and white alder to establish and caused drier conditions on the former floodplains. As a result, the Fremont cottonwood and valley oak are beginning to die of old age.

Natural Communities, including Sensitive Natural Communities

Considering its length and elevational range, the Tuolumne River in the WSIP program area supports relatively few riparian natural communities. The California Natural Diversity Database (CNDDB) (CDFG, 2006a) lists all but the montane meadow community as sensitive. However, as indicated above, the National Park Service considers the low-elevation montane meadow in the Poopenaut Valley to be an outstandingly remarkable value of the Tuolumne Wild and Scenic River area (NPS, 2006). The natural communities along the Tuolumne River are briefly described below.

- **White alder riparian forest** is a streamside deciduous riparian forest strongly dominated by white alder with a shrubby, deciduous understory. A common associated tree species in the upper Tuolumne area is dusky willow. This natural community is associated with rapidly flowing, well-aerated perennial streams with coarse streambed sediments. White

alder riparian forest is found extensively along most of the Tuolumne River below O'Shaughnessy Dam.

- **Montane meadow** is a dense herbaceous natural community dominated by sedges (*Carex* spp.) along with rushes (*Juncus* spp.), perennial grasses, and herbs. It is found on fine-textured, more or less permanently moist or wet soils. Unlike most natural communities identified by Holland (1986), montane meadow actually consists of many vegetation series dominated by a number of grass-like species associated with a wide range of elevations, soils, and hydrologic conditions. The Poopenaut Valley is considered to be an exceptional example of a low-elevation montane meadow.

- **Montane black cottonwood riparian forest** is a dense riparian forest dominated by black cottonwood with emergent Jeffrey pine. Shrub cover is fairly high, and herb cover is typically very high. Montane black cottonwood forest is found on high-flow streams below about 7,000 feet in the mid-Sierra Nevada. Small remnants of this natural community are found in the Poopenaut Valley. It is also found along Cherry Creek, where water diversions have resulted in substantial encroachment by Jeffrey pine.

- **Great Valley mixed riparian forest** is a tall, winter-deciduous, broadleaved riparian forest. Natural examples of this community include box elder, California black walnut (*Juglans hindsii* var. *californica*), California sycamore (*Platanus racemosa*), and several willow species (*Salix* spp.). The understory is a dense tangle of shade-tolerant shrubs, and California grape (*Vitis californica*) is also found in well-developed forests. Great Valley mixed riparian forest is found all along the lower Tuolumne River as well as the lower elevations of the river above Don Pedro Reservoir.

- **Great Valley cottonwood riparian forest** is similar to the preceding natural community. It is strongly dominated by Fremont cottonwood with some Goodding willow. This community is typically found on the largest streams in the Central Valley that provide ample subsurface irrigation even when the channel is dry. Great Valley cottonwood riparian forest is typically inundated yearly during spring, and cottonwood regeneration is dependent on freshly deposited, fine-textured alluvium and on the gradual ebbing of spring flows as the tiny cottonwood seedlings develop their root systems. Remnants of this community are still found along the lower Tuolumne River, although natural recruitment (i.e., growth of new vegetation) has essentially ceased.

- **Great Valley valley oak riparian forest** is a medium to tall, broadleaved, winter-deciduous, closed-canopy riparian forest dominated by valley oak. This community is found on the higher river terraces that receive periodic flooding and annual inputs of sediment. This community has become rare primarily through encroachment by agriculture, mining, and other human uses, although the cessation of flooding and sediment deposition has limited natural reproduction of the dominant species.

Key Special-Status Species and Other Species of Concern

Tables 5.3.7-1 and **5.3.7-2** present key special-status plant and animal species and other species of concern along the Tuolumne River that could be affected by the WSIP. Although the watershed as a whole supports a larger assemblage of species, the key special-status species and other species of concern considered here are limited to those that depend on riparian and river-associated habitats. Riparian, wet meadow, seep, or marsh plants were included if they appeared on CNDDB records for the 21 U.S. Geological Survey 7.5-minute quadrangles that encompass

TABLE 5.3.7-1
POTENTIAL FOR OCCURRENCE OF KEY SPECIAL-STATUS PLANTS AND PLANT SPECIES OF CONCERN IN THE WSIP TUOLUMNE WATERSHED PROGRAM AREA[a]

Common Name *Scientific Name*	CNPS Status[b]	Habitat	WSIP Program Area	
			Upper Tuolumne River	Lower Tuolumne River
Shore sedge *Carex limosa*	List 2	Bogs, fens, marshes, swamps, seeps, upper and lower montane coniferous forest	Potential	
Mariposa clarkia *Clarkia biloba ssp. australis*	List 1B	Chaparral and cismontane woodland, riparian ecotone	Potential	
Delta button-celery *Eryngium racemosum*	List 1B	Riparian scrub		Potential
Knotted rush *Juncus nodosus*	List 2	Meadows and seeps, marshes and swamps; lake margins and mesic sites	Potential	
Pansy monkeyflower *Mimulus pulchellus*	List 1B	Open sandy benches, wet meadows	Known, Poopenaut Valley	
Slender-stemmed monkeyflower *Mimulus filicaulis*	List 1B	Moist meadows, seeps in lower montane coniferous forest	Potential	
White beaked-rush *Rhynchospora alba*	List 2	Bogs, fens, marshes, swamps	Potential	
Brownish beaked rush *Rhynchospora capitellata*	List 2	Meadows, seeps, marsh, swamps, upper and lower montane coniferous forest	Potential	

[a] In this document, CNPS-listed species with no federal or state listing status are considered plant species of concern; no key special-status plants are known to occur in the Tuolumne project area.

[b] California Native Plant Society species codes are as follows:
List 1B: Rare and endangered.
List 2: Rare but not endangered.

SOURCES: CDFG, 2006b; CNPS, 2001.

the Tuolumne River from O'Shaughnessy Dam to the confluence with the San Joaquin River, Lake Lloyd, Cherry Creek, Lake Eleanor, and Eleanor Creek (CDFG, 2006b). The list of animals was compiled from the 2005 California Gap Analysis Project[2] species dependent on valley foothill riparian, montane riparian, and fresh emergent wetland habitat types. The list was then compared with CNDDB records for the 21 quadrangles encompassing the WSIP program area, and additional locality data were obtained by reviewing 2007 species occurrence records from the University of California Museum of Vertebrate Zoology. Figure 4.6-2 in Chapter 4 show the distribution of federally designated critical habitats for species listed under the Federal Endangered Species Act within the WSIP program area.

[2] The Gap Analysis Project provides regional assessments of the conservation status of native vertebrate species and natural land cover types and facilitates the application of this information to land management activities. The Gap Analysis Project is conducted as state-level projects and is coordinated by the U.S. Geological Survey Biological Resources Division.

TABLE 5.3.7-2
POTENTIAL FOR OCCURRENCE OF KEY SPECIAL-STATUS ANIMALS AND ANIMAL SPECIES OF CONCERN IN THE WSIP TUOLUMNE WATERSHED PROGRAM AREA

Common Name *Scientific Name*	USFWS/ CDFG Status[a]	Habitat	WSIP Program Area: Tuolumne River watershed from O'Shaughnessy Dam to Don Pedro Reservoir	WSIP Program Area: Tuolumne River from Don Pedro Reservoir to San Joaquin River
Reptiles and Amphibians				
California tiger salamander *Ambystoma californiense*	FT/CSC*	Seasonal freshwater ponds with little or no emergent vegetation		Potential
Western spadefoot *Spea hammondii*	–/CSC	Seasonal ponds such as vernal pools surrounded by grassland		Potential
California red-legged frog *Rana aurora draytonii*	FT/CSC*	Slow-moving streams and ponds	Potential	Potential
Foothill yellow-legged frog *Rana boylii*	–/CSC*	Shallow, moving water with sunny banks	Potential	
Mountain yellow-legged frog *Rana muscosa*	–/CSC	Fast-moving mountain streams	Potential	
Western pond turtle *Clemmys marmorata*	–/CSC	Permanent water such as streams or ponds	Present	Present
Birds				
Double-crested cormorant *Phalacrocorax auritus* (rookery site)	–/CSC	Colonial nester on coastal cliffs and along lake margins; forages in open water		Potential
White-faced ibis *Plegadis chihi* (rookery site)	–/CSC	Forages in shallow water; winters in Central Valley		Potential
Cooper's hawk *Accipiter cooperi*	–/CSC	Nests in deciduous riparian vegetation and oaks	Potential	Potential
Northern goshawk *Accipiter gentilis*	–/CSC	Nests and forages in dense conifer and mixed forest	Potential	
Sharp-shinned hawk *Accipiter striatus*	–/CSC	Nests in deciduous riparian vegetation and oaks	Potential	Potential
Golden eagle *Aquila chrysaetos*	FP/CSC	Nests on cliffs and in large trees; forages from the air on large prey	Potential	
Ferruginous hawk *Buteo regalis* (wintering)	–/CSC	Roosts in large trees and forages over open ground; winters in Central Valley		Potential
Swainson's hawk *Buteo swainsoni* (nesting)	–/CT*	Nests in large trees; forages over open ground		Present
Great gray owl *Strix nebulosa*	–/CSC	Nests in dense forest; forages in meadows and openings	Potential	
Northern harrier *Circus cyaneus*	–/CSC	Nests and forages in wet meadows		Potential
White-tailed kite *Elanus leucurus* (nesting)	FP/CSC	Nests in large trees; forages for small animals over open country		Potential
Bald eagle *Haliaeetus leucocephalus* (nesting and wintering)	FPD/CE*	Nests on cliffs or in large trees, usually near rivers and lakes; forages on fish when available, also carrion and small mammals	Present	Potential
Osprey *Pandion haliaetus* (nesting)	–/CSC	Nests atop large trees or snags near water; diet almost entirely fish	Potential	Potential

TABLE 5.3.7-2 (Continued)
POTENTIAL FOR OCCURRENCE OF KEY SPECIAL-STATUS ANIMALS AND ANIMAL SPECIES OF CONCERN IN THE WSIP TUOLUMNE WATERSHED PROGRAM AREA

Common Name *Scientific Name*	USFWS/ CDFG Status[a]	Habitat	WSIP Program Area: Tuolumne River watershed from O'Shaughnessy Dam to Don Pedro Reservoir	WSIP Program Area: Tuolumne River from Don Pedro Reservoir to San Joaquin River
Birds (cont.)				
Merlin *Falco columbarius*	–/CSC	Winter visitor in foothills, valleys		Potential
Prairie falcon *Falco mexicanus* (nesting)	–/CSC	Usually nests on cliffs; forages in open country for small birds and mammals		Potential
American peregrine falcon *Falco peregrinus anatum*	FD/CE*	Nests in cliffs and outcrops; forages near wetlands and other water	Potential	Potential
California black rail *Laterallus jamaicensis coturniculus*	FP/CT*	Mainly nests in saltmarsh but may also occur in freshwater and brackish marshes at low elevations		Potential
Greater sandhill crane *Grus canadensis tabida* (nesting and wintering)	FP/CT*	Winters in Central Valley; roosts in shallow water; forages in fields and marshes		Potential
Long-billed curlew *Numenius americanus* (nesting)	–/CSC	Winters in Central Valley, foraging in grasslands and marshes		Potential
Short-eared owl *Asio flammeus* (nesting)	–/CSC	Nests and forages in open or marshy ground	Potential	Potential
Long-eared owl *Asio otus* (nesting)	–/CSC	Roosts and nests in dense trees; forages in open country for small vertebrates		Potential
Burrowing owl *Athene cunicularia*	--/CSC*	Grasslands and open areas; nests in burrows created by digging mammals, sometimes on streambanks		Potential
California spotted owl *Strix occidentalis occidentalis*	–/CSC	Nests in dense forest; forages at night for small mammals	Potential	
Vaux's swift *Chaetura vauxi*	–/CSC	Nests in hollow trees; forages over open water, woodlands	Potential	Potential
Black swift *Cypseloides niger* (nesting)	–/CSC	Nests on sheltered cliffs, often near streams; feeds on flying insects	Present	Potential
Willow flycatcher Empidonax trailii (nesting)	–/CE*	Nests in deciduous shrubs or trees, often willows; forages on insects	Potential	
Loggerhead shrike *Lanius ludovicianus* (nesting)	–/CSC	Open country for hunting; nests in riparian woodland and open woodlands		Potential
Purple martin *Progne subis*	–/CSC	Nests in tree cavities, forages on flying insects	Potential	
Bank swallow *Riparia riparia*	–/CT*	Colonial nester in riparian cliffs; forages on flying insects		Low Potential
Yellow warbler *Dendroica petechia brewsteri*	–/CSC	Nests in low trees and shrubs in riparian zone; forages on various insects	Potential	Potential
Yellow-breasted chat *Icteria virens* (nesting)	–/CSC	Nests low in very dense riparian scrub; forages on insects and fruit	Potential	Potential
Tricolored blackbird *Agelaius tricolor* (nesting)	–/CSC	Colonial nester in emergent vegetation; forages over open water		Potential

TABLE 5.3.7-2 (Continued)
POTENTIAL FOR OCCURRENCE OF KEY SPECIAL-STATUS ANIMALS AND ANIMAL SPECIES OF CONCERN IN THE WSIP TUOLUMNE WATERSHED PROGRAM AREA

Common Name *Scientific Name*	USFWS/ CDFG Status[a]	Habitat	WSIP Program Area: Tuolumne River watershed from O'Shaughnessy Dam to Don Pedro Reservoir	WSIP Program Area: Tuolumne River from Don Pedro Reservoir to San Joaquin River
Mammals				
Pallid bat *Antrozous pallidus*	–/CSC	Roosts in trees; forages over grassland	Potential	Potential
Pacific western big-eared bat *Corynorhinus (=Plecotus) townsendii*	–/CSC	Roosts in caves and buildings; forages in open country	Potential	Potential
Spotted bat *Euderma maculatum*	–/CSC	Requires rocky cliffs for breeding and roosting, forages primarily on moths	Potential	
Small-footed myotis *Myotis ciliolabrum*	–/CSC	Roosts in caves and trees; forages in open country		Potential
Long-eared myotis *Myotus evotis*	–/CSC	Roosts in hollow trees and buildings; forages at streams and ponds	Potential	Potential
Fringed myotis *Myotis thysanodes*	–/CSC	Roosts in hollow trees and buildings; forages at forest edge	Potential	Potential
Long-legged myotis *Myotis volans*	–/CSC	Roosts in caves, old buildings, and under bark	Potential	Potential
Yuma myotis *Myotis yumanensis*	–/CSC	Roosts in riparian vegetation; forages over open water	Potential	Potential
Western mastiff bat *Eumops perotis*	–/CSC	Roosts on cliff faces and cracks in boulders; forages on moths, crickets, and beetles	Potential	
Sierra Nevada snowshoe hare *Lepus americanus tahoensis*	–/CSC	Inhabits creekside willow thickets	Low potential	
Sierra Nevada mountain beaver *Aplodontia rufa californica*	–/CSC	Inhabits creekside thickets; forages on forbs, twigs, and fruits	Low potential	
Sierra Nevada red fox *Vulpes vulpes necator*	–/CT*	High-elevation forest and scrub dweller; forages for rodents, birds, berries, and insects	Low potential	
Pacific fisher *Martes pennanti* (*pacifica*)	FC/CSC	Inhabits mid-elevation forests; forages mostly on small mammals	Potential	
American marten *Martes americanus*	–/CSC	Inhabits dense forests; forages on small mammals	Potential	
American badger *Taxidea taxus*	–/CSC	Lives in open country; forages on burrowing animals, roots, and berries	Potential	Potential

[a] Federal (USFWS) and state (CDFG) protection status codes are as follows:
FC: Federal candidate for listing
FE: Federal endangered
FT: Federal threatened
FD: Federal delisted
FPD: Federal proposed for delisting
CE: California endangered
CT: California threatened
CSC: California species of special concern
CP: California fully protected

* Indicates key special-status species, defined here to mean federal- or state-listed as endangered or threatened. All other species listed here are defined as species of concern.

SOURCES: CDFG, 2006a, 2006b.

Plants

High-elevation plants. No key special-status plants are known to occur in habitats associated with the Tuolumne River or its tributaries in the WSIP program area. Several plant species of concern occur in montane meadows and seeps, including the pansy monkeyflower (*Mimulus pulchellus,* a CNPS List 1B plant). This species grows at the margins of wet meadows and open sandy benches. Several populations of pansy monkeyflower have been reported in the Poopenaut Valley at the edges of the meadow vegetation (CDFG, 2006a). Several other species are known to be present in wet meadows, bogs, seeps, and moist meadows. They have not been reported from this portion of the Tuolumne River watershed, but suitable habitat could be present at the Poopenaut Valley. They include slender-stemmed monkeyflower (*Mimulus filicaulis,* CNPS List 1B), shore sedge (*Carex limosa,* CNPS List 2), knotted rush (*Juncus nodosus,* CNPS List 2), white beaked-rush (*Rhynchospora alba,* CNPS List 2), and brownish beaked rush (*Rhynchospora capitellata,* CNPS List 2) (CDFG, 2006a).

Mariposa clarkia (*Clarkia biloba ssp. australis,* CNPS List 1B) grows in chaparral and cismontane woodland, sometimes on the edge of riparian habitats, in the lower Sierra Nevada at elevations below 3,000 feet.

Don Pedro Reservoir and La Grange Dam to the San Joaquin River. Delta button-celery (*Eryngium racemosum,* CNPS List 1B) grows in riparian scrub in the lower elevations of the Central Valley. Suitable habitat is present in the lowest portions of the Tuolumne River near the confluence with the San Joaquin River, although the nearest known records are from the floodplains of the San Joaquin River several miles to the north and south of the confluence with the Tuolumne River.

Reptiles and Amphibians

Hetch Hetchy Reservoir to Don Pedro Reservoir. California red-legged frog (*Rana aurora draytonii,* federal threatened, California species of special concern) is known to occur in lowlands and foothills in or near permanent sources of water with dense, shrubby, or emergent vegetation. This species has been reported from Woods Creek, a tributary to Don Pedro Reservoir in Tuolumne County, and it may once have ranged into the vicinity of the Tuolumne River (CDFG, 2006b). Foothill yellow-legged frog (*Rana boylii,* California species of special concern) is found in small permanent streams above about 660 feet in the mid-Sierra (Jennings and Hayes, 1994). Suitable habitat could be present along the Tuolumne River and its tributaries. Western pond turtle (*Clemmys marmorata,* California species of special concern) is a thoroughly aquatic turtle that inhabits permanent ponds, rivers, and even ditches. The CNDDB (CDFG, 2006b) has a record of this species at O'Shaughnessy Dam.

Mountain yellow-legged frog (*Rana muscosa,* California species of special concern) is associated with sunny, high-elevation streams that often have vegetation and sloping banks. There are no CNDDB records from the Tuolumne River watershed below O'Shaughnessy Dam. Habitat in the Poopenaut Valley and along Cherry Creek and Eleanor Creek could be suitable for this species. Although these areas are lower than the currently documented known elevation limit for this

species, museum records indicate that this species historically had a lower elevational range (Jennings and Hayes, 1994). The nearest known localities for mountain yellow-legged frog are Crane Flat, Tamarack Flat, and Lake Vernon in Yosemite National Park (Museum of Vertebrate Zoology, 2007).

Don Pedro Reservoir and La Grange Dam to the San Joaquin River. California tiger salamander (*Ambystoma californiense*, federal threatened, California species of special concern) inhabits long-standing or permanent ponds and uplands that contain burrows during the dry season. It is limited to the valley floor and nearby terraces, and a number of historical records document its presence on the valley floor and floodplain of the Tuolumne River in eastern Stanislaus County. California red-legged frog could occur in suitable habitat throughout this portion of the WSIP program area, although it is more likely to be present on the terraces and foothills rather than the valley floor. Western pond turtle could occur anywhere along the Tuolumne River and at Don Pedro Reservoir; there are several recent records from several locations in the WSIP program area. Western spadefoot toad (*Spea hammondii*, California species of special concern) is typically found in association with vernal pools, but may have occurred in seasonal wetlands on floodplains as well. It is known primarily from the valley floor within the program area.

Birds

Entire Tuolumne River WSIP program area. Cooper's hawk (*Accipiter cooperi*, California species of special concern) inhabits open woodland and riparian forest, where it preys on songbirds and small mammals. Sharp-shinned hawk (*Accipiter striatus*, California species of special concern) is found in more dense forest than is Cooper's hawk, where it feeds primarily on small birds. Golden eagle (*Aquila chrysaetos*, California species of special concern) nests on cliffs and in large trees. It is likely to forage over large areas of the program area, except for the valley floor. Bald eagle (*Haliaeetus leucocephalus*, federal delisted, California endangered) nests on cliffs and in large trees, and forages on and near lakes. Suitable habitat is present at Don Pedro Reservoir, and one pair recently nested at Lake Lloyd.

Northern harrier (*Circus cyaneus*, California species of special concern) nests and forages in wet meadows over a wide elevational range that apparently includes all of the program area. Short-eared owl (*Asio flammeus*, California species of special concern) nests and forages in open or marshy ground. It apparently is resident in the higher Sierra Nevada and winters at low elevations in the Central Valley. Long-eared owl (*Asio otus*, California species of special concern) nests in dense trees and forages in open country. Its distributional range includes all of California. Yellow warbler (*Dendroica petechia brewsteri*, California species of special concern) nests in dense riparian vegetation and is found in suitable habitat throughout California. Prairie falcon (*Falco mexicanus*, California species of special concern) usually nests on cliffs and forages in open country, but could also nest in tall riparian trees. American peregrine falcon (*Falco peregrinus anatum*, federal delisted, California endangered) nests on cliffs and outcrops and forages in open country, often near meadows or marshes where small birds are abundant. There are no CNDDB records of species occurrence in the program area, but suitable habitat may be present.

Hetch Hetchy Reservoir to Don Pedro Reservoir. Northern goshawk (*Accipiter gentilis*, California species of special concern) is found in dense forest, where it forages on flying squirrels, birds, ducks, and even hares. Its elevational range may be higher than the WSIP program area, as there are no CNDDB records of species occurrence in the program area. California spotted owl (*Strix occidentalis occidentalis*, California species of special concern) inhabits thickly wooded forests, including riparian forests where it forages on small mammals such as squirrels. Great gray owl (*Strix nebulosa*, California endangered) nests in dense forest and forages in forest openings or meadows. There are several recent records indicating its occurrence in Yosemite National Park down to Pine Mountain Lake. Suitable habitat may be present within the program area. Vaux's swift (C*haetura vauxi*, California species of special concern) nests in hollow trees and forages near water. Although there are no CNDDB records of species occurrence near the program area, habitat appears suitable along much of the mountainous portion of the Tuolumne River. Black swift (*Cypseloides niger*, California species of special concern) nests on cliffs near water and forages for insects. It is reported to occur along the Tuolumne River between Tuolumne Meadows and Hetch Hetchy Reservoir (NPS, 2006). Willow flycatcher (*Empidonax trailii*, California endangered) nests and forages in dense riparian thickets and meadows in mountainous areas. Purple martin (*Progne subis*, California species of special concern) is found in mountain forests, especially near water. Suitable habitat is present in this portion of the Tuolumne River.

Don Pedro Reservoir and from La Grange Dam to the San Joaquin River. Double-crested cormorant (*Phalacrocorax auritus*, California species of special concern) nests in rookeries on cliffs and along lake margins, and forages for fish. Its wintering range includes the Central Valley. White-faced ibis (*Plegadis chihi*, California species of special concern) and greater sandhill crane (*Grus canadensis tabida*, California threatened) winters in the Central Valley, foraging in shallow water along the floodplains of the major rivers. White-tailed kite (*Elanus leucurus*, California species of special concern) nests in trees and forages over open country. It is found mainly in the lower elevations of the program area. California black rail (*Laterallus jamaicensis coturniculus*, California threatened) is a marsh-dwelling species known primarily to occur in salt marsh, but is occasionally found inland in low-elevation marshes. Long-billed curlew (*Numenius americanus*, California species of special concern) winters in the Central Valley and forages in grassland and marshes, including floodplains. Burrowing owl (*Athene cunicularia*, California species of concern) nests in burrows that are created by digging mammals. Sometimes these burrows are located on streambanks, edges of canals, or other areas near riparian habitats. Burrowing owls are found in low-elevation areas such as the Central Valley.

Yellow-breasted chat (*Icteria virens*, California species of special concern) nests low in dense riparian vegetation, breeding in low elevations in California. Tricolored blackbird (*Agelaius tricolor*, California species of special concern) nests and forages near marshes with emergent vegetation. It is found on the valley floor, and the CNDDB has several records of breeding colonies in or near the program area. Ferruginous hawk (*Buteo regalis*, California species of special concern) winters in the Central Valley. Swainson's hawk (*Buteo swainsoni*, California threatened) nests in tall trees and forages in grassland and farmland, primarily in the Central Valley. Some known locations for this species are along the Tuolumne River. Osprey (*Pandion*

haliaetus, California species of special concern) nests in flat-topped trees and snags near water and feeds on fish (primarily in lakes). There are no known records of this species along the Tuolumne River, although it may have once occurred there. Merlin (*Falco columbarius*, California species of special concern) is a winter visitor to the Central Valley.

Loggerhead shrike (*Lanius ludovicianus*, California species of special concern) nests in riparian woodland and forages over open grasslands, meadows, and marshes. It is resident in the Central Valley and would be expected to occur near the Tuolumne River. Bank swallow (*Riparia riparia*, California threatened) nests in banks along large rivers and forages over open water. Although this species may have once been present along the Tuolumne River, there are no current records for this species within the program area.

Mammals

Entire Tuolumne River WSIP program area. American badger (*Taxidea taxus*, California species of special concern) may be found in riparian habitats and open country throughout the program area. Several species of bats (all California species of special concern) could occur within the program area, generally roosting in riparian trees. Pallid bat (*Antrozous pallidus*) and Pacific western big-eared bat (*Corynorhinus* (=*Plecotus*) *townsendii*) roost in trees and forage over open grasslands.

Hetch Hetchy Reservoir to Don Pedro Reservoir. Sierra Nevada snowshoe hare (*Lepus americanus tahoensis*, California species of special concern), Sierra Nevada mountain beaver (*Aplodontia rufa californica*, California species of special concern), and Sierra Nevada red fox (*Vulpes vulpes necator*, California species of special concern) inhabit riparian and forest habitats higher in elevation than the program area. American marten (*Martes americanus*, California species of special concern) and Pacific fisher (*Martes pennanti pacifica*, California species of special concern) live and forage in dense forest at mid- to high elevations in the Sierra Nevada.

Spotted bat (*Euderma maculatum*, California species of special concern) and western mastiff bat (*Eumops perotis*, California species of special concern) primarily nest on cliffs and forage in openings, sometimes near water. These species are reported to occur near the Tuolumne River between Tuolumne Meadows and Hetch Hetchy Reservoir (NPS, 2006) and may also be present along the Tuolumne River below O'Shaughnessy Dam.

Don Pedro Reservoir and from La Grange Dam to the San Joaquin River. All of the bat species except spotted bat and western mastiff bat could occur in this portion of the Tuolumne River. In addition, American badger is likely to occur throughout this portion of the Tuolumne River.

5.3.7.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to terrestrial biological resources, but generally considers that implementation of the proposed program would have a significant biological impact if it were to:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFG or USFWS

- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the CDFG or USFWS

- Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including but not limited to marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means

- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites

- Have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, or substantially reduce the number or restrict the range of an endangered, rare or threatened species

- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance

- Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan, including the *Tuolumne Wild and Scenic River Management Plan* (USFS, 1986)

Approach to Analysis

The assessment of WSIP impacts on terrestrial biological resources is based primarily on the extent to which altered water system operations would change the existing habitat near reservoirs and creeks. This section reviews changes in hydrology (discussed in Section 5.3.1) and analyzes the related effects on riparian and wetland habitats, key special-status species, other species of concern, and common habitats and species. The discussion of riparian and wetland habitats addresses the second and third significance criteria listed above. “Key special-status species” include species that are formally listed as endangered or threatened under the California or Federal Endangered Species Acts, as well as a few other species (such as foothill yellow-legged frog and burrowing owl) that are afforded some degree of legal protection and have a high risk of local population decline or extirpation. The key special-status species discussion addresses the first significance criterion. “Other species of concern” and “common habitats and species” are

more general categories relevant to the fourth and fifth significance criteria. Consistency with biological resources planning for the Tuolumne Wild and Scenic River (the last criterion) is discussed below under Impact 5.3.7-7.

River Hydrology and Riparian Ecology

At any point in a watershed, riparian ecological resources react primarily to two factors in the stream channel: geomorphic and hydrologic processes. Individual riparian species are adapted to a range of physical conditions along gradients of water table depth, soil moisture, and frequency and type of disturbance (Kondolf et al., 1996). Most riparian species depend on open sites created by flood flows for the recruitment of new individuals, and on minimum flows and the gradual return to base flows to provide subsurface soil moisture. Local climate, hydrology, geology, and geomorphology play an important role in determining the abundance, distribution, composition, and overall condition of the riparian habitat along a watercourse. The interrelationships between physical channel processes and riparian vegetation vary along the length of a stream and from river to river (Kondolf et al., 1996; McBain and Trush, 2007).

The effects of diversions on riparian ecology are complex. Reductions in stream flow generally lower species diversity and facilitate riparian encroachment into the active channel (Sierra Nevada Ecosystem Project, 1996b). Diversions and releases vary by site conditions and from year to year. Conditions may improve for one plant species and not another, and may vary from site to site along a reach of stream. Changes in riparian vegetation, in turn, affect the availability of food, cover, and structure for animal species that depend on the habitat. Moreover, causative factors tend to blur together with time: habitat structure and diversity represent an integration of influences spanning many decades. The adjustment to a substantially different flow regime requires many years, since some changes can affect the recruitment of long-lived plant species.

An assessment of impacts is complicated in an already stressed system, because some species may be at a critical stage in which further stress could cause the decline, reproductive failure, or local extirpation of mature individuals, even though they may appear robust and superficially able to adapt to change. Taking this into account, the analysis presented in this section is conservative, using reasonable worse case assumptions about the potential WSIP impacts to terrestrial biological resources that could result from program changes on reservoirs and streams.

Peak Flows

One of the most important influences on riparian structure and function is the magnitude and frequency of flood flows (also referred to as peak flows). Peak flows direct channel processes such as meandering, the formation of gravel bars, and sediment transport (Busch and Scott, 1995). Peak flows also play an important role in determining the period of saturation in the root zone during high water, which can result in a stratification of plant species along a fine topographic/soil moisture gradient up to the floodplain. Peak flows move and remove vegetation, creating open sites for the establishment of seedlings; some woody species that are uprooted or felled can later re-sprout. First, erosion of stream banks during floods carries away the vegetation. The removal or death of some plants during peak flows then creates opportunities for other plants to grow, ensuring regeneration and contributing to a structurally diverse canopy: sediment

deposition can bury and damage some plants that may be able to re-sprout above the new surface, and can provide fresh substrate for other plants to thrive where competition had been reduced (Kattelmann and Embury, 1996).

Major flood events that recur only every few decades can have lasting effects on the channel form. In river systems such as the Tuolumne, very high periodic peak flows scour the channel and canyon walls for a considerable height. Many riparian species depend on such periodic disturbance for recruitment (Friedman and Lee, 2002). In meadow systems, peak flows serve a similar function, depositing sediment, facilitating channel migration, removing decadent vegetation, and creating open sites.

Diversions that reduce peak flows tend to reduce sediment transport and habitat complexity. Meandering and channel-forming processes are constrained. Without the scouring effects of high flows, riparian vegetation can encroach onto formerly active depositional surfaces (McBain and Trush, 2007). A reduction in open sand and gravel bars reduces the habitat for animal species such as foothill yellow-legged frog. Diminished cobble surface reduces the areas suitable for macroinvertebrate production, thus reducing the food supply for amphibians, bats, and many species of birds (McBain and Trush, 2007). In meadow systems, reduced peak flows reduce sediment deposition and limit the formation of openings and the removal of older vegetation.

Sustained High Flows

While peak flows are the most dramatic channel-forming events, sustained high spring flows mobilize sediment, and, as the flows recede, fresh sediment deposits are exposed. These regularly recurring high-flow events are the 1.5- to 2.5-year flows that define ordinary high water and facilitate sediment transport. Low flows and depth to groundwater determine the distribution of riparian vegetation according to ecological requirements. Channel width, meander wavelength, and rate of channel migration are all highly sensitive to discharge. Thus, a reduction in flows constrains the dynamic formation and movement of backchannel ponds, fresh sediment deposits, and other physical variation.

Meadow systems depend on sustained high flows to recharge groundwater, which determines the extent and composition of different sub-habitats such as wet meadows, dry meadows, and seasonal ponds. Wildlife respond to channel-forming processes and the microhabitats they create, and to the variety of structure and species diversity in the riparian vegetation. In addition, aquatic-dependent species such as frogs are directly affected by high flows during the breeding season, when tadpoles and eggs may be entrained and washed downstream.

Diversions that reduce high flows also reduce suitable sites for the recruitment of many riparian species, thus restricting their extent and abundance. The lack of dynamic deposition also allows upland vegetation to encroach into the riparian corridor and onto formerly active bar surfaces. An example of this phenomenon is Cherry Creek below Lake Lloyd, where encroachment has allowed Jeffrey pines to become established in the riparian zone. Reduced high flows also tend to reduce the available habitat and productivity of benthic macroinvertebrates, a food source for

many riparian wildlife. Meadows affected by diversions tend to experience encroachment from upland vegetation.

The Hydrograph

The reproductive cycle of each riparian tree species is specifically tied to the timing of soil and moisture conditions that depend on the stream hydrograph (McBain and Trush, 2007). Many riparian tree species such as willows and cottonwood release large numbers of tiny seeds during a brief period in spring. These seeds are viable, or capable of germination, for only a few weeks. Their establishment depends on moist, bare soil for a period of several weeks or months while the seedling's root system develops to the depth of sustained groundwater. Each species of tree, shrub, and herb has evolved adaptations to ensure a place in the range of soil, moisture, and light conditions found in the highly dynamic riparian habitat.

Diversions that delay the highest spring flows can reduce or eliminate the required germination conditions for species adapted to early seed dispersal and germination events. A reduction in flows on the "receding limb" of the hydrograph can cause exposed sediment bars to dry out before seedlings establish their root system, thus resulting in mortality. Although very high flows can be detrimental for amphibians or other wildlife that may be swept away, a reduction in spring high flows can reduce the available extent and duration of breeding habitat.

Abrupt Changes in the Hydrograph

In a natural stream, water recedes gradually from high flows. Under a diversion scenario, these changes in flow can be much more abrupt. Especially when the flows are diminished rapidly, seedlings can become desiccated and die, and amphibian and invertebrate larvae can become stranded and die (McBain and Trush, 2007). The pattern and timing of stream releases is especially important for aquatic-dependent wildlife. Rapid increases in flow during managed releases can result in scouring and entrainment.

Terrestrial wildlife are also affected by an altered hydrograph resulting from diversions. Many animal species depend on specific plant species or vegetation structure for the completion of their life cycle; for example, willow flycatcher requires low, dense shrubby vegetation for nesting, and yellow-billed cuckoo requires large quantities of insect larvae as forage. Many insect species also have specific relationships with plant species to complete their life cycle; for example, Valley elderberry longhorn beetle requires blue elderberry shrubs of a particular stem diameter in which to lay its eggs. Alteration of the species composition, extent, or structure of the riparian habitat has direct impacts on some species, and indirect impacts on other species that depend on these species. In return, the riparian vegetation itself may be altered if the habitat is insufficient to sustain animal populations of pollinators, seed dispersers, or insectivores that keep the system in balance.

Minimum Flows

Minimum flows are a determining factor in maintaining groundwater levels. Some riparian species, such as alders, require year-round flowing water, while most others depend on groundwater, the extent of which depends to a large degree on sustained minimum flows. While the pattern of the hydrograph governs recruitment of riparian vegetation, minimum flows can

determine the survival of established vegetation. Minimum flows also determine the extent and duration of surface water habitat for aquatic-phase vertebrate and invertebrate species. Similarly, these effects are also important for maintaining the extent and diversity of meadow habitats.

Diversions that substantially reduce minimum flows can cause encroachment by upland vegetation, reduction in the extent of riparian vegetation, and an overall reduction in species diversity and stand structure. Over time, constrained physical conditions reduce the micro-habitats required for the establishment of different riparian species, with an eventual reduction in riparian plant species diversity and structure. Reduced summertime flows also tend to result in higher stream temperatures. Although increased temperature does not affect riparian vegetation, it can adversely effect vertebrate and invertebrate populations, which tend to be more sensitive to water temperature. Since these effects reduce the food base and extent of riparian habitat, they also tend to result in a reduction in the species diversity and abundance of vertebrate riparian wildlife.

Sustained minimum flows deepen the stream channel, further limiting channel migration. In addition, these flows alter growing conditions, favoring plant species that require permanently flowing water for germination, establishment, and growth, such as white alder and willow. If minimum flow releases convert a seasonal stream into a perennial stream, a narrow band of water-dependent species may form along the stream.

Reservoirs

Seasonal wetlands, perennial freshwater marsh, and riparian habitats around reservoirs depend on the season, duration, and elevational range of prevailing water levels. The lower-elevation ecological range of terrestrial plants is limited by inundation, and the upper range is constrained by the limits of water availability. The more consistent the water level from year to year and throughout a season, the more favorable the conditions are for perennial freshwater marsh and a resulting overall high species diversity for both animals and plants.

The more the pattern of water levels approximates a natural regime (i.e., highest levels in spring, with a gradual reduction through the summer and fall), the greater the diversity of habitats and species. Some plant species are limited by sustained inundation when the reservoir is maintained at its highest levels, and some plants are limited by drought when the reservoir is maintained at its lowest levels. Conversely, highly variable water levels decrease plant species diversity, and annual, weedy species become more prevalent. When a reservoir is operated at a higher or lower water level, habitats respond by migrating to the appropriate elevation. Similarly, the structure and composition of riparian and wetland habitats also respond to the timing and duration of maximum and minimum reservoir elevations. Reservoir operations often expose compact, bare, gravelly soil below the sustained high water line. This area generally supports only a sparse cover of weedy annual plants, and the habitat has little value for wildlife.

While the scientific literature presents numerous approaches to assessing and predicting potential effects on riparian ecosystems resulting from water diversions and other hydrologic manipulations (e.g., Kondolf et al., 1996), many of the suggested methods amount to extensive

interdisciplinary research projects.[3] The implementation of such studies is beyond the typical scope of an impact analysis under CEQA. Therefore, the following assessment, based on a review of the scientific literature, is a conservative presumption of effects on the riparian vegetation of the Tuolumne River that might be expected to occur as a result of the WSIP.

Impact Summary

Table 5.3.7-3 presents a summary of the impacts on terrestrial biological resources in the Tuolumne River system and downstream water bodies that could result from implementation of the proposed water supply and system operations.

TABLE 5.3.7-3
SUMMARY OF IMPACTS –
TERRESTRIAL BIOLOGICAL RESOURCES IN THE TUOLUMNE RIVER WATERSHED

Impacts on Terrestrial Biological Resources	Sensitive Habitats	Key Special-Status Species	Other Species of Concern	Common Habitats and Species
Impact 5.3.7-1: Impacts on riparian habitat and related biological resources in Hetch Hetchy Reservoir and along the bedrock channel portions of the Tuolumne River from O'Shaughnessy Dam to Don Pedro Reservoir	LS	LS	LS	LS
Impact 5.3.7-2: Impacts on alluvial features that support meadow and riparian habitat along the Tuolumne River from O'Shaughnessy Dam to Don Pedro Reservoir	PSM	PSM	PSM	PSM
Impact 5.3.7-3: Impacts on biological resources in Lake Eleanor and along Eleanor Creek	LS	LS	LS	LS
Impact 5.3.7-4: Impacts on biological resources in Lake Lloyd and along Cherry Creek	LS	LS	LS	LS
Impact 5.3.7-5: Impacts on biological resources in Don Pedro Reservoir	LS	LS	LS	LS
Impact 5.3.7-6: Impacts on biological resources along the Tuolumne River below La Grange Dam	PSM	PSM	PSM	PSM
Impact 5.3.7-7: Conflicts with the provisions of adopted conservation plans or other approved biological resources plans for the Tuolumne Wild and Scenic River	LS			

LS = Less than Significant impact, no mitigation required
PSM= Potentially Significant impact, can be mitigated to less than significant

[3] For example, in a baseline analysis and long-term monitoring study conducted along Bishop Creek, California, the authors conclude: "Collection of data over the next thirty years will result in an evaluation of the effects of streamflow alteration on the riparian ecosystem on a time scale more suitable for ecological interpretation" (Nachlinger et al., 1989).

Impact Discussion

Impact 5.3.7-1: Impacts on riparian habitat and related biological resources in Hetch Hetchy Reservoir and along the bedrock channel portions of the Tuolumne River from O'Shaughnessy Dam to Don Pedro Reservoir.

Sensitive Habitats

The WSIP would not affect the maximum elevation of Hetch Hetchy Reservoir, and little wetland habitat has developed around the periphery of the reservoir because of the granite substrate and existing large annual fluctuations in storage. Although annual fluctuations in reservoir storage would be greater under the WSIP, the impact on riparian and wetland habitats around and above Hetch Hetchy Reservoir would be less than significant.

Under the WSIP, the delay in snowmelt releases to the Tuolumne River below O'Shaughnessy Dam could incrementally reduce the extent and frequency of germination events, seedling survivorship, plant growth rates, and species diversity in riparian habitats. In the bedrock channel portions of the river, encroachment of riparian vegetation into the channel would be minimal. Riparian tree structure is already limited, and channel incision in the bedrock channel would be insignificant.

Studies supported by the SFPUC are currently underway to assess the physical and ecological conditions in the upper river. Given the dynamic hydrology, steep banks, and rocky substrate, there are few sensitive receptors for impact, since tree structure and channel incision are resistant to change. The effects of the WSIP in the confined bedrock channel portions of the upper river area would be relatively small and therefore difficult to quantify. As a result, this impact would be less than significant for the bedrock channel portions of the Tuolumne River and Hetch Hetchy Reservoir.

Thus, the effects of the WSIP on sensitive habitats would be *less than significant*, and no mitigation measures would be required.

Key Special-Status Species

No key special-status species are reported to occur at Hetch Hetchy Reservoir. The Tuolumne River between O'Shaughnessy Dam and Don Pedro Reservoir supports or has historically supported foothill yellow-legged frog and may support California red-legged frog. It contains only marginal habitat for willow flycatcher (see also Impact 5.3.7-2). Since changes in the structure and diversity of the riparian habitat at the reservoir and in the bedrock channel portion of the river would be less than significant, this impact would also be *less than significant*. No mitigation measures would be required.

Other Species of Concern

Species of concern potentially using Hetch Hetchy Reservoir and the bedrock channel reaches of this section of the Tuolumne River include Cooper's hawk, sharp-shinned hawk, California spotted owl, great gray owl, Vaux's swift, black swift, purple martin, yellow warbler, and several bat species, including spotted bat and mastiff bat. Since the changes in the structure and diversity

of the riparian habitat at the reservoir and in the bedrock channel portion of the river are expected to be less than significant, this impact would also be *less than significant*. No mitigation measures would be required.

Common Habitats and Species

Impacts of the WSIP on common habitats and species around Hetch Hetchy Reservoir and in the bedrock channel portion of the Tuolumne River below O'Shaughnessy Dam would be minimal and *less than significant;* no mitigation measures would be required.

Impact Conclusions

Overall, implementation of the proposed WSIP water supply and system operations would result in *less than significant* impacts on terrestrial biological resources in this portion of the WSIP program area. No mitigation measures would be required.

Impact 5.3.7-2: Impacts on alluvial features that support meadow and riparian habitat along the Tuolumne River from O'Shaughnessy Dam to Don Pedro Reservoir.

Sensitive Habitats

The alluvial area supporting the largest wetland complex in this section of the Tuolumne River is the Poopenaut Valley, although smaller alluvial areas downstream, where larger tributaries empty into the Tuolumne River, also support riparian and/or wetland habitats. A delay in snowmelt releases, reduction in flows, and the resulting reduction in meadow groundwater recharge under the WSIP could contribute to a reduction in wetland habitats and encroachment of upland vegetation. All habitats could experience a reduction in their extent as well as in germination events and stand diversity. All wetland and riparian habitats in the Poopenaut Valley are considered sensitive, including seasonal wetlands, wet meadows, hanging ponds, tule bulrush stands, dry meadows, and willow communities. Similarly, the extent and diversity of sensitive wetland and riparian areas on alluvial features farther downstream along the Tuolumne River would be affected by a reduction in the quantity and timing of releases from O'Shaughnessy Dam. This impact would be *potentially significant*.

Key Special-Status Species

Key special-status species potentially using meadows and riparian habitats on alluvial deposits in this portion of the Tuolumne River include foothill yellow-legged frog and potentially California red-legged frog in the lower section of this portion of the Tuolumne River. Potential habitat may be present for willow flycatcher in dense riparian scrub. A reduction in wetland and riparian habitat would reduce suitable breeding habitat for these species, populations of which are already critically reduced in the Sierra Nevada (Jennings and Hayes, 1994). This impact would be *potentially significant.*

Other Species of Concern

Pansy monkeyflower is present at the edges of wet meadows in the Poopenaut Valley. A reduction in wet meadow habitat and upland species encroachment could reduce suitable habitat for this species. Several other plant species of concern could occur in wetlands and riparian edges in this portion of the Tuolumne River (see Table 5.3.7-2). A reduction in the extent and diversity of wetland and riparian habitats could reduce suitable habitat for these plants. A number of animal species of concern depend on meadows and diverse riparian habitats. Mountain yellow-legged frog has not been documented in the Poopenaut Valley, but may have occurred there historically, and suitable habitat may still be present. Western pond turtle, Vaux's swift, black swift, spotted bat, and mastiff bat are known to occur in this reach of the Tuolumne River. Other species likely to be present are Cooper's hawk, sharp-shinned hawk, northern goshawk, northern harrier, California spotted owl, great gray owl, purple martin, willow flycatcher, Pacific fisher, and several bat species. Because of the potential for a reduction in habitat quality and extent, the impact on species of concern would be *potentially significant*.

Common Habitats and Species

The habitats that could be affected by the WSIP are all considered sensitive; no impacts on common habitats would occur. However, a large number of common animal species depend on meadows and larger riparian areas in the mid-elevation Sierra Nevada for food and cover. From a regional perspective, incremental impacts on meadow habitats could have a *potentially significant* impact on common wildlife species.

Impact Conclusions

Overall, implementation of the proposed WSIP water supply and system operations could result in potentially significant impacts on terrestrial biological resources due to potential effects on riparian habitat and species of concern. Implementation of Measure 5.3.7-2, Controlled Releases to Recharge Groundwater in Streamside Meadows and Other Alluvial Deposits, would manage releases from Hetch Hetchy reservoir to recharge riverside meadows, including the Poopenaut Valley. In combination with the groundwater and plant population monitoring being carried out in accordance with Provision 6 of the amended permit for the Canyon Power Project (March 1987) and further adjustment of controlled releases, timing, and magnitude in collaboration with the USFWS, it is expected that meadow conditions in the Poopenaut Valley will be maintained in the current state or improved. Therefore, controlled releases under Measure 5.3.7-2, if timed properly and of adequate volume, would be sufficient to fully mitigate these impacts to less-than-significant.

Impact 5.3.7-3: Impacts on biological resources in Lake Eleanor and along Eleanor Creek.

Sensitive Habitats

Lake Eleanor supports limited wetland habitats. The WSIP would not change the level and pattern of reservoir storage in Lake Eleanor, except that increased transfers to Lake Lloyd could

occur during extended droughts. This change under the WSIP could slightly reduce the extent and quality of potential suitable habitat for wetland species. Riparian habitats along Eleanor Creek would be unaffected because the quantity and timing of releases would be essentially the same as under existing conditions. Overall, impacts on sensitive riparian and wetland habitats due to the WSIP would be *less than significant,* and no mitigation measures would be required.

Key Special-Status Species

There are no records indicating the presence of key special-status species in Lake Eleanor and Eleanor Creek. However, habitat in Eleanor Creek appears to be suitable for foothill yellow-legged frog. Since habitat changes are predicted to be small, any potential effects on this species and its habitat would be *less than significant,* and no mitigation measures would be required.

Other Species of Concern

Species of concern potentially using the riparian habitats associated with Lake Eleanor and Eleanor Creek are similar to those for the Tuolumne River below O'Shaughnessy Dam. They include western pond turtle, mountain yellow-legged frog, Cooper's hawk, sharp-shinned hawk, California spotted owl, great gray owl, Vaux's swift, black swift, purple martin, willow flycatcher, and several bat species. Since WSIP-induced impacts on habitat are predicted to be very small, the impact on species of concern would also be *less than significant,* and no mitigation measures would be required.

Common Habitats and Species

Potential impacts of the WSIP on common habitats and species are expected to be *less than significant*, and no mitigation measures would be required.

Impact Conclusions

Overall, the impacts on terrestrial biological resources due to implementation of the proposed WSIP water supply and system operations would be *less than significant,* and no mitigation measures would be required.

Impact 5.3.7-4: Impacts on biological resources in Lake Lloyd and along Cherry Creek.

Sensitive Habitats

Lake Lloyd would experience a small decrease in average reservoir water levels under the WSIP, but this lake contains little wetland habitat. The WSIP would increase releases somewhat during dry years, which could benefit riparian habitats along Cherry Creek. Overall, impacts on sensitive riparian and wetland habitats would be *less than significant*, and no mitigation measures would be required.

Key Special-Status Species

There are no records indicating the presence of key special-status species in Lake Lloyd or Cherry Creek. However, habitat in Cherry Creek appears to be suitable for foothill yellow-legged frog. Since habitat changes are predicted to be small, any potential effects on this species and its habitat would be *less than significant*, and no mitigation measures would be required.

Other Species of Concern

Species of concern potentially using the riparian habitats associated with Lake Lloyd and Cherry Creek are similar to those for the Tuolumne River below O'Shaughnessy Dam. They include western pond turtle, mountain yellow-legged frog, Cooper's hawk, sharp-shinned hawk, western spotted owl, great gray owl, Vaux's swift, black swift, purple martin, willow flycatcher, and several bat species. Since WSIP-induced impacts on habitat are predicted to be very small, the impact on species of concern would also be *less than significant*, and no mitigation measures would be required.

Common Habitats and Species

Potential impacts of the WSIP on common habitats and species are expected to be *less than significant*, and no mitigation measures would be required.

Impact Conclusions

Overall, impacts on terrestrial biological resources due to implementation of the proposed WSIP water supply and system operations would be *less than significant*, and no mitigation measures would be required.

Impact 5.3.7-5: Impacts on biological resources in Don Pedro Reservoir.

Sensitive Habitats

Because riparian and wetland habitat at Don Pedro Reservoir is limited, the impact on sensitive habitats due to the increased drawdown under the WSIP would be *less than significant*, and no mitigation measures would be required.

Key Special-Status Species

Very limited potential habitat for California red-legged frog is present at Don Pedro Reservoir, and no other key special-status species are known to occur there. As a result, the impact on key special-status species at Don Pedro Reservoir would be *less than significant*, and no mitigation measures would be required.

Other Species of Concern

Western pond turtle could be affected by an incremental reduction in the quality and extent of habitat due to increased drawdown. An incremental but small reduction in habitat could occur for several bat species, bird species such as osprey, and bald eagle. Because of the very limited

reduction in potentially suitable habitat for species of concern, this incremental impact would be *less than significant*, and no mitigation measures would be required.

Common Habitats and Species

The increased reservoir drawdown under the WSIP would not reduce any common habitats; therefore, the impact on common species would be *less than significant*, and no mitigation measures would be required.

Impact Conclusions

Overall, impacts on terrestrial biological resources at Don Pedro Reservoir due to implementation of the proposed WSIP water supply and system operations would be *less than significant*, and no mitigation measures would be required.

Impact 5.3.7-6: Impacts on biological resources along the Tuolumne River below La Grange Dam.

Sensitive Habitats

Slightly delayed spring releases as well as reductions in average peak flows and total flow in the Lower Tuolumne River (especially during and following an extended drought) would incrementally affect riparian communities through upland encroachment into the riparian habitat and riparian encroachment into the channel. Existing conditions have already eliminated conditions for Fremont cottonwood regeneration and reduced the species diversity and variety of riparian vegetation stand structure. The proposed flows under the WSIP could further reduce stand diversity and variation in structure and further reduce or eliminate suitable conditions for recruitment of some riparian species. The degree of potential impact on riparian habitat due to the WSIP is difficult to quantify. However, because it would result in an incremental adverse change in a severely stressed system, the impact of the WSIP is considered *potentially significant.*

Key Special-Status Species

The WSIP would incrementally reduce habitat for some species that depend on the riparian habitats in the lower Tuolumne River, such as California tiger salamander, Valley elderberry longhorn beetle, and Swainson's hawk. Because of the known presence of key special-status species and the very limited amount of remaining suitable habitat along the Tuolumne River, this incremental impact would be *potentially significant.*

Other Species of Concern

Several species of concern could be affected by the incremental reduction in riparian habitat quality and extent under the WSIP. These species include western pond turtle, several bat species, and a wide variety of riparian- and marsh-associated bird species. Because of the known presence of species of concern and the very limited amount of remaining suitable habitat along the Tuolumne River, this incremental impact would be *potentially significant.*

Common Habitats and Species

Potential impacts of the WSIP on common habitats are expected to be less than significant. However, many common species depend on riparian habitats, and their populations would be incrementally affected by the alteration of habitat. As a result, this impact would be *potentially significant*.

Impact Conclusions

Overall, implementation of the proposed WSIP water supply and system operations would result in *potentially significant* impacts on terrestrial biological resources due to potential effects on riparian habitat, other species of concern, and common habitats and species. If feasible, implementation of Measure 5.3.6-4a, Avoidance of Flow Changes by Reducing Demand for Don Pedro Reservoir Water, would result in reduced demand on Don Pedro Reservoir water. The result would offset the reduction in inflow to Don Pedro Reservoir attributable to the WSIP and the release pattern from La Grange Dam would be the same or similar to the existing condition. If fully implemented, this measure would reduce the potential impact of the WSIP on riparian resources to less than significant and no further mitigation would be required.

Due to some uncertainty regarding negotiations with MID/TID that would be necessary to implement Measure 5.3.6-4a, Avoidance of Flow Changes by Reducing Demand for Don Pedro Reservoir Water, this measure may not be feasible. In the event that Measure 5.3.6-4a is deemed infeasible, implementation of Measure 5.3.7-6, Lower Tuolumne River Riparian Habitat Enhancement, which would require SFPUC to implement riparian habitat enhancement actions on the lower Tuolumne River, would reduce the impact of WSIP operations on riparian resources on the lower Tuolumne River to a less-than-significant level.

Impact 5.3.7-7: Conflicts with the provisions of adopted conservation plans or other approved biological resources plans for the Tuolumne Wild and Scenic River.

The U.S. Forest Service identified the Tuolumne River as a Wild and Scenic River and has developed a management plan for the 29 miles of the Tuolumne River downstream of the Yosemite National Park boundary to Don Pedro Reservoir (shown in Figure 5.2-1). The *Tuolumne Wild and Scenic River Management Plan* (Wild and Scenic Plan), approved in 1986 and administered by the U.S. Forest Service, calls for providing cover and forage habitat for fish and riparian-associated wildlife species by maintaining medium to high habitat quality according to the certain habitat quality criteria. Specific guidelines include maintaining and enhancing habitat for threatened, endangered, and sensitive indicator species, including peregrine falcon, bald eagle, mule deer, western gray squirrel, yellow warbler, and Sierra Nevada red fox and protecting streamside vegetation (USFS, 1986).

The Wild and Scenic Plan does not apply to the exercise of the CCSF's water rights under the existing Raker Act grant, as stated in the Wild and Scenic Rivers Act (Section 3 [a] [53] Tuolumne, California) as follows: "Nothing in this section is intended or shall be construed to

affect any rights, obligations, privileges, or benefits granted under any prior authority of law including chapter 4 of the Act of December 13, 1913, commonly referred to as the Raker Act (38 Stat. 242) and including any agreement or administrative ruling entered into or made effective before the enactment of this paragraph [September 28, 1984]." However, although SFPUC's operations are exempt from the provisions of the Wild and Scenic Plan, WSIP impacts on biological resources, including those specifically addressed in the Wild and Scenic Plan, are evaluated in this PEIR under CEQA.

Potential WSIP impacts on sensitive habitats and associated species of concern along the reach of the Tuolumne River covered by the Wild and Scenic Plan are included in the analyses presented in Impacts 5.3.7-1 and 5.3.7-2. As noted under Impact 5.3.7-1, impacts on riparian habitat and related biological resources along the bedrock channel portions of this reach of the Tuolumne River would be less than significant. As described in Impact 5.3.7-2, the changes in streamflow associated with implementation of the WSIP could affect streamside vegetation on alluvial features that support meadow and riparian habitats along this reach of the river; however, for the reach of the Tuolumne River downstream of the Yosemite National Park boundary to Don Pedro Reservoir, there are no notable alluvial features that support meadow and riparian habitats. Furthermore, this reach of the river receives inflow from numerous side tributaries, including Cherry Creek, which would mask any WSIP-related changes in streamflow, and no noticeable changes on sensitive habitats and associated species of concern along the reach of the Tuolumne River covered by the Wild and Scenic Plan would be expected. Therefore, impacts related to the potential conflicts related to the provisions of the adopted Wild and Scenic Plan are considered *less than significant*.

The National Park Service (NPS) has identified the Tuolumne River, and specifically the Poopenaut Valley, as an outstandingly remarkable value of the Tuolumne Wild and Scenic River corridor in Yosemite National Park (NPS, 2006). The *Tuolumne Wild and Scenic River Draft Report, Outstandingly Remarkable Values* (NPS, 2006) calls for maintaining and enhancing riparian and meadow habitats within the Tuolumne River corridor. This report is part of the NPS's ongoing development of the management plan for the designated wild and scenic reaches of the Tuolumne River within Yosemite Park, including the Poopenaut Valley. Since this plan is still under development and not yet adopted, no impact determination is made regarding conflicts with any of its provisions.

Impacts related to the potential conflicts related to the provisions of adopted conservation plans are therefore considered *less than significant*.

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5.3.8 Recreational and Visual Resources

The following setting section describes recreational and visual resources in the Tuolumne River watershed that could be affected by the WSIP. The impact section (Section 5.3.8.2) provides a description of the changes in recreational opportunities and visual quality that would result from WSIP-induced changes in stream flow and reservoir water levels.

5.3.8.1 Setting

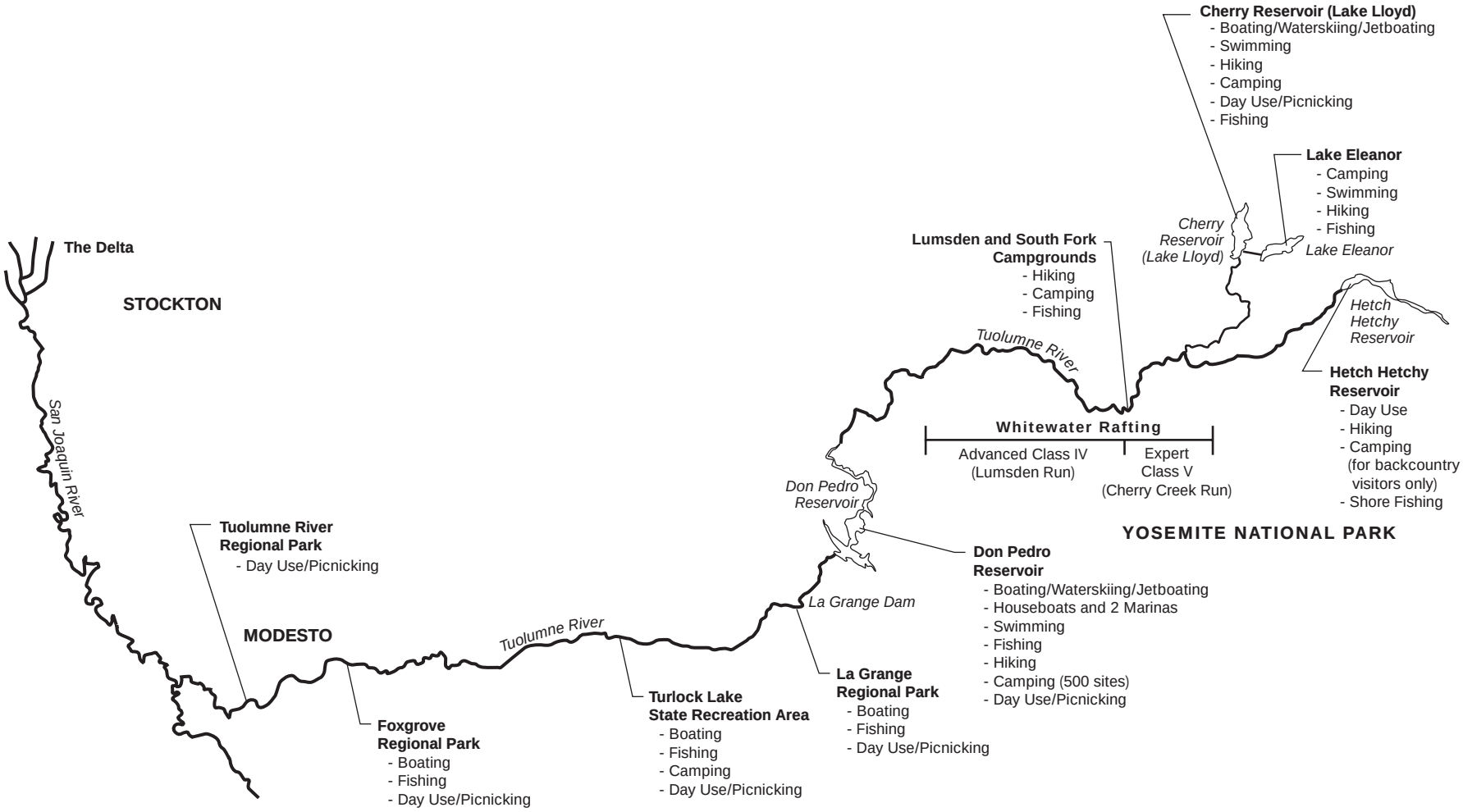
Recreational activities and facilities are dispersed throughout the Tuolumne River system (except for whitewater boating, which is limited to the upper reaches of the river above Don Pedro Reservoir). Water recreational activities in the Tuolumne River, other than whitewater rafting, include boating (often consisting of "flatwater" river kayaking or rafting), fishing, and swimming. Boating recreation is generally limited to sections of the river with suitable river access (e.g., boat ramps for hard-bottomed boats). Both fishing and swimming within the Tuolumne River is regulated. Swimming is generally discouraged due to the often hazardous currents.

Off-water river-related recreation consists of hiking, picnicking, and camping. Hiking occurs throughout the Tuolumne River system in several forms, including both vigorous trail walking and more casual sightseeing or nature viewing. Picnicking is a common activity at nearly all of the region's recreation sites, but overnight camping along the river is mainly limited to developed campsites. Recreational resources are identified by location in order to delineate the specific impacts of the WSIP within the Tuolumne River system (see **Figure 5.3.8-1**).

Yosemite National Park and the Hetch Hetchy Watershed

Hetch Hetchy Reservoir

Hetch Hetchy Reservoir and the associated watershed lands lie mainly in Yosemite National Park. The park encompasses approximately 1,170 square miles, and about half of this area lies within Tuolumne County (the remainder is in Mariposa and Merced Counties). Yosemite receives about 4 million visitors a year and offers a wide variety of recreational activities, including camping, hiking, mountain climbing, fishing, and river rafting. The headwaters of the Tuolumne River lie within the park. The Hetch Hetchy Reservoir watershed encompasses the 459 square miles that make up the Tuolumne River watershed. There are numerous recreational facilities and activities in the watershed above Hetch Hetchy Reservoir at Tuolumne Meadows and the Glen Aulin High Sierra Camp. Tuolumne Meadows attracts by far the greatest amount of recreational use in the watershed at its large developed campground, visitor center, trailheads, and Tuolumne Meadows Lodge. Glen Aulin High Sierra Camp also generates substantial recreational use. There is also considerable backcountry visitation within the Hetch Hetchy watershed above the reservoir. Between 1990 and 2005, annual overnight use was approximately 40,000 user nights in the backcountry wilderness of the Hetch Hetchy watershed (NPS, 2006c). However, since no program-related changes would occur upstream of the reservoir, wilderness users who only visit the Hetch Hetchy watershed backcountry (i.e., do not hike along the reservoir or downstream along the Tuolumne River) would not be affected by the WSIP.



5.3.8-2

SOURCE: ESA + Orion

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Figure 5.3.8-1
Principal Recreational Resources
Tuolumne River System

Hetch Hetchy Reservoir sits in a dramatic valley of steep, glacier-eroded mountains. Dispersed and scrubby vegetation is predominantly clustered around the flatter portions and fissures of the surrounding mountainsides. Due to the steep slopes, most of the surrounding rock faces are bare granite rock. Around the lakeside, scoured whiter rings (referred to as the "bathtub ring") are periodically visible when the water level falls. While no recreational activities are permitted on the Hetch Hetchy Reservoir due to water quality restrictions, hiking is permitted within the watershed area, overnight backpacking is allowed with a wilderness permit, and visitors with a valid California fishing license, who comply with the rainbow trout catch-and-release policy, are allowed to fish from the reservoir shoreline. Considerable day use of the reservoir occurs from early May to early October, except during the hottest periods of late July and August when visitation typically decreases. A walk-in campsite operates at Hetch Hetchy for backpackers hiking in and out of the backcounty. Swimming in the off-reservoir streams is currently permitted, but the National Park Service is in the process of promulgating a regulation that would prohibit body contact in the tributaries within one mile of the reservoir in accordance with the sanitary provisions of the Raker Act. The road to Hetch Hetchy is generally open year-round during daylight hours, except on occasion during the winter and spring when it is closed due to extreme weather conditions (NPS, 2007).[1]

Only limited and partial past visitation data for the Hetch Hetchy entrance gate and backcounty use are available. Annual visitation frequently fluctuates considerably between years, often due to weather conditions. Over the last five years, visitation has generally averaged approximately 14,300 vehicles annually; in 2005, the number of vehicles using the entrance increased to nearly 22,000, likely due to the increased media attention on the reservoir. Based on an assumption of 2.5 visitors per vehicle, average visitation through the Hetch Hetchy entrance was approximately 35,750 visitors annually between 2000 and 2005. In comparison, visitation between 1990 and 1995 was approximately 50 percent higher, averaging 21,056 vehicles per year between April and early November. According to National Park Service staff, the majority of day-use visitors to Hetch Hetchy Reservoir and Tuolumne River trails use this entrance.

Statistics on wilderness permits for backcounty use fluctuate greatly and are considered less reliable measurements of visitor use, since not all visitors using the backcountry obtain permits. Nonetheless, based on the available wilderness permit data for 2003 to 2005, approximately 2,345 backcountry visitor permits were issued from the Hetch Hetchy location. It is estimated that these backcountry visitors stayed an average of 2.3 nights in the area (NPS, 2006a), accounting for about 5,400 user nights. Since these permits were obtained from the Hetch Hetchy location, it is presumed that the majority of these permits were likely used to hike and camp in the Hetch Hetchy area.

While a small number of other backcountry users may have obtained their permits from other park wilderness offices or from U.S. Forest Service (USFS) locations, this number, according to park staff, would represent a very small proportion of backcountry users along the Tuolumne River below Hetch Hetchy Reservoir or around the reservoir itself.

[1] Due to safety concerns, access to the O'Shaughnessy Dam parking lot is limited to 8:00 a.m. to sunset, and no overnight parking is permitted.

Lake Eleanor

Lake Eleanor, another SFPUC system reservoir, also lies within Yosemite National Park. Lake Eleanor has a 79-square-mile watershed along Eleanor Creek. The lake measures three miles long and one mile wide and is situated at an elevation of 4,660 feet. Activities at and around the lake include camping, fishing, swimming, nonmotorized boating, and hiking. Trailheads connect this area to the Emigrant Wilderness, Hetch Hetchy Reservoir, and the rest of Yosemite National Park. No visitor counts are available specifically for Lake Eleanor; however, due to its lack of direct road access, Lake Eleanor is a far less popular recreational destination than Hetch Hetchy Reservoir, which better accommodates day use (NPS, 2006b).

The visual setting for Lake Eleanor is characterized by open vistas of mixed conifer forest covering most of the gradually sloped surrounding mountains. These hills and low mountains are less dramatic than those around Hetch Hetchy Reservoir, but are generally more forested.

Poopenaut Valley

All of the Tuolumne River within the Poopenaut Valley downstream to the western park boundary is classified as Wild, apart for the first mile below the O'Shaughnessy Dam (which is classified as Scenic). While there is limited hiking and other recreational access to the Wild section of the river, the *Tuolumne Wild and Scenic River Study Final EIS and Study Report* (U.S. DOI and USDA, 1979) found this segment of the river to have numerous "outstandingly remarkable values," including Scenic, Recreation, Geological, Wildlife, Historic, and Scientific values. The Tuolumne River's outstanding scenic values in this segment are based on the stunning views of verdant meadows, a glacially carved bedrock valley, large river pools, dramatic canyon walls, and a constricted slot canyon below the Poopenaut Valley (NPS, 2006d). The river's outstanding recreational values are based its opportunities for recreation in a largely undisturbed, low-elevation riparian environment dominated by natural scenery and soundscapes. In addition, the recreational opportunities are considered unique for the Sierra Nevada as a result of the rarity of such low-elevation designated wilderness.

Stanislaus National Forest

The Stanislaus National Forest, which is managed by the USFS, encompasses almost 900,000 acres to the west of Yosemite National Park. It stretches through Tuolumne, Calaveras, and Alpine Counties in a wide band from the Mokelumne River on the north to the Merced River on the south. Recreational opportunities in the Stanislaus National Forest include river rafting, hiking, and fishing. A 29-mile stretch of the Tuolumne Wild and Scenic River (described below) lies within the Stanislaus National Forest (USFS, 2007a).

Lake Lloyd, another part of the SFPUC water system, is the largest lake in the Stanislaus National Forest. It has a 114-square-mile watershed along Cherry Creek, mainly in the Emigrant Wilderness, and numerous recreational activities are permitted (SFPUC, 2007). The lake is 3.8 miles long and one mile wide and lies at an elevation of 4,702 feet. The lake is impounded by an earthen dam that was constructed in 1954 (SFPUC, 2007). Fishing and boating are common activities, as are camping, hiking, swimming, waterskiing, and jet-boating. There are

46 campsites in the Cherry Valley Campground, and shoreline boat-in camping is popular. Fish species targeted by anglers include several species of trout (rainbow trout, eastern brook trout, and German brown trout) as well as some sockeye (kokanee) salmon (Fish Sniffer, 2006).

The visual setting for Lake Lloyd is similar to that of the neighboring Lake Eleanor, generally consisting of mixed conifer forest on the surrounding High Sierra mountains. The lake is open year-round; however, the access road to Lake Lloyd can experience closures in the winter (USFS, 2007b).

Upper Tuolumne River Corridor

In 1984, Congress designated the Tuolumne River as one of the nation's Wild and Scenic Rivers. The river provides an abundance of recreational opportunities, including fishing, hiking, and whitewater rafting. In total, 83 miles of the Tuolumne River have been classified as Wild (47 miles), Scenic (23 miles), or Recreation (13 miles) (NPS, 2006c), as shown in Figure 5.2-1. Most of the river corridor within the 29 miles of the Tuolumne Wild and Scenic River located outside of Yosemite National Park is classified as Wild. The one-mile stretch of river between Early Intake and Cherry Creek is classified as Recreational because a road parallels it, and the four miles of river starting about a mile above the Lumsden Bridge is recognized as Scenic.

Whitewater rafting is the primary water recreation activity in the Tuolumne River corridor above Don Pedro Reservoir and is discussed in the section below. Other water and off-water recreational resources are discussed separately following the whitewater recreation discussion.

Whitewater Recreational Resources

There are two whitewater boating runs in the Tuolumne River watershed. The Cherry Creek Run extends from just above the Cherry Creek/Tuolumne River confluence to Lumsden Campground, and the Lumsden Run extends from Lumsden Campground to the Wards Ferry Bridge, just upstream of Don Pedro Reservoir. Both runs are located within the jurisdiction of the Groveland Ranger District of the Stanislaus National Forest and managed under the 1986 USFS *Tuolumne Wild and Scenic River Management Plan*.

Cherry Creek Run

This nine-mile run begins at Holm Powerhouse on Cherry Creek and ends at Lumsden Campground on the Tuolumne River. The Cherry Creek Run is one of the most difficult whitewater boating runs on the West Coast, and is probably the most challenging run in the country that has regularly scheduled commercial boating trips. The Cherry Creek Run is suitable solely for expert boaters and can only be run during low summer flows. The run's excellent scenery, outstanding rapids, and relative proximity to the Bay Area and Sacramento make it California's most popular Class V (expert) run (Cassady, 1995). It is commonly considered to be the initiation run for boaters ready to transition from Class IV to Class V (Holbeck, 1998).

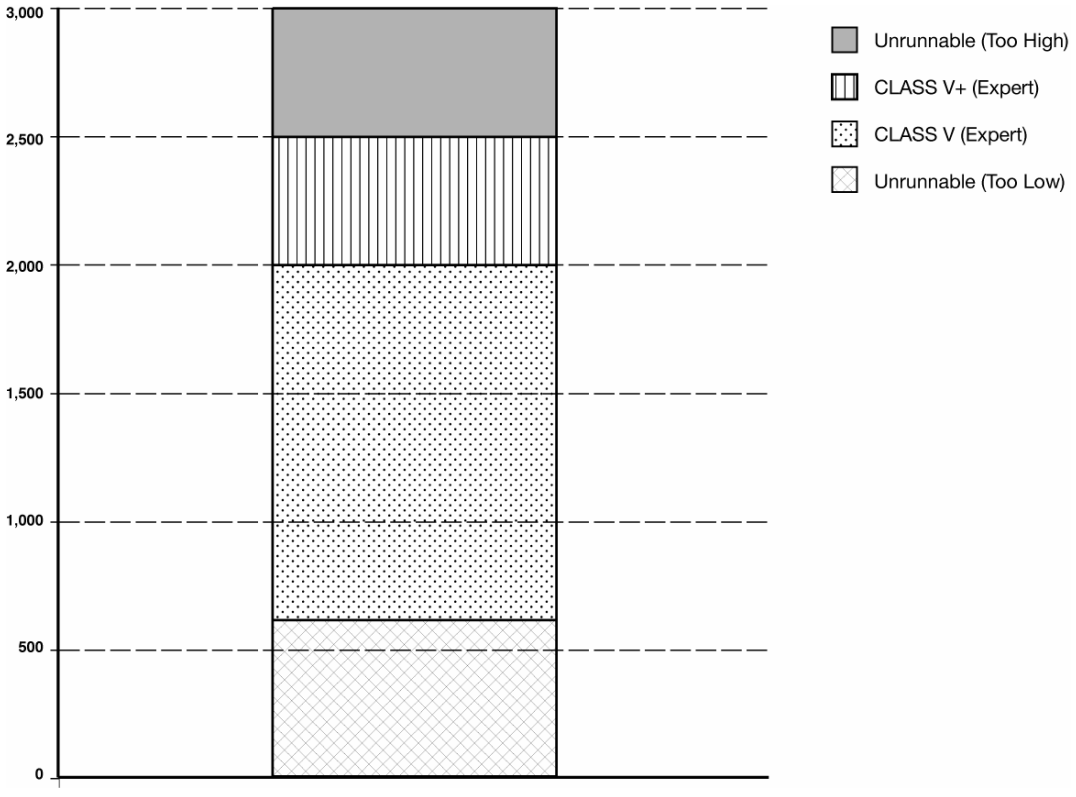
The run's gradient generally falls 110 feet per mile, although one section consists of a 200-foot descent over the course of one river mile. However, the rapids are generally formed from large,

round granite boulders that are relatively forgiving for boaters and less likely to result in entrapment hazards than other comparable runs. The typical whitewater boating condition thresholds for the Cherry Creek Run are shown in **Table 5.3.8-1** and **Figure 5.3.8-2**.

TABLE 5.3.8-1
WHITEWATER RAFTING CONDITION THRESHOLDS FOR THE CHERRY CREEK RUN

River Flows	Rating	User Type
600–1,500 cfs	Class V	Expert
1,500–2,000 cfs	Class V+	Expert +
> 2,000 cfs	Unrunnable	NA

SOURCE: All-Outdoors California Whitewater Rafting, 2007.



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SOURCE: Cassady, 1995; Holbeck 1998..

Figure 5.3.8-2
Whitewater Rafting Condition Thresholds for the Cherry Creek Run

The Cherry Creek Run is predominantly used by private kayakers in the mid- and late summer, when it is one of the few remaining suitable expert runs in the country. Earlier in the year, flows are generally above 2,000 cfs and the run is unsafe.

Lumsden Run

The lower 18-mile run on the main fork of the Tuolumne River extends from Lumsden Campground to Ward's Ferry Bridge. This stretch of the river is generally known as the Lumsden Run (Rosekrans et al., 2004). The Lumsden Run is a premier California whitewater boating run that is famous within the rafting and kayaking community. It is typically rated as a Class IV+ run and provides a high-quality experience for boaters. The Lumsden Run offers the opportunity for an overnight trip, which is rare in the central Sierra region. The run's beautiful scenery, wilderness solitude, and challenging rapids within easy driving distances from Sacramento and the Bay Area make it a popular whitewater boating location for both private and commercial boaters.

The run's gradient generally falls 40 feet per mile through difficult boulder slalom rapids. The typical whitewater boating conditions for the Lumsden Run are shown in **Table 5.3.8-2** and **Figure 5.3.8-3**.

TABLE 5.3.8-2
WHITEWATER RAFTING CONDITION THRESHOLDS FOR THE LUMSDEN RUN

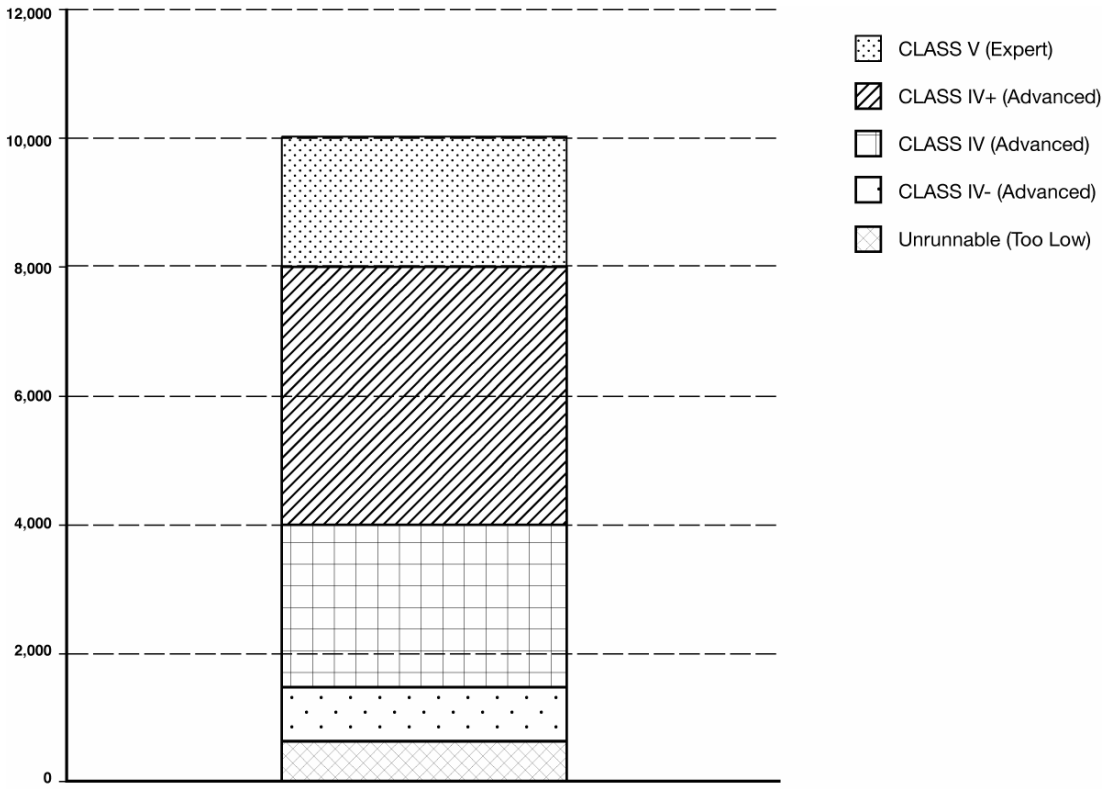
River Flows	Rating	User Type
600–1,500 cfs	Class IV-	Advanced
1,500–4,000 cfs	Class IV	Advanced
4,000–8,000 cfs	Class IV+	Advanced
> 8,000 cfs	Class V	Expert

SOURCE: All-Outdoors California Whitewater Rafting, 2007.

Current Operating Conditions

The 1995 FERC Settlement Agreement (see Chapter 2 for a description of the agreement) requires the SFPUC to consult, cooperate, and communicate with whitewater recreational interests regarding releases from the Hetch Hetchy system, but does not require the SFPUC to schedule releases for the purpose of maintaining or enhancing whitewater recreation. However, subject to the availability of water and hydropower needs, the SFPUC attempts to accommodate whitewater recreation in the Tuolumne River below its reservoirs by "shaping" releases from Holm Powerhouse on Cherry Creek, upstream of its confluence with the Tuolumne River. These "pulse" releases enable whitewater rafting during the summer season when flows are otherwise insufficient (see **Figure 5.3.8-4**).

The SFPUC meets annually with whitewater recreation representatives to develop, to the degree practicable, a schedule of releases for whitewater recreation. The schedule of these releases is developed in accordance with the duration of expected spills below the Hetch Hetchy systems' Tuolumne River watershed reservoirs and the projected availability of water in Lake Lloyd and



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SOURCE: Cassady, 1995; Holbeck 1998..

Figure 5.3.8-3
Whitewater Rafting Condition Thresholds for the Lumsden Run

Lake Eleanor beyond the amount necessary to maintain the SFPUC's water deliveries from its Tuolumne River reservoirs. The need to divert Cherry Creek water to Early Intake through the Lower Cherry Aqueduct for water supply use in the Bay Area in emergencies and extreme droughts as well as the expected price of energy and maintenance projects are also considered in establishing the schedule of releases for whitewater recreation.

The primary considerations in scheduling releases are the needs to maintain water supply, undertake maintenance, and deliver water in emergencies. The SFPUC maintains high levels of carryover storage in Lake Lloyd and Lake Eleanor because releases from these reservoirs can be used to meet TID's and MID's Raker Act water entitlements in the event that the SFPUC's storage in its water bank in Don Pedro Reservoir is exhausted. This enables continued water deliveries to Bay Area customers from Hetch Hetchy Reservoir. This operational strategy is consistent with the SFPUC's obligation to operate the Hetch Hetchy system for "water first."

The price of energy is also a consideration in establishing the annual schedule of boating releases. Once Hetch Hetchy Reservoir, Lake Lloyd, and Lake Eleanor have finished spilling spring and early summer runoff, which typically occurs by July 1, releases to streams are reduced to the minimum required flow. Flow in the Tuolumne River consists of the minimum releases from the

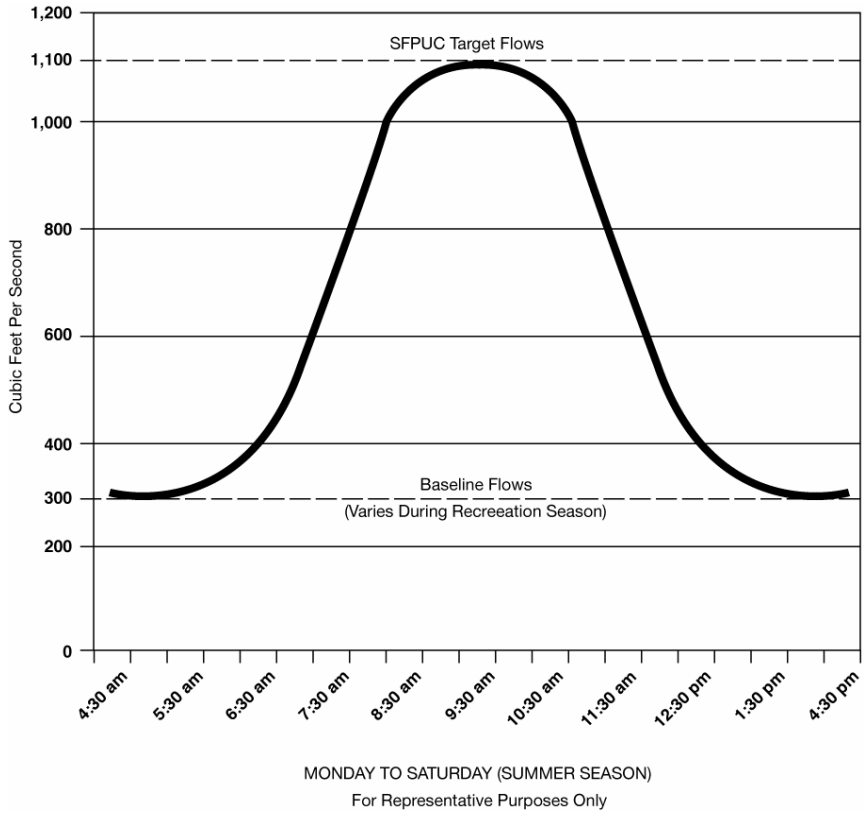

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Figure 5.3.8-4
Example of a Pulse Release
for Whitewater Recreation

reservoirs, tributary flow, and releases from Holm, Kirkwood, and Moccasin Powerhouses. Hydropower generation at Kirkwood and Mocassin Powerhouses is limited to that which is incidental to water deliveries to the Bay Area. In a typical year, hydropower from the two powerhouses is insufficient to meet the SFPUC's peak municipal and retail power demand for several months beginning at the end of June, and the SFPUC must purchase power. When the SFPUC chooses to generate hydropower at the Holm Powerhouse, it must offer some electrical power to TID and MID at an agreed upon price for their municipal needs and agricultural pumping.

Energy prices are at their seasonal maximum during the summer and fall, because the cheapest source of energy (i.e., hydropower) is no longer plentiful. In addition, the price of energy rises during the day to a peak price around midday, when energy use is the highest. If the SFPUC were to operate solely to meet its own municipal and retail demand for energy or to maximize revenue from hydropower sales, it would generate hydropower during the midday period only. To deliver a pulse flow to Lumsden Campground for boaters by 9:30 a.m., the SFPUC must begin hydropower generation at Holm Powerhouse by 7:00 a.m. Were the SFPUC to operate solely in its own interest, it would not begin generation until late morning. Operating Holm Powerhouse early in the morning to produce boating flows represents both lost revenues as well as exposure to higher energy costs when the SFPUC must purchase energy to meet its needs in the middle of the day.

Scoping comments received in response to the Notice of Preparation for this PEIR (see Appendix A) included expressions of concern that the WSIP could further restrict the quality of whitewater rafting on the Tuolumne River by reducing water release hours or flows, or by shortening the length of the summer rafting season.

Since the 1995 FERC Settlement Agreement, representatives for the commercial boating community have met annually with SFPUC staff to collaborate in determining operating and flow management schedules that can better accommodate whitewater recreation downstream of Hetch Hetchy Reservoir and Lake Lloyd. While commercial users have generally adapted their trips and operations to conform to the flow conditions, reductions in water releases (typically resulting in an earlier ending to the whitewater recreation season) inevitably reduce the commercial operators' earnings. The highest demand for whitewater use of the Tuolumne River is during the Memorial to Labor Day season. In addition, there is also considerable and frequently unmet whitewater recreational demand for the early to mid-September shoulder season. In May and early June, the colder water and weather as well as the often higher river flows are less attractive to many whitewater boaters. Furthermore, later in the summer season many other rivers are no longer runnable. As a result, the late summer whitewater opportunities on the Tuolumne River are generally in greatest demand and offer users particularly high-quality whitewater recreation experiences (Welch, 2006).

A 900-cfs flow at Lumsden Campground is the minimum required for whitewater paddleboats; a 600-cfs flow is the minimum required for kayaks and oar boats, and a 1,200-cfs flow is considered optimal. The commercial whitewater outfitters prefer a six-hour release, but a three-hour release allows them to launch one-, two-, or three-day trips. One-day trips launch first and ride the pulse down to Wards Ferry; two-day trips launch next and run nine miles down river; and three-day trips launch last and ride five miles down river. Launches of two- and three-day trips from riverside campgrounds are staged to avoid congestion at rapids.

In recent years, the water releases to the river have generally been in a daily three- to four-hour pulse release timed to reach the upper reaches of the rafting runs in the mid-morning. According to representatives of the commercial users, three hours represents a minimum adequate duration for whitewater recreation, as launchings and all associated recreation must occur during the flow of released water down the river (Welch, 2006). If the duration of flow is insufficient, crowding can decrease the quality of the recreational experience for some users. A longer duration water release pulse would provide more opportunities for users to spread out their river use and take greater advantage of the off-river hiking and other recreational opportunities.

Due to the demand for power generated from the Lake Lloyd's water releases, the weekday water releases may be larger than the Saturday releases. Typically, no water releases occur on Sunday, and, as a result, the Tuolumne River is mostly unrunnable on Sunday. Many commercial operators have adapted their weekend trips to include an off-river hiking day on Sunday. However, the absence of a Sunday release has a greater impact on private users, who generally value weekend recreational opportunities for whitewater use of the river.

Whitewater Recreational Use

As shown in **Table 5.3.8-3**, whitewater use of the Tuolumne River varies considerably from year to year. Over the last 10 years, an average of 6,000 people per year boated on the river. In recent years, use has been limited by the water release schedules from Hetch Hetchy Reservoir and Lake Lloyd. In 2005, water releases were halted on August 21 so that maintenance could be performed on upstream dam facilities. According to commercial boaters, many additional river trips would otherwise have occurred on the Lumsden Run. In 2001, during the height of the California energy crisis, water releases were only delivered between July 2 and August 11. The shortened rafting season resulted in many trip cancellations during June and later in August and early September of that year.

TABLE 5.3.8-3
ANNUAL BOATER USE ON THE TUOLUMNE RIVER
(1984–2005)

Year	Lumsden Run			Cherry Creek Run			Total		
	Commercial	Private	Total	Commercial	Private	Total	Commercial	Private	Total
1984	3,751	4,410	8,161	86	390	476	3,837	4,800	8,637
1985	3,536	3,540	7,076	366	620	986	3,902	4,160	8,062
1986	3,729	3,240	6,969	90	290	380	3,819	3,530	7,349
1987[a]	–	–	–	–	–	–	–	–	–
1988	1,778	1,605	3,383	37	410	447	1,815	2,015	3,830
1989	2,725	2,469	5,194	138	428	566	2,863	2,897	5,760
1990	3,012	2,120	5,132	169	519	688	3,181	2,639	5,820
1991	2,049	2,437	4,486	123	506	629	2,172	2,943	5,115
1992	2,801	2,164	4,965	218	664	882	3,019	2,828	5,847
1993	4,149	3,051	7,200	182	564	746	4,331	3,615	7,946
1994	3,641	3,323	6,964	294	1,169	1,463	3,935	4,492	8,427
1995	2,940	1,829	4,769	141	560	701	3,081	2,389	5,470
1996	3,095	2,600	5,695	141	614	755	3,236	3,214	6,450
1997	3,722	3,181	6,903	264	1,297	1,561	3,986	4,478	8,464
1998	2,729	1,572	4,301	102	964	1,066	2,831	2,536	5,367
1999	3,087	1,858	4,945	111	593	704	3,198	2,451	5,649
2000	4,446	2,615	7,061	254	1,282	1,536	4,700	3,897	8,597
2001	1,676	1,344	3,020	164	1,071	1,235	1,840	2,415	4,255
2002	2,999	2,211	5,210	150	1,311	1,461	3,149	3,522	6,671
2003	2,639	1,676	4,315	140	730	870	2,779	2,406	5,185
2004	2,634	1,899	4,533	161	513	674	2,795	2,412	5,207
2005	2,516	1,302	3,818	109	362	471	2,625	1,664	4,289
Average (1995–2005)	**2,953**	**2,008**	**4,961**	**158**	**845**	**1,003**	**3,111**	**2,853**	**5,964**

[a] Drought conditions prevented whitewater recreation in 1997.

SOURCE: USFS Groveland Ranger District, 2006b.

The majority of Tuolumne River whitewater recreation occurs on the Lumsden Run; only 17 percent of whitewater users boated the Cherry Creek Run. Since many visitors take multiple day trips down the Lumsden Run, this run accounts for an even greater proportion of whitewater recreation user days. The length of stay for both private and commercial users on the Lumsden Run averages 1.8 days. Between 1995 and 2005, the total whitewater user days on the Tuolumne River averaged 9,930 per year, of which the Lumsden Run accounted for 90 percent of the user days.

The majority of whitewater river use on the Tuolumne is by rafters. Only limited statistics on kayak use are available, but the number of annual commercial kayak trips is very small (Welch, 2006). In 2005, total kayak use among private users was approximately 44 percent, which is equivalent to 17 percent of all boaters. Although late summer rafting use was reduced due to the cessation of water releases in late August 2005, this proportion of kayak use is considered generally representative of typical river use.

A USFS analysis of Tuolumne River whitewater recreation between 1980 and 2000 concluded that total boater use on the Lumsden Run appeared to be stable, although use fluctuated considerably from year to year. Private boater use on the Lumsden Run was found to be decreasing. Over the 20-year study period, boating use was found to be relatively evenly split between commercial and private users, although since 1992 commercial use has been consistently higher than private use (this trend continued through 2005) (Norman, 2001). Between 1998 and 2000, the analysis also found commercial use to be about 30 percent higher than private use. This trend has also generally continued in the subsequent years.

While the USFS determined there were no statistically significant trends in total use (as can be seen in Table 5.3.8-3), peak use levels (6,900 users or more) have been attained periodically over the last 20 years (1984–1986, 1992–1993, 1997, and 2000) that are far higher than the average use levels between 2001 and 2005. Over the last five years, total use of the Lumsden Run has averaged 4,180 users. While reductions in river flows and releases have contributed to lower use numbers, a reduction in Groveland ranger staff since 1999 has significantly reduced permit compliance monitoring at Meral's Pool. Therefore, actual private boater levels may be significantly higher than reported. USFS analysis for a comparable management situation in Georgia determined that additional non-permit use was about 25 percent of permit use levels (Norman, 2001).

For the Cherry Creek Run, private use was found to be steadily increasing, while commercial use remains limited and stable.

The USFS statistical analysis found no significant correlation between seasonal flow averages and the private or commercial use levels for either of the two runs. However, this analysis did not examine actual daily flow levels. On high-demand weekend days, flow levels could affect user demand. However, only limited monthly river use data are available from the USFS. **Table 5.3.8-4** shows the reported monthly private boater use on the Lumsden and Cherry Creek Runs.

TABLE 5.3.8-4
PRIVATE BOATER USE BY MONTH
(1990–2002)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Lumsden Run													
May	598	783	868	515	841	76	231	321	268	273	283	297	345
June	783	786	678	476	812	255	603	757	110	204	500	47	706
July	395	582	459	839	678	246	850	901	217	821	813	680	576
August	165	286	0	614	471	887	443	850	752	407	635	320	547
September	21	0	0	302	111	365	226	303	225	153	384	0	34
Total	**1,962**	**2,437**	**2,005**	**2,746**	**2,913**	**1,829**	**2,353**	**3,132**	**1,572**	**1,858**	**2,615**	**1,344**	**2,208**
Cherry Creek Run													
May	139	48	14	5	0	0	0	0	10	0	0	40	12
June	149	112	176	263	0	0	0	8	0	6	0	33	60
July	159	213	186	44	298	0	132	450	0	206	422	555	385
August	68	116	288	224	413	297	292	433	395	194	421	443	718
September	4	17	0	291	69	263	190	406	559	193	433	0	136
Total	**519**	**506**	**664**	**827**	**780**	**560**	**614**	**1,297**	**964**	**599**	**1,276**	**1,071**	**1,311**

SOURCE: USFS Groveland Ranger District, 2006b.

The USFS analysis determined that the highest private boater demand for whitewater recreational use of the Lumsden Run occurred in drier years earlier in the season (typically May through July), while in wet years, the highest demand occurred in the summer during the months of July and August. However, rather than reflecting user preferences, this finding may simply represent the availability of adequate water flows for recreational use of the river.

Commercial Rafting. Commercial rafting on the Tuolumne River began in the 1970s under permits issued by the Stanislaus National Forest. Commercial use of both the Cherry Creek and Lumsden Runs is allowed only through special-use permits issued by the USFS. There are seven commercial outfitters permitted to operate commercial rafting trips down the river. Total commercial use by these outfitters is limited to two commercial trips per day. Each of these trips is limited to a maximum of 26 passengers (each trip typically includes six guides, so there are 20 customers per commercial trip). The Groveland Ranger District is responsible for administration and oversight of the commercial operators. Although a few commercial trips are taken down Cherry Creek Run each year, the vast majority of commercial rafting occurs on the Lumsden Run (approximately 95 percent of passengers). Furthermore, since many of the commercial trips are multiday trips, an even greater proportion of the commercial operators' revenues are based on Lumsden rafting trips (USFS, 2007b).

Most of the rafting companies also operate trips on other rivers in California, although a few are small companies that primary rely on Tuolumne River trips for the majority of their business. Several of the Tuolumne operators are large rafting companies that offer river trips throughout the West and even internationally.

Commercial use has declined in recent years, in part due to the reduced water releases and flow conditions. Between 2001 and 2005, commercial use of the Tuolumne River averaged 2,640 boaters and 4,620 user days, which represents a decrease of approximately 15 percent from the 1995 to 2005 average commercial boating levels of 3,111 users (see Table 5.3.8-3).

Private Rafting. Rafters wishing to run the Lumsden and Cherry Creek Runs are required to obtain a private boater permit by telephone or in person from the USFS Groveland Ranger Station. Permits can be booked in advance and are limited to a maximum of 90 people launching per day for the Lumsden Run. There are currently no limits on private use of the Cherry Creek Run.

Private use has declined in recent years, in part due to the reduced water releases and flow conditions. Between 2001 and 2005, private boater use of the Tuolumne River averaged 2,485 passengers and 3,760 user days. During that period, private boater use of the Lumsden Run averaged 1,690 passengers and 2,960 user days. This recent decline in total private boaters is about 13 percent of the 1995 to 2005 average levels.

Other Water and Off-Water Recreational Resources

In addition to whitewater use, recreationists also hike, camp, and fish within the Tuolumne River above Don Pedro Reservoir. While a major proportion of whitewater users participate in these

other recreational activities as part of their trip, many park visitors come solely to enjoy the area's non-whitewater resources. Due to its relatively remote location, many visitors camp overnight in the area as part of their trip. The majority of camping along this section of the Tuolumne River occurs at designated sites. There are three developed campgrounds along the National Forest portion of the Wild and Scenic Tuolumne River corridor. Camping is free, but the campgrounds are only open from April to October. Access to the three developed campgrounds is via a five-mile-long steep dirt road that is unsuited to trailers or motor homes. The Lumsden Bridge Campground offers the farthest upstream opportunity for developed camping. There are nine campsites, two vault toilets, grills, and tables for users at the campsite. The South Fork Campground, located near the confluence of the Tuolumne River and its south fork tributary, is approximately two miles below the Lumsden Bridge Campground site. The South Fork Campground has eight campsites, two vault toilets, grills, and tables for users. The Lumsden Campground is located a mile downstream of the South Fork Campground and consists of 11 campsites with grills and tables. There are also four vault toilets at the site.

Over a dozen undeveloped campsites are dispersed along the Tuolumne River below the Meral's Pool launch site. These sites are used by whitewater boaters as well as hikers in the area. However, hiking use along the river within most of the Tuolumne River valley is relatively limited, since there are no improved trails and the hiking conditions are difficult.

Below Hetch Hetchy Reservoir, the principal hiking trails along the Tuolumne River are the Preston Flat and Tuolumne River Canyon Trails. The Preston Flat Trail parallels the north side of the Tuolumne River upstream from the Early Intake. The trail is 4.5 miles long and is of average difficulty, with an elevation gain of 400 feet over its course. The trail generally runs near the riverside and is predominantly used by anglers to access the river. Most trail use occurs at the start of the trout season and during the late spring and early summer, when wildflowers are present and the weather is not too hot. However, even during the most popular periods, trail use is typically only about 30 to 40 visitors per day. While the canyon is generally sparsely forested, sections of the north side are moderately to densely vegetated, especially near the river's edge (USFS, 2006b).

The Tuolumne River Canyon Trail is considerably more strenuous and hiked less frequently. The trail starts a half mile from the Lumsden boat launch and follows the south side of the Tuolumne River down to its confluence with the Clavey Trail. The trail is six miles long and generally runs along the canyon sides several hundred feet above the riverbed. The steep slopes of the canyon are sparsely vegetated, although during the late spring and early summer wildflowers cover much of the hillsides.

The area's visual resources generally consist of a narrow and rocky riparian valley with limited vegetation. Much of the mostly steep-walled, V-shaped canyon is bare of vegetation. Some trees grow within the narrow floodplain on the river's edge. Along much of the river's course, a narrow band of trees stands along the riverside, while larger groupings of trees and other vegetation are occasionally present at the outer bends for river where adequate river sediment has accumulated. When the river contains sufficient flow, it provides an abundant variety of water forms, including

rapids, cascades, waterfalls, and pools. When flow is sufficient, these water forms as well as the dramatic geological formations define the visual setting throughout most of the Tuolumne River's course.

Don Pedro Reservoir and Recreation Area

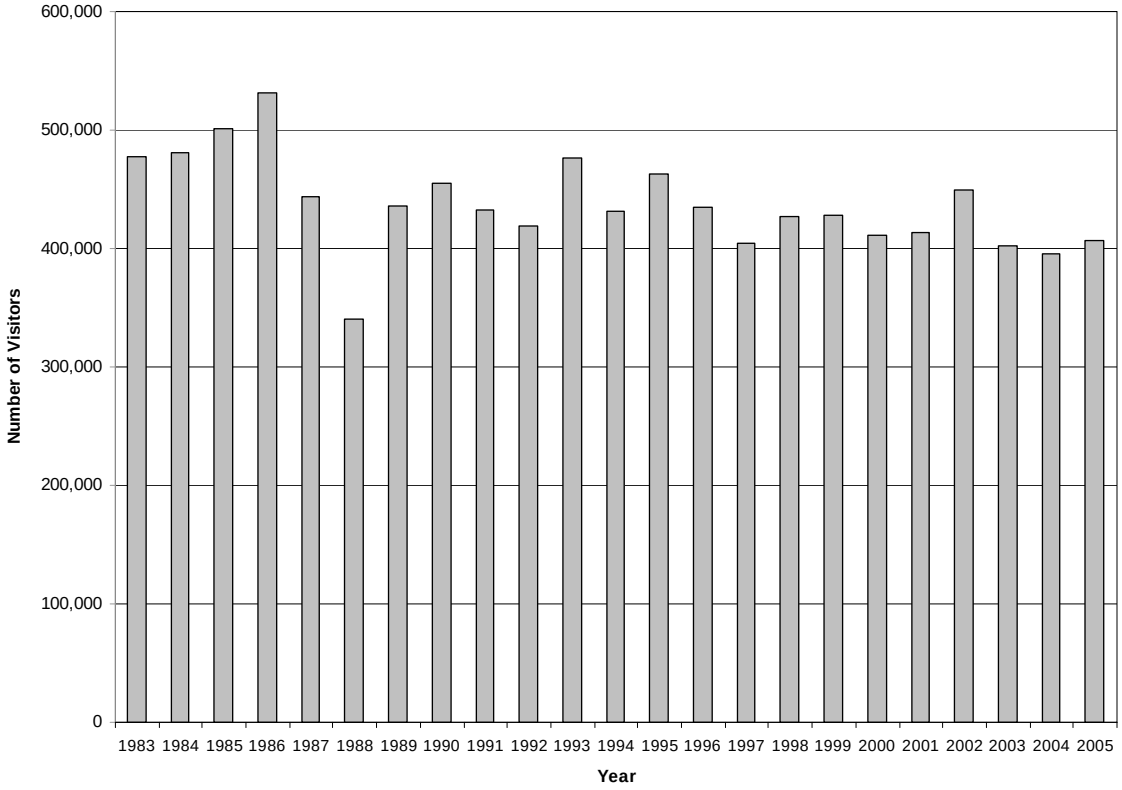
The Don Pedro Reservoir and Recreation Area is located on the Tuolumne River near the western border of Tuolumne County. The reservoir is primarily managed by the Don Pedro Lake Recreation Agency and TID. The Don Pedro Recreation Agency is an independent agency supervised by a board of directors made up of representatives from the TID, MID, and SFPUC. TID provides administrative support and day-to-day supervision. The reservoir provides 160 miles of shoreline and 13,000 surface acres of water at its maximum pool elevation of 830 feet above mean sea level (msl). Don Pedro Reservoir is the fifth largest reservoir in California.

Water recreation at Don Pedro Reservoir includes boating, swimming, waterskiing, jet skiing, windsurfing, sailing, house-boating, fishing, and boat-in camping. Boat launch facilities are located at the Fleming Meadows Recreation Area on the southern shoreline, Blue Oaks Recreation Area on the southwestern shoreline, and Moccasin Point Recreation Area on the northeastern arm of Moccasin Bay. Two full-service marinas (i.e., with docks, boat slips, mooring areas, and provisions) are located at the Flushing Meadows and Moccasin Point Recreation Areas. In addition, there are 257 privately owned houseboats and 20 rental houseboats on Don Pedro Reservoir (USBR, 1999).

Boating and waterskiing take place throughout the reservoir; swimming occurs mainly at the Fleming Meadows swimming lagoon, a two-acre pool separated from the main reservoir. The lagoon has a maximum depth of 6 feet and is surrounded by a sandy beach area. Anglers fish from the shore and boats, mainly for non-native bass, trout, salmon, crappie, bluegill, and catfish. The CDFG plants the lake with species such as brook trout from the San Joaquin River Hatchery, and sub-catchable rainbow and brown trout from the Moccasin Creek Hatchery, which is upstream from Don Pedro Reservoir on Moccasin Creek.

Off-water recreation at Don Pedro Reservoir includes picnicking, camping, and sightseeing. There are a total of 550 campsites at the Fleming Meadows, Blue Oaks, and Moccasin Point Recreation Areas (Don Pedro Recreation Agency, 2007). Don Pedro is by far the largest and most popular recreation destination along the Tuolumne River system. **Figure 5.3.8-5** shows visitation at Don Pedro Reservoir since 1983. Annual visitation at the reservoir is typically more than 400,000 visitors, and even exceeded half a million in 1985 and 1986. Between 1983 and 1999, average reservoir visitation averaged approximately 446,000 per year. However, visitation has declined slightly since that time, averaging approximately 413,800 since 2000. Don Pedro Reservoir attracts considerable visitation from the Bay Area and Sacramento, and many visitors stay for several days or a week at a time (Jackson, 2006).

Beach use at Don Pedro Reservoir generally begins to decline once its elevation falls below 790 feet msl (i.e., 40 feet below its maximum pool elevation of 830 feet msl). Use of the reservoir



SFPUC Water System Improvement Program / *203287* ■

SOURCE: Don Pedro Recreation Agency, 2006.

Figure 5.3.8-5
Don Pedro Reservoir Annual Visitation

declines moderately until the 750-foot level, below which use then begins to decrease more considerably. The Fleming Meadows boat ramp is out of operation when water levels fall below 600 feet msl (minimum pool). Between 710 feet and 600 feet msl, five of the reservoirs boat ramps are lost. The Moccasin Point boat ramp cannot be used below an elevation of 722 feet msl, and the Blue Oaks boat ramp cannot be used below 726 feet msl. The Fleming Meadows and Moccasin Point marina operations are limited when water levels fall below 600 and 630 feet msl, respectively. The swimming lagoon is used at all reservoir water surface elevations because it is separated from the main reservoir, and water is pumped from the reservoir into the lagoon to maintain water levels (USBR, 1997).

Don Pedro Reservoir's visual setting is characterized by its numerous long expanses of flatwater that stretch through a series of narrow valleys and inlets. The Sierra Nevada foothills surround the reservoir, rising gradually from its shoreline and giving wide and open views. The hillsides are largely covered by trees interspersed with grassland areas that remain unvegetated during the dry summer months. As the water level falls, an unvegetated ring around the entire reservoir is clearly visible.

Stanislaus County

The Tuolumne River continues through Stanislaus County for approximately 52 miles below Don Pedro Reservoir to the confluence with the San Joaquin River. This reach crosses mainly private open space and grazing lands, City of Modesto property, and several public parks. The principal recreational resources related to the Tuolumne River are described below.

Water recreation includes fishing, boating, rafting, and some swimming. These activities are dispersed along the river corridor and primarily depend on the availability of river access. No single public agency has comprehensively estimated recreational use along the river and, as a result, there is very limited recreation data for this reach of the river. Nonetheless, as with most recreational activities, summer is the peak season, and the majority of use occurs between Memorial Day and Labor Day. During the nonpeak season, winter and early spring use of the river is very limited.

The primary game fish in this stretch of the Tuolumne River are rainbow and brown trout, largemouth and smallmouth bass, striped bass, and Chinook salmon. The fishing season is from late April to mid-October; anglers are required to use barbless hooks and to release their trout catches, and are permitted to keep one salmon if it is caught in the lower reaches of the river. Between mid-October and the end of December, the CDFG increases enforcement of its fishing regulations at popular local fishing sites to protect the winter salmon run (CDFG, 2006a). The USBR has determined flow thresholds for boating recreation on the lower Tuolumne River. According to the USBR, the optimal flow range for boating activities is from 400 to 700 cfs. For swimming use, the optimal flows are between 200 and 600 cfs. Critical flows for power boating on the river occur below 500 cfs, and for canoeing and kayaking occur below 150 cfs (USBR, 1999).

La Grange Regional Park

La Grange Regional Park consists of 700 acres at 11 different sites, including an off-highway vehicle park, a Kiwanis Youth Camp, and the Joe Domecq Wilderness Area. The park has a boat ramp and a riverside picnic area as well as 225 acres of mostly undeveloped river plain areas along the Tuolumne River. Other park facilities include parking, restrooms, gravel beach area for swimming, trails and pathways, and handicapped access. Overnight camping is prohibited within the park. The majority of fishing and other river-related uses within the park take place at the Basso Bridge site, where there are approximately two acres of parkland on the river. Fishing at the river is prohibited between mid-October and the end of December to protect adult spawning salmon (Stanislaus County Department of Parks and Recreation, 2006). The visual setting of La Grange Regional Park is characterized by wide forested floodplain terraces, with some open space and turf areas. The river runs wide along major portions of its course downstream. Other parts of the park include less vegetated areas located on the dredge tailings from former gold mining operations (mostly on the northern side of the river).

Turlock Lake State Recreation Area

Turlock Lake State Recreation Area is located on the south side of the Tuolumne River, approximately 25 miles east of Modesto. Turlock Lake has 26 miles of shoreline and a surrounding area of 228 acres that is leased from TID. All of the park's 63 campsites are located in the northern area overlooking or near the Tuolumne River. Although no recreational vehicle hookups are provided, the campsites can accommodate 27-foot vehicles; each site is equipped with a grill, table, and food locker and is near to potable water, showers, and flush toilet facilities (California Department of Parks and Recreation, 2006). The park's annual visitation over the last few years has been approximately 69,000 visitors, of which more than three-quarters were day users.

There is about a mile of Tuolumne River shoreline within the park; however, the majority of the park's recreational facilities and opportunities are located lakeside. While park users can access the river, there is no beach area and most visitors instead recreate at the lake. Relatively few park visitors fish in the river due to CDFG regulations, which do not apply on the nearby Lake Turlock. The primary river-related recreation at the park occurs during the late summer, when park visitors occasionally "float" the river with inflatable rafts or inner tubes. In contrast, Turlock Lake offers a wide range of recreational opportunities, including camping, fishing, picnicking, swimming, boating, and water skiing. Lakeside recreational facilities consist of two formal picnic areas (each with nearby parking and toilet facilities), a boat launching ramp, and a swim area (although no lifeguards are on duty). As a result, the majority of the non-camping recreational use is lake-related.

The park's visual setting is similar to that of La Grange Regional Park, comprising a primarily open view of the flat, forested river floodplain within mostly undeveloped land. The river and its adjacent sloughs are forested by numerous native tree species, including interior live oak, cottonwood, and white alder. The broad riparian areas are also vegetated with underbrush that provides habitat for many birds and animals.

Fox Grove Regional Park

Fox Grove Regional Park encompasses approximately 64 acres along a one-mile river frontage, providing fishing access to the Tuolumne River. The park has a boat ramp, river access, barbecues, and picnic tables, and disabled access to the park is provided. The river runs deeper at Fox Grove than at the area's other popular river and fishing access site at Basso Bridge; as a result, flat-bottomed boat use is typically allowed at Fox Grove throughout the summer. Public access to the site is generally prohibited by the Stanislaus County Department of Parks and Recreation between mid-October and the end of December to protect the winter salmon run (Stanislaus County Department of Parks and Recreation, 2006). The visual setting at Fox Grove Regional Park is very similar to that at Turlock Lake State Recreation Area.

Tuolumne River Regional Park

The proposed Tuolumne River Regional Park lies along a seven-mile stretch of the Tuolumne River and encompasses approximately 500 acres of land (EDAW, 2005). Stanislaus County, the City of Modesto, and the City of Ceres have partnered to commence development of this project, and park plans are currently in environmental review. The majority of the parkland is located on

the north side of the river, with the exception of Mancini Park and a series of small, riverfront parcels near the western end of the park.

Approximately 180 acres of the parkland has already been developed for recreational purposes, including open lawn areas within mature tree canopies as well as park amenities (e.g., park benches, picnic tables, trails, restrooms, and parking areas). The Dryden and Modesto Municipal Golf Courses are included as part of the city of Modesto's greenway areas for the park. The privately owned River Oaks Golf Course is also located along the southern bank of the river east of the Modesto Airport. However, recreational use of these golf courses is sport-focused and therefore non-river-related.

The eastern section of the park near the Modesto Airport is already developed for park use. The neighboring 50-acre Legion Park has mowed lawns, picnic tables, barbecue sites, and restrooms and is occasionally used for community special events such as the annual Cinco de Mayo celebration and Scottish Games. Mancini Park is located on the southern bank of the river and consists of 25 acres, including a children's play area, ball field, restrooms, and parking area. There is no river access from the park, and the remaining 320 acres are unimproved open space. The developed parkland areas include open space and turfed areas with scattered trees that provide shade. Sections of the park are heavily vegetated by trees and underbush that hide much of the nearby housing and other urban development. However, the majority of the undeveloped areas contain little vegetation, with much of the land consisting of denuded open or disked farmland (Tuolumne River Regional Park, 2007).

Future development of the park, proposed under the *Tuolumne River Regional Park Master Plan,* aims to restore a continuous riparian corridor along the river as well as develop a riverside bicycle and pedestrian trail. The plan also proposes to add river access at Legion Park and develop a regional sports complex in the Carpenter Road area (although this development is to be planned and approved separately from the master plan). The majority of the master plan's future park improvements would be located at the Gateway parcel site. These planned improvements include a river promenade trail and internal trail system, multi-use meadows suitable for community events and informal park activities, wetland areas for stormwater runoff, removal of Dennett Dam, a pedestrian bridge connection to the western parkland across Dry Creek, new parking, an "amphimeadow" (a grassy, outdoor amphitheater within a natural, meadow-like setting), and river access piers. Special events at the amphimeadow, construction of the river piers, and Dennet Dam removal are planned as subsequent projects to the master plan.

5.3.8.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to recreational and visual resources, but generally considers that implementation of the proposed program would have a significant impact if it were to:

Recreation

- Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated (Secondary impacts of growth are evaluated in Chapter 7, Growth-Inducement Potential and Indirect Effects of Growth)

- Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment (Secondary impacts of growth are evaluated in Chapter 7)

- Physically degrade existing recreational resources

The first two criteria do not apply to the analysis of the proposed water supply and system operations component of the WSIP presented in this section of the PEIR, because these components of the proposed program would not increase the use of existing parks, nor would they require the construction or expansion of recreational facilities. Therefore, only the third criterion (potential physical degradation of existing recreational resources) is considered in the impact analysis below. The physical degradation of existing resources could occur if the WSIP were to:

- Remove or damage existing recreational resources

- Cause environmental impacts (such as air quality or noise effects) that would indirectly result in deterioration in the quality of the recreational experience

- Disrupt access to existing recreational facilities (which would divide a community from some of the established amenities used by its members)

While impeding a visitor's ability to participate in recreational activities does not in itself qualify as an environmental effect under CEQA, visitor use impacts can serve as indicators of physical changes to a recreational resource.

For visual resources, significant impacts could occur if the WSIP were to:

Visual Quality

- Have a substantial adverse effect on a scenic vista

- Substantially damage scenic resources, including but not limited to trees, rock outcroppings, and other features of the built or natural environment, that contribute to a scenic public setting

- Substantially degrade the existing visual character or quality of the site and its surroundings

Approach to Analysis

The analysis of impacts on recreation generally distinguishes between recreational activities associated with the rivers and reservoirs (e.g., swimming, boating, and fishing) and off-water recreation (e.g., hiking, picnicking, and camping). However, recreational activities are not

separately identified, except for whitewater rafting, which is discussed separately and in greater detail due to the potential magnitude of impacts and the unique factors related to this recreational use of the Tuolumne River.

River-related recreational use within the Tuolumne River system predominantly occurs during the summer season between Memorial Day and Labor Day. In addition, there are relatively short shoulder seasons after mid-April and late October. During the off-season from November to mid-April, there is very limited river-related recreational use. Therefore, the primary focus of this impact analysis is on the summer season, when the majority of recreational activity occurs.

This analysis also considers potential visual impacts of the WSIP. Due to the Tuolumne River's limited accessibility and visibility, any visual or aesthetic changes to the river would predominantly affect recreation users; therefore, this analysis evaluates potential program-related changes in the quality of the visual experience for recreation users. The predominant visual effect that could occur at reservoirs under the WSIP involves the "bathtub ring" at reservoirs that are also used for recreational purposes. The bathtub ring refers to the exposed shoreline below the maximum water surface elevation, which is usually devoid of vegetation. This effect is a normal and unavoidable occurrence at reservoirs as water levels decline. Nonetheless, the WSIP would reduce reservoir water levels for longer periods and thus could diminish aesthetic values at program area reservoirs. The magnitude, incidence, and duration of future changes in the reservoirs' aesthetic values are qualitatively assessed as part of this analysis.

As noted above, the changes in river recreation that could result from the WSIP are consequences of changes in stream flow and reservoir water levels. These WSIP-induced changes in stream flow and reservoir water levels were estimated using the HH/LSM. An overview of the model is presented in Section 5.1. Detailed information on the model and the assumptions that underlie it is provided in Appendix H.

Impact Summary

Table 5.3.8-5 presents a summary of the impacts on recreational and visual resources in the Tuolumne River system that could result from implementation of the proposed water supply and system operations.

TABLE 5.3.8-5
SUMMARY OF IMPACTS –
RECREATIONAL AND VISUAL RESOURCES IN THE TUOLUMNE RIVER SYSTEM

Impact	Significance Determination
Impact 5.3.8-1: Effects on reservoir recreation due to changes in water system operations	LS
Impact 5.3.8-2: Effects on river recreation due to changes in water system operations	LS
Impact 5.3.8-3: Effects on the aesthetic values of the Tuolumne Wild and Scenic River	LS

LS = Less than Significant impact, no mitigation required

Impact Discussion

Impact 5.3.8-1: Effects on reservoir recreation due to changes in water system operations.

Lake Eleanor

The WSIP would have very little effect on water levels or water quality in Lake Eleanor, as described in Sections 5.3.1 and 5.3.3. Therefore, recreational impacts at Lake Eleanor would be less than significant.

Hetch Hetchy Reservoir

The WSIP would result in an average monthly lowering of reservoir water levels by an additional 1 to 10 feet over the course of the year compared to the existing condition. During the primary recreation season (between Memorial Day and Labor Day), the WSIP-related decrease in reservoir depth would be less than 5 feet from current levels except in critically dry years, when up to a 10-foot drop in reservoir levels would be expected. In average wet to normal hydrologic years, no change in reservoir levels would occur during the months of May through July; therefore, under these conditions, no recreational impact would result.

Off-water activities such as hiking and camping are the predominant recreational use at Hetch Hetchy Reservoir, since no swimming or boating is permitted. During the summer season for non-dry years, the drop in reservoir levels would increase the size of the "bathtub ring" visible to hikers by up to 4 feet; however, this increase would not likely be perceptible to most hikers, even in foreground views. Furthermore, during most of the year, Hetch Hetchy Reservoir would appear as it does a week or so earlier under current operating conditions. Between October and late December, visual conditions at the reservoir would be typical of those seen a month later under current conditions.

Only during the period between January and March would average reservoir levels at Hetch Hetchy fall lower than they normally do under the current operating conditions. On average, the maximum extra decrease in reservoir depth would be 10 feet in March, which would represent an approximate 15 percent increase to the reservoir's current average 65-foot drawdown. This additional drawdown could be noticeable in foreground views; however, in views across the reservoir, the increase would likely be imperceptible to most hikers. This visual impact would only occur during the off-season, when visitation to the reservoir is low. Furthermore, the bathtub ring is a typical feature of an operating reservoir and would be a familiar sight for hikers at the reservoir. Therefore, recreational impacts at Hetch Hetchy Reservoir would be less than significant.

Lake Lloyd

The potential WSIP-related impacts on Lake Lloyd would be limited. During normal and below-normal hydrologic years, no changes in the reservoir's current operations would occur, and no recreational impacts would result.

During wet or above-normal hydrologic years, future reservoir depths would generally be reduced by 1 or 2 feet; this reduction in the reservoir's depth (less than 1 percent) would be imperceptible

to recreational users. Furthermore, no reservoir level reductions would occur during the months of June through September, when the majority of the recreational use occurs. Therefore, no impacts on recreation would result.

During the summer season of critically dry hydrologic years, Lake Lloyd's depth would be expected to decrease by a maximum of 3 or 4 feet from current levels. However, this drop in reservoir levels (less than 2 percent) would be imperceptible to water and off-water recreational users. Furthermore, the conditions for fish species inhabiting the lake would not be affected by the WSIP. These non-native fish species are acclimated to the water-level fluctuations that occur in the reservoir, and thus impacts on the lake's recreational fishery are expected to be less than significant. Use of Lake Lloyd by other water recreationists for swimming or boating would also not be impaired. Therefore, recreational impacts at Lake Lloyd would be less than significant.

Don Pedro Recreation Area

With an average of more than 400,000 visitors a year, Don Pedro Reservoir is the most popular recreational resource in the Tuolumne River system that could be affected by the WSIP. The program's proposed increase in water withdrawals from the Tuolumne River would result in lower reservoir levels, varying on average up to 4 to 6 feet lower during above-normal or wet hydrologic years over the course of the year.

During below-normal, dry, and critically dry hydrologic years, water levels in Don Pedro Reservoir would be expected to fall up to 7 to 10 feet below current levels during the May to September recreational season. The reservoir's full depth is 530 feet (with a dead pool depth[2] of 230 feet below the maximum pool level). The average decrease in water levels from current levels would be less than 1 percent, and the decrease during dry years would be approximately 2.1 percent. Given the large annual fluctuation in the reservoir's depth both during the year and between years, these decreases in reservoir levels are likely to be barely perceptible to most recreational users. Water level changes are more likely to be noticed by on-water recreational users than by off-water recreationists at the reservoir.

Past recreational studies of Don Pedro Reservoir identified a threshold of 490 feet (i.e., a 40-foot decrease from the maximum elevation) below which recreational use of the beaches declined. However, only at levels below 450 feet (i.e., 80 feet below maximum pool) would recreational use decrease considerably. All of Don Pedro's recreational facilities nonetheless remain fully operational until the reservoir depth falls to 426 feet (i.e., 104 feet below maximum pool), at which point the Blue Oaks boat ramp is no longer operational, and 422 feet (i.e., 108 feet below maximum pool), at which point the Moccasin Point boat ramp is no longer operational (USBR, 1997). Critical thresholds are also reached when water levels decrease to the point that reservoir water levels recede from hiking trails, campsites, and picnic areas. A water-level decrease below the 426-foot threshold would impair use of the lake and limit reservoir access.

Under the proposed water withdrawal schedule (as shown in **Figure 5.3.8-6**), even at its lowest levels during the months of October and November, Don Pedro Reservoir would typically remain

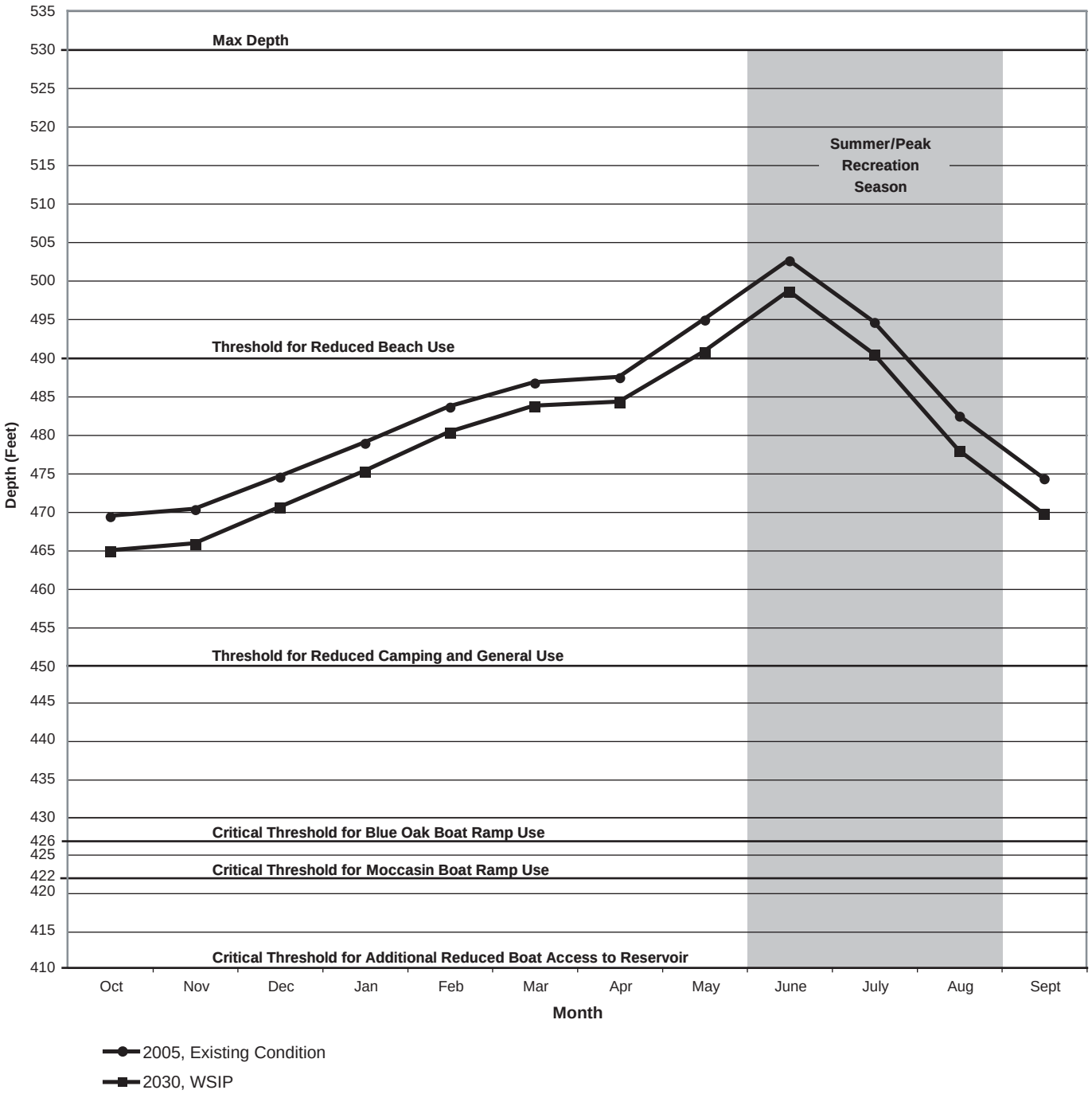
[2] Dead pool is the depth beyond which the reservoir cannot be drained.

more than 15 feet above the 450-foot threshold, below which recreational use would begin to decline significantly. Average annual reservoir levels would be 490 feet or above during the summer months of June and July, when the majority of recreational use occurs; this level is more than 40 feet above the threshold for significant recreation impacts and 64 feet above facility-use impacts. In August, the reservoir's levels would typically fall an additional 4 feet with the WSIP, but would still be 488 feet—well above the 450 foot-threshold level. Because future reservoir levels in most years are expected to remain well above the threshold for adverse effects on recreational visitation, no significant impacts on recreational use at Don Pedro Reservoir are expected.

However, following a succession of dry years, the reduction in summer storage in Don Pedro Reservoir could increase the likelihood of adverse recreation impacts. Effects on Don Pedro's water levels associated with WSIP operational changes for the summer recreation season (i.e., June through August) were projected based on the available 82-year hydrologic record. Currently, out of 82 years, there were 13 months during the summer period (June through August) when water levels at Don Pedro Reservoir would have been below the 426-foot threshold (at which the Blue Oaks boat ramp becomes unusable). Under the proposed program, the incidence would increase to 24 summer months over the 82-year period. The 12-month increase represents an approximate doubling in the amount of time boat ramp facilities would be physically impaired (equivalent to 1 out of every 20 years). However, at reservoir depths below the 450-foot threshold, boat ramp use would be reduced but would continue to be possible. At 422 feet, the Moccasin Point ramp would not be usable. Another boat ramp access point would be unavailable at 410 feet. Currently, reservoir levels would fall below this threshold a projected 9 summer months out of 82 years. Under the WSIP, future Don Pedro levels would fall below this threshold for 13 summer months—an increase of 4 months.

Therefore, future operations under the WSIP are expected to reduce access to boating facilities. However, given the limited frequency of the impacts (which would occur only in extended drought periods) and the limited lost boating ramp use (since both marinas and most boat ramps would continue to function adequately), the impact on boating due to Don Pedro's increased vulnerability to drought effects would be less than significant.

Recreational fishing would not be affected by the WSIP, as the non-native fish populations in Don Pedro Reservoir can tolerate the changes in reservoir levels. Largemouth bass and bluegill, which are a popular catch for anglers, use the lakeshore as spawning ground during the springtime; however, effects on fishing as a result of the WSIP would be less than significant.



SFPUC Water System Improvement Program . 203287

SOURCE: ESA, 2006

Figure 5.3.8-6
Don Pedro Reservoir Annual Average Reservoir Depth and Recreational Uses

Off-water activities such as hiking and camping are more indirectly related to reservoir levels. The program-related drop in reservoir levels would increase the size of the bathtub ring visible to hikers, campers, and other reservoir users by up to 7 feet in foreground views (i.e., during the summer season of drier-than-average hydrologic years). This increase would likely be noticeable only to reservoir users who are very familiar with the reservoir. Furthermore, during most of the year, Don Pedro Reservoir would appear as it does two weeks or so earlier under current operating conditions. Between October and late December, visual conditions at the reservoir would be typical of those seen a month later under current conditions.

Only during the period between October and November would average reservoir levels at Don Pedro fall lower than they do under current operations. The visual impact associated with the bathtub ring would occur in the off-peak season only, when visitation to the reservoir is low. On average, the decrease in reservoir depth would be approximately 4 feet, which would represent a less than 10 percent increase in the reservoir's current average 45-foot drawdown over the year. This additional drawdown could be noticeable in foreground views; however, in views across the reservoir, the increase would not likely be very noticeable to most reservoir users. Furthermore, the bathtub ring is a typical feature of an operating reservoir and would be a familiar sight for frequent visitors to the reservoir. If fish were spawning along the reservoir shoreline during the spring, the increase in reservoir drawdown would have the potential to affect only a limited number of spawning grounds. Therefore, recreational impacts at Don Pedro Reservoir associated with WSIP operational changes would be less than significant.

Summary of Impacts

Overall, implementation of the proposed WSIP water supply and system operations would result in *less than significant* impacts on reservoir recreation.

Impact 5.3.8-2: Effects on river recreation due to changes in water system operations.

Diversion of additional water from the Tuolumne River as a result of the WSIP could affect the availability of water for whitewater rafting uses in the upper reaches of the river. It could also decrease stream flow in lower reaches of the river, thereby reducing opportunities for (and the quality of recreational experiences at) existing and planned parks and recreational facilities located at the river's edge, such as the Tuolumne River Parkway, a 500-acre parkway to be sited along a seven-mile stretch of the Tuolumne River in the Modesto area.

Whitewater Recreation

Hetch Hetchy Reservoir and Lake Lloyd are usually drawn down to their seasonal minimum in the spring. The SFPUC captures some of the late spring/early summer snowmelt runoff to refill the reservoirs and releases the rest to the Tuolumne River and Cherry Creek.

Flow in the Tuolumne River just below the confluence with Cherry Creek, and just downstream of the launching point for the Cherry Creek whitewater run, consists of releases and spills from

Hetch Hetchy Reservoir, Lake Lloyd, and Lake Eleanor; releases from Holm and Kirkwood Powerhouses; and tributary flow. Flow at this location is at its seasonal minimum in October. Flow typically increases through the winter and early spring and then increases sharply in the May and June with the snowmelt.

Hetchy Hetchy Reservoir would be drawn down farther in the spring with the WSIP than it is under the existing condition because diversions at Hetch Hetchy Reservoir would increase to meet 2030 water demand in the Bay Area. A greater proportion of the spring runoff would be needed to refill the reservoir than under the existing condition. As a result, with the WSIP, the onset of large releases from Hetch Hetchy Reservoir would be delayed by an average of one to two days (and up to eight days) and the total volume of releases would be reduced. After the large releases begin, releases during the rest of the year would be similar with the WSIP and under the existing condition.

Table 5.3.8-6 shows flows just below the Cherry Creek confluence under the existing condition and with the WSIP. The table slightly understates flow at this location because it does not include the small amount of inflow from tributaries between Hetch Hetchy Reservoir and Cherry Creek.

The WSIP would have very little effect on flow below the Cherry Creek confluence in wet and above-normal years. It would result in reductions in average monthly flow of up to 14 percent in May of normal, below-normal, and dry years. The reductions would manifest themselves as a delay in the onset of large snowmelt flows. This situation can best be illustrated with a simplified example. Under the existing condition, flow might be 1,000 cfs for the first five days in May and then 5,000 cfs for the remaining 26 days, for an average monthly flow of 4,354 cfs. With the WSIP, flow might be 1,000 cfs for the first 10 days of May and then 5,000 cfs for the remaining 21 days, for an average monthly flow of 3,709 cfs.

Currently, whitewater recreation on the upper river from mid-June through the summer is generally only possible due to SFPUC releases from Holm Powerhouse. For rafting flows, the SFPUC attempts to provide up to 1,100 cfs on the Tuolumne River at Lumsden for about four hours in the morning, from Monday through Saturday and on holiday weekends.

Tables 5.3.8-7 and **5.5.8-8** show flows in the Tuolumne River below the Cherry Creek confluence under the existing condition and with the WSIP for the 82-year hydrologic record. Although the flows shown in the tables understate actual flows at Lumsden Campground because they do not include tributary flows, they provide insight into the effects of the WSIP on whitewater rafting.

Under the existing condition and in May, the first month the weather is warm enough for whitewater rafting, flows below Cherry Creek would exceed 1,100 cfs in 74 years of the 82-year hydrologic record. A flow of 1,100 cfs in the Tuolumne River below Cherry Creek, and at least that at Lumsden Campground, would be suitable for rafting without a pulse release from Holm Powerhouse. With the WSIP and in May, flows below Cherry Creek would exceed 1,100 cfs in 72 years of the 82-year hydrologic record. Under the existing condition and in June, flows in the Tuolumne River below Cherry Creek would exceed 1,100 cfs in 64 years of the 82-year hydrologic

TABLE 5.3.8-6
ESTIMATED AVERAGE MONTHLY FLOWS IN THE TUOLUMNE RIVER IMMEDIATELY BELOW THE CHERRY CREEK CONFLUENCE UNDER VARIOUS CONDITIONS
(cubic feet per second)

	Wet	Above Normal	Normal	Below Normal	Dry	All
Existing Condition (2005)						
Oct	264	181	198	169	207	203
Nov	318	570	203	197	112	283
Dec	1,135	775	511	430	357	641
Jan	1,305	835	572	285	218	641
Feb	1,351	1,345	1,086	539	462	956
Mar	1,408	1,240	1,140	819	593	1,040
Apr	1,540	1,546	1,370	1,296	911	1,335
May	5,057	3,444	3,486	2,448	1,111	3,105
June	7,742	5,398	3,648	1,887	636	3,857
July	4,028	1,401	670	300	225	1,313
Aug	609	307	300	273	242	345
Sept	491	379	380	365	335	390
Future with WSIP (2030)						
Oct	264	179	198	164	207	202
Nov	318	563	203	197	112	281
Dec	1,100	746	507	429	358	627
Jan	1,290	853	603	278	216	646
Feb	1,339	1,324	1,086	544	477	953
Mar	1,406	1,276	1,141	857	617	1,060
Apr	1,526	1,540	1,353	1,247	907	1,316
May	4,920	3,359	3,221	2,239	960	2,936
June	7,715	5,380	3,642	1,770	610	3,817
July	4,028	1,401	670	312	219	1,314
Aug	609	307	300	265	242	343
Sept	490	379	380	361	321	386
Difference and Percent Change, Existing Condition (2005) vs WSIP (2030)						
Oct	0	[0%]	-2	-[1%]	0	[0%]	-5	-[3%]	0	[0%]	-1	[0%]
Nov	0	[0%]	-7	-[1%]	0	[0%]	0	[0%]	0	[0%]	-2	-[1%]
Dec	-35	-[3%]	-29	-[4%]	-4	-[1%]	-1	[0%]	1	[0%]	-14	-[2%]
Jan	-15	-[1%]	18	[2%]	31	[5%]	-7	-[2%]	-2	-[1%]	5	[1%]
Feb	-12	-[1%]	-21	-[2%]	0	[0%]	5	[1%]	15	[3%]	-3	[0%]
Mar	-2	[0%]	36	[3%]	1	[0%]	38	[5%]	24	[4%]	20	[2%]
Apr	-14	-[1%]	-6	[0%]	-17	-[1%]	-49	-[4%]	-4	[0%]	-19	-[1%]
May	-137	-[3%]	-85	-[2%]	-265	-[8%]	-209	-[9%]	-151	-[14%]	-169	-[5%]
June	-27	[0%]	-18	[0%]	-6	[0%]	-117	-[6%]	-26	-[4%]	-40	-[1%]
July	0	[0%]	0	[0%]	0	[0%]	12	[4%]	-6	-[3%]	1	[0%]
Aug	0	[0%]	0	[0%]	0	[0%]	-8	-[3%]	0	[0%]	-2	-[1%]
Sept	-1	[0%]	0	[0%]	0	[0%]	-4	-[1%]	-14	-[4%]	-4	-[1%]

Note: The data represent the summation of releases to rivers/creeks from: Hetch Hetchy Reservoir, Lake Eleanor, Lake Lloyd, Holm Powerhouse, and Kirkwood Powerhouse. The flow data are incomplete and do not include accretions from the watersheds below the dams. These accretions would remain constant under all modeling scenarios. Actual Tuolumne River flow at the Cherry Creek confluence would be greater than the values presented.

Key
> 0%
< 0 to -5%
< -5%

TABLE 5.3.8-7
FLOW IN THE TUOLUMNE RIVER IMMEDIATELY BELOW THE CHERRY CREEK CONFLUENCE UNDER EXISTING CONDITIONS (cubic feet per second)

YEAR TYPE	WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
W	1983	1,823	603	1,102	1,010	1,012	1,279	1,045	5,134	12,573	8,389	2,555	573
W	1995	169	364	552	810	1,012	1,878	1,644	5,104	9,666	8,172	1,547	427
W	1969	138	475	1,000	1,182	1,012	1,025	1,978	8,994	8,566	3,774	318	390
W	1982	286	1,146	1,092	1,010	1,850	1,025	2,563	6,957	7,108	3,536	459	947
W	1938	140	115	1,906	365	1,713	1,801	1,809	4,043	9,599	3,606	344	397
W	1998	169	116	170	624	1,012	1,074	1,059	3,047	9,964	6,628	488	508
W	1997	167	621	1,449	6,087	1,381	1,662	1,372	6,358	4,437	592	308	432
W	1956	111	104	3,085	1,849	1,713	1,787	1,705	2,334	8,063	3,095	387	375
W	1967	67	408	1,007	657	1,012	1,025	1,045	4,626	7,832	5,542	468	390
W	1980	314	248	449	2,225	1,448	1,025	1,690	4,576	7,092	4,556	423	451
W	1986	296	198	954	622	1,989	2,688	2,176	6,547	7,111	1,407	325	463
W	1952	140	179	1,010	1,010	1,713	1,025	1,242	6,176	6,620	3,736	374	429
W	1978	78	81	552	789	1,012	1,025	1,045	3,423	8,499	3,955	383	801
W	1965	124	219	3,031	1,786	1,713	1,788	1,665	1,937	3,812	2,626	617	458
W	1958	152	131	251	286	1,012	1,202	1,045	5,980	7,121	2,553	404	398
W	1993	45	79	552	567	1,012	1,210	1,548	5,678	5,808	2,274	348	409
AN	1941	130	98	536	1,786	1,616	1,587	1,473	2,131	5,868	2,612	315	381
AN	1951	336	3,770	3,000	1,786	1,713	993	1,753	1,561	2,772	286	299	368
AN	1922	123	70	118	197	1,012	1,025	1,800	3,497	8,836	2,037	329	400
AN	1984	324	2,087	2,143	1,695	1,571	1,255	1,116	3,862	3,636	811	303	396
AN	1943	133	553	514	740	1,012	1,270	2,262	5,643	4,513	1,414	304	378
AN	1942	142	201	851	1,010	1,012	1,025	1,424	3,733	7,124	3,091	321	385
AN	1996	153	71	444	467	1,746	1,450	1,994	6,410	4,970	1,274	324	418
AN	1974	169	1,158	515	700	1,012	1,068	1,045	5,398	5,608	1,063	299	312
AN	1940	380	87	886	401	1,670	1,752	1,630	3,226	4,582	309	298	363
AN	1936	176	114	93	348	1,703	1,745	1,926	3,566	5,189	1,138	302	386
AN	1932	101	59	1,400	1,570	1,212	1,187	1,116	1,709	3,709	1,743	313	410
AN	1935	153	226	552	1,663	1,429	546	1,361	2,067	5,002	869	305	383
AN	1999	181	311	415	529	1,713	1,801	1,774	2,751	5,305	617	300	371
AN	1945	160	417	466	451	1,277	1,801	1,714	2,141	5,607	1,803	308	388
AN	1927	117	332	508	515	1,012	1,025	1,045	4,174	6,480	1,481	319	413
AN	1963	210	70	605	134	1,321	530	1,045	4,395	5,704	1,747	267	299
AN	1975	86	70	130	204	832	1,025	1,800	2,279	6,856	1,516	314	401
N	1973	140	133	1,000	1,010	1,012	1,025	1,044	5,434	3,784	274	279	287
N	1921	387	269	358	412	1,713	1,752	1,672	1,778	4,417	718	302	399
N	1937	139	71	157	118	1,702	1,697	1,565	2,627	4,945	542	298	391
N	1970	317	147	721	1,525	1,012	1,025	1,045	3,473	3,301	452	276	340
N	2000	113	118	102	562	1,012	1,025	1,234	5,205	3,566	315	310	422
N	1925	241	231	995	789	1,000	1,025	1,836	3,169	3,984	1,060	358	418
N	1979	125	103	139	523	1,012	1,025	1,061	5,984	3,772	362	328	445
N	1946	562	499	1,280	894	1,713	1,726	1,630	2,098	3,167	311	296	386
N	1923	144	147	377	615	1,012	778	1,790	2,842	3,496	1,626	317	493
N	1962	109	55	552	359	845	1,025	1,319	2,618	5,524	1,083	287	340
N	1971	113	418	670	645	1,012	1,025	1,045	2,772	4,409	973	280	337
N	1950	114	105	260	115	1,694	1,651	1,586	2,044	3,415	398	303	383
N	1953	138	91	150	603	794	1,015	1,205	2,082	4,557	1,852	309	385
N	1928	266	514	594	253	625	1,014	1,096	4,870	1,461	248	277	347
N	1954	138	115	123	126	469	1,057	1,543	4,393	1,984	266	282	356
N	2002	127	238	692	607	756	374	1,245	4,386	2,587	238	294	357
BN	1957	192	172	170	175	659	1,000	1,035	2,669	5,325	391	146	326
BN	1948	386	155	779	248	153	971	1,450	1,925	3,303	546	296	386
BN	1989	114	131	552	567	616	849	1,442	3,824	2,567	288	296	493
BN	1966	134	535	1,010	282	817	799	1,446	3,323	234	146	247	348
BN	1944	153	100	108	152	832	1,015	1,035	2,843	2,543	625	282	354
BN	1949	137	91	100	96	148	1,710	1,661	2,177	1,817	239	283	364
BN	1985	276	417	789	167	519	745	1,127	3,335	1,111	233	292	385
BN	1972	70	195	318	702	725	746	854	2,249	2,158	213	258	298
BN	1930	110	60	800	449	678	572	858	1,186	2,944	299	281	391
BN	1964	195	674	342	362	499	280	1,471	2,025	1,657	276	278	352
BN	1955	116	109	220	290	817	1,200	1,320	1,742	1,140	270	281	347
BN	1926	238	135	181	240	232	1,256	2,080	2,114	576	217	277	351
BN	1933	127	70	314	45	689	108	1,638	1,519	2,259	333	281	394
BN	1991	133	45	552	234	88	304	1,035	1,893	2,778	356	289	360
BN	2001	194	131	136	187	388	1,057	1,052	3,773	278	246	305	388
BN	1947	182	258	391	472	519	668	1,045	3,418	916	216	277	338
BN	1960	122	68	557	186	787	640	1,478	1,594	480	207	279	336
D	1981	70	70	98	113	669	794	1,838	2,048	1,358	248	322	417
D	1968	99	76	145	193	786	822	1,035	2,816	1,163	211	271	264
D	1959	75	86	71	355	781	1,068	1,728	1,656	761	219	275	603
D	1939	287	199	365	227	534	980	1,616	1,608	136	186	279	362
D	1929	134	78	86	87	191	594	1,005	1,356	2,399	270	279	361
D	1990	568	179	557	263	616	437	597	1,295	929	304	111	326
D	1992	154	166	557	318	616	572	1,208	2,208	570	618	111	92
D	1994	177	74	118	105	241	645	968	1,414	935	181	241	312
D	1988	158	121	552	567	626	319	411	397	528	204	241	314
D	1934	139	71	188	289	402	1,428	872	714	466	178	243	344
D	1961	116	104	1,000	314	335	184	608	359	230	185	250	321
D	1976	588	220	443	175	186	351	554	329	141	171	294	402
D	1987	188	76	76	86	236	440	1,042	655	243	172	248	324
D	1931	143	116	779	187	607	296	361	329	100	112	241	333
D	1924	266	101	121	76	331	506	570	357	119	166	241	293
D	1977	152	50	552	130	231	61	159	232	101	167	233	298

Notes: The data represent the summation of releases to rivers/creeks from: Hetch Hetchy Reservoir, Lake Eleanor, Lake Lloyd, Holm Powerhouse, and Kirkwood Powerhouse. The flow data are incomplete and do not include accretions from the watersheds below the dams. These accretions would remain constant under all modeling scenarios. Actual Tuolumne River flow at the Cherry Creek confluence would be greater than the values presented. Year Types: Wet, AN – Above Normal, BN – Below Normal, Dry, and Critical

TABLE 5.3.8-8
FLOW IN THE TUOLUMNE RIVER IMMEDIATELY BELOW THE CHERRY CREEK CONFLUENCE WITH THE WSIP (cubic feet per second)

YEAR TYPE	WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
W	1983	1,823	603	1,102	1,010	1,012	1,279	1,045	5,086	12,573	8,389	2,555	573
W	1995	169	364	552	810	1,012	1,952	1,644	5,104	9,666	8,172	1,547	427
W	1969	138	475	1,000	1,182	1,012	1,025	1,978	8,994	8,566	3,774	318	390
W	1982	286	1,146	1,092	1,010	1,606	1,025	2,563	6,957	7,108	3,536	459	947
W	1938	140	115	1,917	365	1,713	1,801	1,779	3,832	9,599	3,606	344	397
W	1998	169	116	170	624	1,012	1,074	1,059	3,047	9,964	6,628	488	508
W	1997	167	621	1,449	5,891	1,381	1,849	1,212	6,358	4,437	592	308	432
W	1956	111	104	2,917	1,849	1,713	1,778	1,695	2,282	8,063	3,095	387	375
W	1967	67	408	1,007	657	1,012	1,025	1,045	4,493	7,832	5,542	468	390
W	1980	314	248	449	2,403	1,448	1,025	1,690	4,576	7,092	4,556	423	451
W	1986	296	198	863	653	2,054	2,496	2,110	6,547	7,111	1,407	325	463
W	1952	140	179	1,010	1,010	1,713	1,025	1,242	5,913	6,620	3,736	374	429
W	1978	78	81	552	789	1,012	1,025	1,045	2,100	8,499	3,955	383	796
W	1965	124	219	2,949	1,786	1,713	1,801	1,714	1,974	4,034	2,626	617	458
W	1958	152	131	251	286	1,012	1,202	1,045	5,776	7,121	2,553	404	398
W	1993	45	79	325	314	1,011	1,107	1,545	5,678	5,162	2,274	348	409
AN	1941	130	98	536	1,786	1,609	1,581	1,464	2,125	5,848	2,612	315	381
AN	1951	336	3,641	3,000	1,786	1,713	1,101	1,740	1,582	2,653	286	299	368
AN	1922	123	70	118	197	1,012	1,025	1,800	3,331	8,836	2,037	329	400
AN	1984	288	2,087	2,143	1,695	1,571	1,414	1,150	3,671	3,636	811	303	396
AN	1943	133	553	514	740	1,012	1,235	2,262	5,643	4,513	1,414	304	378
AN	1942	142	201	851	1,010	1,012	1,025	1,424	3,733	7,124	3,091	321	385
AN	1996	153	71	444	467	1,682	1,450	1,994	6,410	4,970	1,274	324	418
AN	1974	169	1,158	515	700	1,012	1,068	1,045	5,398	5,608	1,063	299	312
AN	1940	380	87	650	543	1,702	1,793	1,665	3,407	4,582	309	298	363
AN	1936	176	114	93	348	1,696	1,700	1,879	3,314	5,189	1,138	302	386
AN	1932	101	59	774	1,522	1,140	1,123	1,070	1,693	3,665	1,743	313	410
AN	1935	153	226	552	1,680	1,450	1,005	1,314	2,030	4,684	869	305	383
AN	1999	181	311	415	529	1,713	1,801	1,738	2,500	5,303	617	300	371
AN	1945	160	417	466	451	1,522	1,801	1,749	2,172	5,829	1,803	308	388
AN	1927	117	332	615	515	1,012	1,025	1,045	3,772	6,387	1,481	319	413
AN	1963	210	70	862	336	817	530	1,045	3,945	5,704	1,747	267	299
AN	1975	86	70	130	204	832	1,025	1,800	2,377	6,922	1,516	314	401
N	1973	140	133	1,000	1,010	1,012	1,025	1,044	5,200	3,784	274	279	287
N	1921	387	269	358	412	1,713	1,730	1,647	1,757	4,303	718	302	399
N	1937	139	71	157	118	1,673	1,665	1,536	2,552	4,878	542	298	391
N	1970	317	147	721	1,963	1,012	1,025	1,045	3,337	3,301	452	276	340
N	2000	113	118	102	562	1,012	1,096	1,234	5,038	3,566	315	310	422
N	1925	241	231	995	789	1,000	1,025	1,792	2,868	3,984	1,060	358	418
N	1979	125	103	139	523	1,012	1,025	1,061	5,984	3,772	362	328	445
N	1946	562	499	1,280	894	1,713	1,698	1,603	1,956	3,167	311	296	386
N	1923	144	147	377	615	1,012	778	1,790	2,565	3,496	1,626	317	493
N	1962	109	55	552	359	845	1,025	1,319	1,229	5,524	1,083	287	340
N	1971	113	418	670	645	1,012	1,025	1,045	2,399	4,409	973	280	337
N	1950	114	105	200	175	1,713	1,674	1,608	2,060	3,501	398	303	383
N	1953	138	91	150	603	794	1,015	1,051	2,077	4,557	1,852	309	385
N	1928	266	514	594	253	625	1,014	1,045	4,811	1,461	248	277	347
N	1954	138	115	123	126	469	1,071	1,580	3,889	1,984	266	282	356
N	2002	127	238	692	607	756	374	1,245	3,811	2,587	238	294	357
BN	1957	192	172	170	175	659	1,000	1,035	2,153	5,325	391	146	326
BN	1948	386	155	779	248	153	978	1,405	1,888	3,101	546	296	386
BN	1989	114	131	552	567	616	849	1,236	3,299	2,567	288	296	493
BN	1966	134	535	1,010	282	817	799	1,027	3,385	234	146	247	348
BN	1944	153	100	108	152	832	1,015	1,035	2,344	2,543	625	282	354
BN	1949	137	91	100	96	148	1,679	1,626	2,155	1,699	239	283	364
BN	1985	276	417	789	167	519	745	1,127	3,255	1,111	233	292	385
BN	1972	70	195	318	702	725	746	854	1,770	2,158	213	258	298
BN	1930	110	60	800	449	678	572	858	1,214	2,944	299	281	391
BN	1964	195	674	342	362	499	374	1,470	1,859	1,157	276	278	352
BN	1955	116	109	220	290	817	1,295	1,318	1,714	991	270	281	347
BN	1926	238	135	181	240	232	1,514	1,994	1,985	359	217	277	351
BN	1933	127	70	314	45	689	268	1,585	1,466	1,973	333	281	394
BN	1991	45	45	527	106	60	304	1,035	1,943	2,231	562	146	297
BN	2001	194	131	136	187	388	1,057	1,052	3,080	278	246	305	388
BN	1947	182	258	391	472	519	668	1,045	2,906	916	216	277	338
BN	1960	122	68	557	186	896	712	1,490	1,644	508	207	279	336
D	1981	70	70	98	113	669	794	1,838	1,878	1,169	248	322	417
D	1968	99	76	145	193	786	822	1,035	2,330	1,163	211	271	264
D	1959	75	86	71	355	781	1,318	1,666	1,420	761	219	275	603
D	1939	287	199	365	227	534	980	1,162	1,670	136	186	279	362
D	1929	134	78	86	87	191	594	1,005	1,092	2,190	270	279	361
D	1990	568	179	557	263	616	437	597	1,155	1,300	304	111	92
D	1992	154	166	557	318	616	572	1,729	1,899	608	618	111	92
D	1994	177	74	118	105	241	645	968	961	935	181	241	312
D	1988	158	121	552	567	870	319	317	359	135	123	241	314
D	1934	139	71	211	266	405	1,549	898	400	436	178	243	344
D	1961	116	104	1,000	314	335	184	608	359	230	185	250	321
D	1976	588	220	443	175	186	351	554	329	141	171	294	402
D	1987	188	76	76	86	236	440	1,042	591	228	172	248	324
D	1931	143	116	779	187	607	296	361	329	100	112	241	333
D	1924	266	101	121	76	331	506	570	357	119	166	241	293
D	1977	152	50	552	130	231	61	159	232	101	167	233	298

Notes: The data represent the summation of releases to rivers/creeks from: Hetch Hetchy Reservoir, Lake Eleanor, Lake Lloyd, Holm Powerhouse, and Kirkwood Powerhouse. The flow data are incomplete and do not include accretions from the watersheds below the dams. These accretions would remain constant under all modeling scenarios. Actual Tuolumne River flow at the Cherry Creek confluence would be greater than the values presented. Year Types: Wet, AN – Above Normal, BN – Below Normal, Dry, and Critical

record. With the WSIP and in June, flows below Cherry Creek would also exceed 1,100 cfs in 64 years of the 82-year hydrologic record. Thus, during May and June, the high flow months, the WSIP would have very little effect on the number of days flow in the river is suitable for rafting and would have very little effect on the need for pulse releases from Holm Powerhouse.

Typically, inflow to the SFPUC's reservoirs in the Tuolumne River watershed is much diminished by mid-July, and large releases to the Tuolumne River have ended. Only the minimum required releases are made through the rest of the summer and early fall. Under the existing condition and in July, flows in the Tuolumne River below Cherry Creek would exceed 1,100 cfs in 28 years of the 82-year hydrologic record. With the WSIP and in July, flows below Cherry Creek would also exceed 1,100 cfs in 28 years of the 82-year hydrologic record. Under the existing condition and with the WSIP in August, flows below Cherry Creek would exceed 1,100 cfs in two years of the 82-year hydrologic record. Under the existing condition and with the WSIP in September, flows below Cherry Creek would never exceed 1,100 cfs in the 82-year hydrologic record. During many Julys, almost all Augusts, and all Septembers, releases from Holm Powerhouse would be needed to provide suitable flows for rafting under the existing condition and with the WSIP. There would be no appreciable increase in the amount of time releases would need to be made from Holm Powerhouse to provide rafting flows with the WSIP. Thus, the WSIP would have a less-than-significant effect on whitewater rafting in the Tuolumne River between the Cherry Creek confluence and Don Pedro Reservoir, and no mitigation measures would be necessary.

Comparison of the modeled controlled releases from Lake Lloyd, Lake Eleanor, and Holm Powerhouse for the existing condition and with the WSIP indicates that changes in the average monthly flow below Holm Powerhouse would occur in one or more months in 18 percent of the years in the 82-year hydrologic record. The WSIP would result in both increased and decreased flow rates; in some cases, flow would increase and decrease within the same year. These modeled changes primarily reflect slight changes in reservoir operations that may not occur during actual operations. The changes identified in the model occur rarely, and it is concluded that flow in Cherry Creek below Holm Powerhouse would be the same under either condition. Thus, the WSIP would have a less-than-significant effect on flows in the short section of the Cherry Creek Run between Holm Powerhouse and the confluence with the Tuolumne River, and no mitigation measures would be needed.

Other River Recreation Upstream of Don Pedro Reservoir

Non-rafting recreation on the Tuolumne River is limited. A majority of campers and hikers along the river are also on river rafting trips; therefore, any reductions in whitewater recreation would likely result in a related decrease in non-rafting recreational use.

However, as discussed in the Setting, some non-rafting visitors choose to recreate along the upper Tuolumne River despite the limited developed hiking trails and other recreational resources. The majority of recreational opportunities for these visitors are off-water activities, although a number of the visitors to this reach do partake in fishing. However, because no change in the flow releases for July through August are expected, no WSIP-related recreational impacts on river flow levels would occur during the peak recreational period.

Due to the considerable variance in the upper Tuolumne flow rates both seasonally and daily (as a result of the pulse releases), the relatively minor changes in river flow levels associated with the WSIP, predominantly in May and June, would be imperceptible to visitors. Therefore, impacts on non-rafting recreation along the upper Tuolumne River would be less than significant.

River Recreation Below La Grange Dam

Under existing conditions, most of the time (717 months in the 987-month hydrologic record) flow in the Tuolumne River below La Grange Dam consists of the minimum required instream flows. In average critically dry years, the releases made from La Grange Dam are those needed to sustain the minimum required instream flows. In other hydrologic year types, releases in excess of minimum flows are made primarily between November and June.

Don Pedro Reservoir would be drawn down farther in the spring with the WSIP than it is under the existing condition because diversions at Hetch Hetchy Reservoir would increase to meet 2030 water demand in the Bay Area and inflow to Don Pedro Reservoir would be reduced. A greater proportion of the winter and spring runoff would be needed to refill the reservoir than under the existing condition. As a result, with the WSIP, the onset of releases above from La Grange Dam above the minimum required would be delayed, and the total volume of releases would be reduced. After releases in excess of the minimum required begin, releases during the rest of the year would be similar with the WSIP and under the existing condition.

The effects of the WSIP on average monthly flows in the Tuolumne River below La Grange Dam in different year types are shown in Table 5.3.1-6. During the summer recreational season, when the majority of river-related recreation occurs, the WSIP would have no effect on releases from La Grange Dam in average below-normal, dry, and critically dry years. Therefore, the WSIP would have no effect on river recreation in these year types.

During average wet and above-normal years, the WSIP would reduce flow in some summer months by up to 25 percent. The greatest effect would be in June of average above-normal years, when a 25 percent reduction would occur. The next greatest proportional reduction in flow (7 percent) would occur in June of average wet years. Nonetheless, the resulting flow conditions with the WSIP in wet and above-normal years would still be appreciably higher than the typical flow conditions that now occur at that time of the year. The WSIP-induced decrease in flow in wet and above-normal years would not likely reduce accessibility or use of the area's recreational resources.

Below Don Pedro Reservoir, recreational use of the Tuolumne River is limited. The river's flow conditions, limited public access, as well as county and other agency regulations limit the type and level of river recreation. The Tuolumne County Recreation Department generally discourages swimming in the river at La Grange and Fox Grove Regional Parks due to dangerous undercurrents and the absence of lifeguard supervision. Although the CDFG annually restocks the river with fish, fishing in the Tuolumne River is regulated. Only barbless hooks and "catch and release" fishing is generally permitted, and no fishing is allowed during certain winter periods to protect the fall run of spawning adult Chinook salmon (CDFG, 2006b). Furthermore, the

minimum instream flows for salmon and other fish populations would be maintained within the lower river to protect fishery habitat.

As discussed in the Setting, many local residents participate in off-water recreation in the parks along the Tuolumne River. However, this recreational use is generally independent of river flow conditions, which park visitors expect to vary considerably during the summer season. Future minimum flow conditions would be maintained under all circumstances during the summer season. Therefore, impacts river recreation along the Tuolumne River below La Grange Dam would be less than significant.

Summary of Impacts

Overall, implementation of the proposed WSIP water supply and system operations would result in *less than significant* impacts on river recreation.

Impact 5.3.8-3: Effects on the aesthetic values of the Tuolumne Wild and Scenic River.

Increasing the Hetch Hetchy system's reliance on Tuolumne River water sources could affect future stream flows within the Wild and Scenic sections of the Tuolumne River below O'Shaughnessy Dam, thereby degrading the river's visual resources. Such an impact, if it were to occur, could contravene policies of the *Tuolumne Wild and Scenic River Management Plan* (USFS, 1988) with respect to maintaining and improving the appearance of the stream and its water quality for aesthetic purposes. Reduction in the river's free-flowing condition could also diminish the management plan's policy to protect the river's outstandingly remarkable values.

Current flow conditions in the Tuolumne River vary considerably as a result of natural variations in rainfall and snowmelt in addition to the existing operation of the Hetch Hetchy system. Stream flow is only one of several qualities contributing to the river's scenic values. Other components of the river corridor's setting and scenery include geological and biological resources, which may be independent of and/or unaffected by WSIP changes in the water release schedule.

WSIP-induced changes in Tuolumne River flows would be greatest directly below O'Shaughnessy Dam. The effect of the WSIP would decrease in a downstream direction as more tributary flow and runoff enter the river, increasing river flow. As shown in Table 5.3.1-5, in most months of most hydrologic year types, flows in the Tuolumne River below O'Shaughnessy Dam with the WSIP and under the existing condition would be the same. In some months, usually in the spring, flows with the WSIP would be reduced compared to the existing condition. Average flows in May of all years would be 11 percent lower than under the existing condition. During average below-normal and dry years, the reduction in flows would be up to 30 percent in May. The WSIP would typically delay the initial spring release of water from Hetch Hetchy Reservoir by a few days, lengthening the period in which only the minimum required flow is released to the river by a few days. With the WSIP in place, flow in the Tuolumne River would remain within the range experienced under the existing condition. WSIP-related flow reductions would likely

not be noticeable to most of the relatively few recreational users that hike along the Tuolumne River within the Wild sections of the Poopenaut Valley below the dam.

In addition, observers of the Tuolumne River's visual conditions are almost entirely recreational visitors. Although late-spring recreational use along the Wild and Scenic section of the river does occur, the greatest recreational use is during the summer season between Memorial Day and Labor Day. As a result, most recreationists would experience the Tuolumne River's Wild and Scenic visual resources during this period, when conditions would not be affected by the WSIP. In addition, a major proportion of the river users are whitewater rafters who also recreate on the river during the pulse flow releases, which would therefore reduce the period of time when visitors could observe any reductions to the Tuolumne's water flow conditions during non-pulse flows.

As a result, any future WSIP reductions in stream flow within the Tuolumne River would likely be imperceptible to or unobserved by most visitors. Therefore, impacts on the visual resources of the Tuolumne Wild and Scenic River would be *less than significant*, and no mitigation measures would be required.

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5.3.9 Energy Resources

This section describes the potential effects of the WSIP water supply and systemwide operations on energy resources. The impact section (Section 5.3.9.2) provides a description of the changes in hydropower generation and energy consumption that would result from implementation of the proposed program. For a discussion of overall energy production and use by the WSIP, see Chapter 4, Section 4.15.

5.3.9.1 Setting

There are four major hydropower generation facilities on the Tuolumne River. Three, the Holm, Kirkwood, and Moccasin Powerhouses, are owned by the CCSF and operated by the SFPUC. The fourth, Don Pedro Power Plant, is owned by TID and MID and operated by TID. Hydropower facilities convert the energy of flowing or falling water into electrical power. Water released from a reservoir flows through a tunnel or pipeline to a powerhouse where it rotates one or more turbines. The spinning turbines drive electricity power generators.

Water is released from Lake Lloyd and flows to Holm Powerhouse though the Cherry Power Tunnel. Holm Powerhouse is equipped with two turbine and generator sets with a maximum generation capacity of 170 megawatts (MW). After passage through the turbines, water is released from Holm Powerhouse to Cherry Creek.

Water is diverted from Hetch Hetchy Reservoir and flows to Kirkwood Powerhouse through the Canyon Tunnel. Kirkwood Powerhouse is equipped with three turbine and generator sets with a maximum generation capacity of 126 MW. After passage through the turbines, most of the water from Kirkwood Powerhouse enters Mountain Tunnel, which conveys it to Priest Regulating Reservoir. The remainder is released to the Tuolumne River.

Water is released from Priest Regulating Reservoir and flows to Moccasin Powerhouse in the Moccasin Power Tunnel. Moccasin Powerhouse is equipped with two turbine and generator sets with a maximum generation capacity of 110 MW. After passage through Mocassin Powerhouse, water is discharged to Moccasin Reregulating Reservoir. Most of the water is diverted from the reregulating reservoir into Foothill Tunnel and conveyed to the Bay Area for water supply. Some water is discharged to Moccasin Creek, which discharges to Don Pedro Reservoir.

Water stored in Don Pedro Reservoir is conveyed through Don Pedro Dam in two tunnels to the Don Pedro Powerhouse, which is located at the base of the dam. The powerhouse is equipped with two turbine and generator sets with a capacity of 161 MW. After passage through the turbines, water is released from the powerhouse to the Tuolumne River.

The amount of hydropower generated at facilities on the Tuolumne River in any particular year depends on hydrologic conditions in that year and in preceding years. On average, and under current conditions, the hydropower facilities produce about 2.2 million megawatt-hours (MWh) (see Appendix H2-1).

The regulatory framework for energy use in the area served by the WSIP is described in Chapter 4, Section 4.15. It includes the National Energy Policy, the state's Energy Action Plan II and building energy efficiency standards, and San Francisco's Sustainability Plan, Electricity Resource Plan, and Climate Action Plan.

5.3.9.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to energy resources, but generally considers that implementation of the proposed program would have a significant energy resource impact if it were to:

- Encourage activities that result in the use of large amounts of fuel, water, or energy, or use these resources in a wasteful manner
- Reduce the production of renewable energy

Approach to Analysis

Changes in river flow, reservoir storage, and hydropower generation rates attributable to the WSIP were estimated using the Hetch Hetchy/Local Simulation Model. Detailed information on the model is provided in Appendix H.

Impact Summary

Table 5.3.9-1 presents a summary of the impacts on energy resources along the Tuolumne River that could result from implementation of the proposed water supply and system operations.

TABLE 5.3.9-1
SUMMARY OF IMPACTS – ENERGY RESOURCES ALONG THE TUOLUMNE RIVER SYSTEM

Impact	Significance Determination
Impact 5.3.9-1: Effects on hydropower generation at facilities along the Tuolumne River	B

B = Beneficial impact

Impact Discussion

Impact 5.3.9-1: Effects on hydropower generation at facilities along the Tuolumne River.

On average under current conditions, the SFPUC's hydropower facilities on the Tuolumne River generate 1,618,180 MWh of electricity each year. With the WSIP, this amount would rise to an average of 1,641,257 MWh, an increase of about 23,000 MWh or 1.4 percent. The increase in hydropower generation is attributable to the increase in diversion of water from Hetch Hetchy

Reservoir to meet water demand in the Bay Area. En route to the Bay Area, the water generates hydropower at the Kirkwood and Moccasin Powerhouses.

On average under current conditions, TID's and MID's facilities generate 590,180 MWh of electricity per year. With the WSIP, this amount would be reduced to an average of 576,046 MWh, a decrease of about 14,000 MWh or 2.4 percent. The decrease in hydropower generation is attributable to reduced inflow to Don Pedro Reservoir because of increased upstream diversion and a slightly lowered average water level in the reservoir.

Overall, the WSIP would increase hydropower generation on the Tuolumne River by an average of about 9,000 MWh, or 0.4 percent. Thus, the impact of the WSIP on the production of renewable energy from the Tuolumne River would be *beneficial*.

5.4 Alameda Creek Watershed Streams and Reservoirs

Section 5.4 Subsections

5.4.1 Stream Flow and Reservoir Water Levels
5.4.2 Geomorphology
5.4.3 Surface Water Quality
5.4.4 Groundwater
5.4.5 Fisheries
5.4.6 Terrestrial Biological Resources
5.4.7 Recreational and Visual Resources
(References included under each section)

5.4.1 Stream Flow and Reservoir Water Levels

The following setting section describes the streams and reservoirs in the Alameda Creek watershed that could be affected by the WSIP. The impact section (Section 5.4.1.2) provides a description of the changes in stream flow and reservoir water levels that would result from implementation of the WSIP.

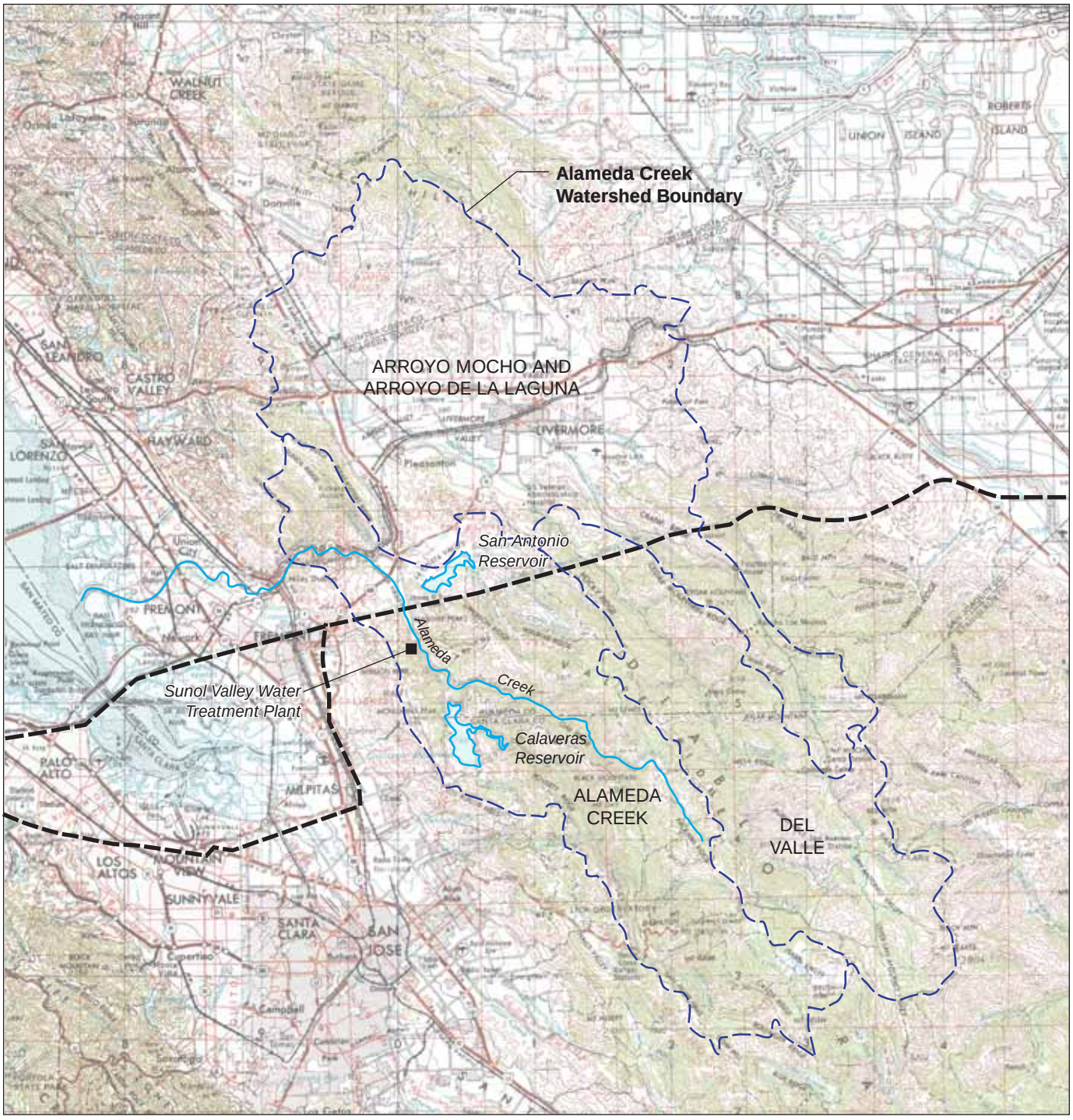
5.4.1.1 Setting

Watershed Overview

The Alameda Creek watershed covers an area of about 633 square miles in the East Bay, 30 miles southeast of San Francisco (**Figure 5.4.1-1**). Precipitation in the watershed is primarily in the form of rainfall, most of which falls in the November through March rainy season. Average annual precipitation ranges from about 20 to 25 inches per year; precipitation is heaviest in the west at higher elevations, and lowest in the eastern part of the watershed and at lower elevations.

There are two major drainage basins within the greater watershed: the Livermore Drainage Unit (shown as Arroyo Mocho and Arroyo de la Laguna in Figure 5.4.1-1) and the southern Alameda Creek watershed (also referred to as the Sunol Drainage Unit). The southern Alameda Creek watershed occupies about 175 square miles between Pleasanton to the north and Mount Hamilton to the south, spanning Alameda and Santa Clara Counties. Natural drainage is from the hills toward San Francisco Bay via Alameda Creek. The City and County of San Francisco (CCSF) owns 56 square miles (36,000 acres), or a little less than one-third, of the southern Alameda Creek watershed (shown in Chapter 2, Figure 2.2). The natural hydrology of the Alameda Creek watershed has been altered by water supply activities as well as by development and flood control.

Alameda Creek flows through a series of alluvial valleys linked by narrow bedrock-channel corridors. Alameda Creek is usually a perennial stream in the upper parts of the watershed, but in



SOURCE: ESA + Orion; USGS 1969

Figure 5.4.1-1
Alameda Creek Drainage Area

the Sunol Valley and other alluvial flats, a high rate of infiltration and through-flow (water flowing through sediments) typically results in a dry creekbed during the summer months. The creek then resurfaces as pools in the confined bedrock canyons. Many of the tributaries that supply flows to the creek are historically intermittent and can be isolated from the main stem beginning in early to mid-summer (Gunther et al., 2000). The primary exception to this is Arroyo Hondo, which has year-round flow in many locations. In addition to fluctuations in stream flow caused by varying levels of surface water runoff, flows in Alameda Creek tributaries also vary greatly with rising and falling water tables in the area (Gunther et al., 2000). For the period from 1970 through 2003, Alameda Creek had an annual mean flow of 139 cubic feet per second (cfs), ranging from 31.5 cfs in the critically dry year of 1977 to 621 cfs in 1983. Mean flows are not indicative of daily flows, which can rise and fall dramatically depending on storm events. The highest peak flow (measured at the Niles gaging station) was 17,900 cfs on February 3, 1998. The total average annual runoff is 100,900 acre-feet (USGS, 2005a).

The SFPUC manages the Alameda Creek watershed portion of the regional system with the primary objective of conserving local watershed runoff for delivery to customers. Therefore, the Alameda reservoirs are managed to capture winter and early spring runoff in order to maximize storage and water delivery to customers during the winter months, while Hetch Hetchy runoff is stored for summer and fall delivery. This interconnectivity of the Alameda and Hetch Hetchy systems provides for substantial flexibility in operations, which are described in Chapter 2 and in this section.

The proposed WSIP system operations would affect the two SFPUC reservoirs in this watershed—Calaveras and San Antonio Reservoirs—as well as some reaches of Alameda Creek and its tributaries. These creeks and facilities are shown on **Figure 5.4.1-2**. Within the CCSF-owned watershed, Calaveras Creek and Arroyo Hondo drain directly to Calaveras Reservoir, and Alameda Creek flow is diverted into Calaveras Reservoir via the Alameda Creek Diversion Tunnel through operation of the Alameda Creek Diversion Dam (diversion dam). Farther downstream, San Antonio Creek drainage flows to San Antonio Reservoir, which is also used to store water from the Hetch Hetchy system and, periodically, water from Calaveras Reservoir. Downstream of its confluence with San Antonio Creek, Alameda Creek continues flowing through the Sunol Valley and then through Niles Canyon, eventually draining to San Francisco Bay. The drainage areas of each of these sub-watersheds of Alameda Creek are shown in **Table 5.4.1-1**.

Alameda Creek below the diversion dam conveys flows through the Sunol Valley, then to Niles Canyon and eventually to San Francisco Bay. As shown in Figures 5.4.1-1 and 5.4.1-2, tributaries include Calaveras Creek, which conveys releases from Calaveras Reservoir; Welch Creek, which flows into Alameda Creek near the Sunol Valley Water Treatment Plant (WTP); San Antonio Creek, which conveys releases from San Antonio Reservoir; Arroyo de la Laguna, which conveys flows from the Livermore Drainage Unit and Del Valle Drainage Unit; and Stoneybrook Creek, which enters Alameda Creek from the north within Niles Canyon.

TABLE 5.4.1-1
AREAS OF ALAMEDA CREEK SUB-WATERSHEDS IN THE WSIP STUDY AREA

	Sub-Watershed Area	
	Acres	**Square Miles**
Calaveras Reservoir	**62,662**	**97.9**
Arroyo Hondo	51,969	81.2
Calaveras Creek	10,693	16.7
Upper Alameda Creek (above diversion dam)	**21,679**	**33.9**
Mid Alameda Creek	**19,488**	**30.5**
Diversion dam to USGS gage at Calaveras Creek confluence	4,553	7.1
Calaveras Creek confluence gage to San Antonio Creek confluence	10,189	16
San Antonio Creek confluence to Arroyo de la Laguna confluence	4,746	7.4
San Antonio Reservoir	**24,645**	**38.5**

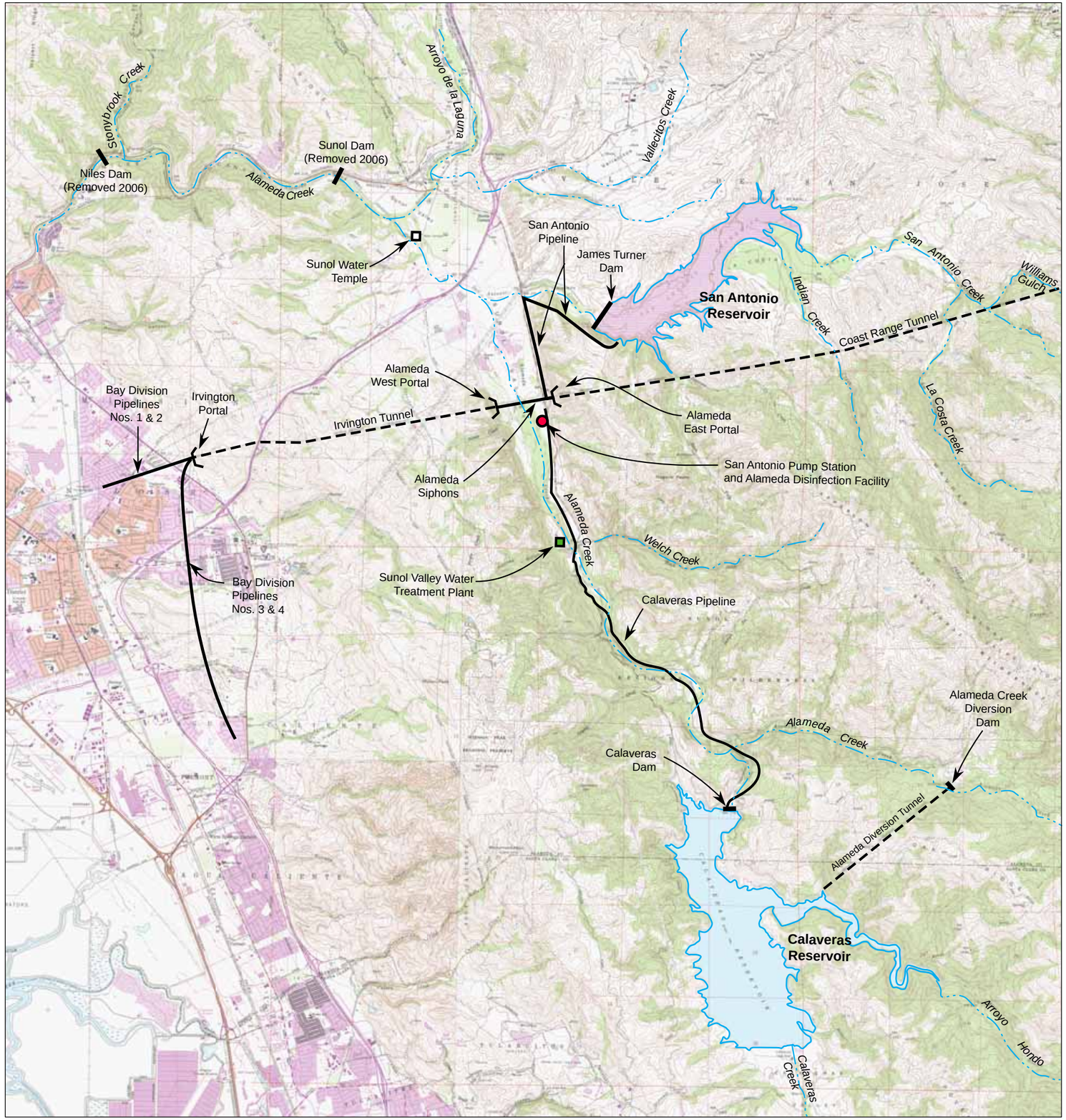
SOURCE: EDAW, 2007.

The reach of Alameda Creek through the Sunol Valley has a low gradient, with an elevation change of about 80 feet in five river miles. The creek channel is wide and braided in places; long sections have very shallow depths of water when flows are below about 75 cfs (Entrix, 2004). The Sunol Valley is broad but is bordered in parts by steep slopes (Center for Ecosystem Management and Restoration, 2002).

The reach of Alameda Creek through Niles Canyon, which starts downstream of the confluence with Arroyo de la Laguna, is constrained on both sides by steep canyon walls. There are several instream structures in this reach, including a culvert at the Stoneybrook Creek confluence and a U.S. Geological Survey (USGS) weir (Center for Ecosystem Management and Restoration, 2002). In 2006, the SFPUC completed removal of the Sunol and Niles Dams as part of an effort to restore creek flows and fish habitat along this reach of Alameda Creek; these facilities were historical parts of the regional water system that were built prior to construction of the Hetch Hetchy system.

After exiting Niles Canyon, Alameda Creek is contained within a flood control channel for 12 miles until it reaches San Francisco Bay. The Alameda County Water District (ACWD) manages this part of the creek for water supply, and the Alameda County Flood Control and Water Conservation District (ACFCWCD) maintains the channel for flood control purposes. Three large, inflatable rubber dams span the width of the channel and divert water to several hundred acres of ponds (former gravel quarries), where water percolates to recharge the underlying Niles Cone Groundwater Basin, a major source of water supply for the ACWD (ACWD, 2007). A flow control structure known as the BART weir (owned by the ACFCWCD and located where the BART and railroad tracks cross Alameda Creek in Fremont) provides grade control and is a barrier to fish passage along this reach.

Mean annual precipitation over lower portions of the Alameda Creek drainage is about 20 inches.



SOURCE: ESA + Orion; USGS 1969

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Figure 5.4.1-2
Alameda Watershed Facilites

Final Screencheck Draft (May 2007) Not for Public Distribution

Calaveras Reservoir and Creek

Calaveras Reservoir

Calaveras Reservoir was constructed between 1913 and 1925 with a storage capacity of 96,800 acre-feet, corresponding to a spillway elevation of 756 ft (USGS datum). Since December 2001, in response to safety concerns about the seismic stability of the dam and mandates from the California Department of Water Resources, Division of Safety of Dams (DSOD), the SFPUC has operated Calaveras Reservoir with the goal of holding the maximum water level at about 705 feet or below (USGS datum), which is approximately 37,800 acre-feet (roughly 40 percent of its maximum capacity). Because of heavy spring rains, Calaveras Reservoir has reached elevations of 720 to 736 feet for a few months during the springs of 2005, and 2006, as shown on **Figure 5.4.1-3**.

The natural drainage basin contributing to the Calaveras Reservoir drainage includes the Arroyo Hondo and Calaveras Creek Subbasins as well as local drainage areas along the west shore of the reservoir, with a total area of approximately 98 square miles. Stream flows within the Calaveras Reservoir drainage are highest during the winter and early spring rainy season and are minimal in summer and early fall. Calaveras Creek and Arroyo Hondo provide an average combined inflow to Calaveras Reservoir of about 36,000 acre-feet per year (afy) (nearly 12 billion gallons per year) (Bookman-Edmonston Engineering, Inc., 1995). Under pre-2002 conditions,[1] diversions from Alameda Creek added an average of approximately 6,000 afy (about 17 percent) to inflows into Calaveras Reservoir.

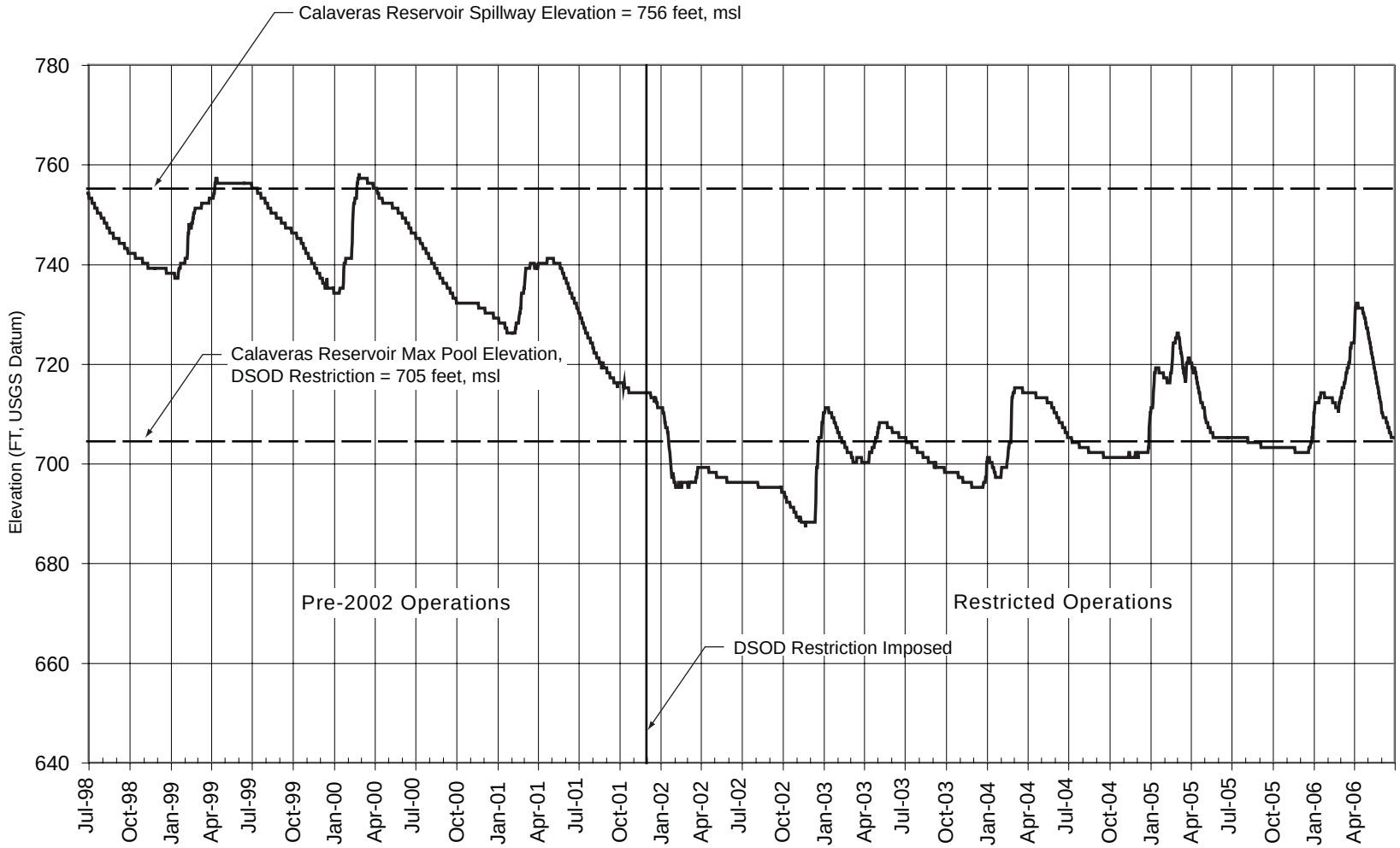
Water from the 35 square miles that drains into Alameda Creek upstream of the diversion dam can be diverted to Calaveras Reservoir through the Alameda Creek Diversion Tunnel. As shown in Figure 5.4.1-2, the diversion tunnel is situated about two miles upstream from the confluence with Calaveras Creek. At this overflow-type diversion, stream flow backs up behind an impoundment, flows into a short canal, and then enters the diversion tunnel if the diversion dam gates are open. During these conditions, flow in Alameda Creek in excess of the capacity of the diversion tunnel flows over the diversion dam and continues down Alameda Creek.

Much of the land surrounding Calaveras Reservoir is eroded or highly susceptible to erosion, and the subbasins of Calaveras Creek and Arroyo Hondo also contain eroded and steep soils. Above the diversion dam, slopes along Alameda Creek are eroded or severely eroded, with slope angles as high as about 45 percent (San Francisco Planning Department, 1999).

The SFPUC operates Calaveras Reservoir to meet the following objectives:

- Maximize storage within the reservoir to meet potential drought and water supply needs
- Maximize conservation of runoff on a long-term basis
- Meet short-term water supply operational requirements

[1] Calaveras Reservoir operations before the 2001 DSOD restrictions are referred to throughout this document as "pre-2002 operations"; pre-2002 conditions are associated with pre-2002 operations.



SOURCE: SFPUC, HH/LSM (see Appendix H)

Figure 5.4.1-3

Calaveras Reservoir, Historical Water Levels, 1998 to 2006

Normal releases from Calaveras Reservoir are made through the intake tower. Under pre-2002 conditions, water could be withdrawn from three reservoir depths, corresponding to the elevations of the intake openings (adits) in the intake tower. However, the top adit is above the 705-foot restricted reservoir level; therefore, under current conditions, water can only be drawn from the lower two adits. Water from the tower's vertical conduit is conveyed through the 4.1-mile-long Calaveras Pipeline to the Sunol Valley WTP.

Water from Calaveras Reservoir is treated at the Sunol Valley WTP before entering the transmission system. Water flows from the reservoir to the treatment plant by gravity. The Sunol Valley WTP treats the water, which then travels by gravity to the transmission system at the Alameda Siphon No. 2. System operators have also transferred water from Calaveras Reservoir to San Antonio Reservoir as part of DSOD-restricted operations, in addition to making deliveries to the Sunol Valley WTP and releases via the cone valve.

Before December 2001, the reservoir would typically be operated to fill by the end of the rainy season in normal or wet years. The reservoir would be drawn down 15,000 to 20,000 acre-feet by early winter to ensure sufficient capacity to capture winter runoff. During a drought or water supply emergency, the reservoir would be drawn down farther to meet SFPUC water supply needs.

Following periods of heavy inflow, reservoir storage rises temporarily; at such times, the SFPUC employs "best efforts" to lower the level by releasing water to the regional system, and, if necessary, discharging excess inflow to Calaveras Creek. Average monthly storage in Calaveras Reservoir under restricted operations ranges from about 31,000 to 38,000 acre-feet in all conditions and months. As indicated in Figure 5.4.1-3, recent historical elevations in Calaveras Reservoir have varied from about 690 to 755 feet, with maximum post-2001 elevations of up to 736 feet. The SFPUC has also maintained a minimum water level elevation of 690 feet in accordance with a 1991 letter sent to the California Department of Fish and Game (CDFG) (SFPUC, 2005), as described in Chapter 2, Section 2.5.3.

In 1997, the CCSF and CDFG signed a Memorandum of Understanding (MOU) regarding releases of water from Calaveras Reservoir and maintenance of minimum storage levels from July through October to enhance fishery habitat, improve the coldwater fishery resources downstream of Calaveras Dam, and enhance warm-water fisheries in the lower reach of the creek. The SFPUC agreed to use best efforts to maintain at least 30,000 acre-feet in the reservoir (690-foot elevation) as well as to release up to 6,300 afy from Calaveras Reservoir. The MOU indicated possible year-round releases if target flows below the confluence of Alameda and Calaveras Creeks were not met. However, implementation of the 1997 MOU instream flow requirement below Calaveras Reservoir is currently on hold and hindered by the lack of sufficient cold-water storage in Calaveras Reservoir. (MOU flows are shown below in Table 5.4.1-9.)

Calaveras Creek Below Calaveras Dam

As part of system operations, the SFPUC can make releases from Calaveras Reservoir to Calaveras Creek, which then flow to Alameda Creek. Controlled emergency releases and other controlled releases (i.e., for fish studies) can be made through the dam outlet works, which can

release up to about 1,100 cfs. Uncontrolled releases are conveyed to Calaveras Creek through the spillway structure. Spillway discharges could exceed 33,000 cfs if the reservoir were to fill to an elevation near the top of the dam.

Uncontrolled releases (spills) over the Calaveras Dam spillway have been infrequent. Recorded spills since 1938 have occurred in the following water years: 1941, 1945, 1952, 1956, 1958, 1965, 1967, 1969, and 1996–2000, as shown in **Table 5.4.1-2**.

TABLE 5.4.1-2
HISTORICAL CALAVERAS RESERVOIR SPILLWAY RELEASES (UNCONTROLLED)

Date	Average Daily Spill (cfs)
02/18/41 – 03/21/41	438
03/30/41 – 04/21/41	518
04/09/45 – 05/05/45	137
01/11/52 – 02/20/52	634
02/28/52 – 03/06/52	49
03/08/52 – 04/09/52	379
04/27/52 – 05/26/52	128
01/18/56 – 02/09/56	515
02/23/56 – 05/06/56	254
03/17/58 – 05/29/58	574
04/12/65 – 05/08/65	431
04/03/67 – 05/15/67	540
02/25/69 – 05/15/69	378
01/28/96 – 04/30/96	506
01/03/97 – 02/22/97	592
02/06/98 – 06/17/98	439
04/13/99 – 07/02/99	31
02/24/00 – 03/30/00	497

SOURCE: SFPUC, 2006.

The spillway has not been used since the 2001 DSOD restrictions were placed on reservoir storage. Reservoir storage rises temporarily following periods of heavy inflow, and the SFPUC attempts to lower the reservoir level by releasing water to the Sunol Valley WTP and occasionally discharging water through the cone valve to Calaveras Creek. **Table 5.4.1-3** summarizes the releases made through the cone valve since the imposition of DSOD restrictions. As stated above, 1997 MOU fishery releases from Calaveras Reservoir are on hold due to the lack of sufficient cold-water storage in the reservoir.

Alameda Creek Above the Diversion Dam

Alameda Creek above the diversion dam has a reach length of about 14.9 miles, with an average slope of about 125 feet per mile. The average annual stream flow in Alameda Creek at the diversion dam has been estimated at 12,000 acre-feet (Bookman-Edmonston Engineering, Inc., 1995). As shown in **Table 5.4.1-4**, upper Alameda Creek is “flashy”; the creek has brief periods

TABLE 5.4.1-3
APPROXIMATE CALAVERAS CONE VALVE RELEASES SINCE 2001 (CONTROLLED)

Dates	Release
12/2001 – 02/2002	37,385 acre-feet at @ 375 cfs
03/2005 – 05/2005	33,574 acre-feet at @ 373 cfs
03/2006 – 06/2006	65,402 acre-feet at @ 336 cfs
Cone valve closed 6/23/2006	

NOTE: Variations in the identified release rates have occurred within these times periods.

SOURCE: SFPUC, 2006.

of high flows interspersed with longer periods of low flows. Because the table shows daily means, it substantially understates the "flashiness" of the creek, where peak flows may occur for a few hours or less. As indicated on **Table 5.4.1-5**, measured peak flows at the diversion dam have exceeded 650 cfs on 48 days in the past 11 years, or an average of about four days per year. Despite the rarity of these flows, they constitute a substantial amount of stream flow volumes.

Alameda Creek Between the Diversion Dam and Calaveras Creek Confluence

Alameda Creek from the diversion dam to Calaveras Creek is 2.85 miles long with an average slope of 190 feet per mile. This reach has areas of boulders and pools with a segment of gorge carved through sandstone deposits, including the "Little Yosemite" area. Peak flows typically occur in the December through May rainy season. Minimal flows occur from July through October.

The diversion dam includes a dam/spillway, a sluice gate at the bottom of the dam that is used annually to wash out sediments that have accumulated behind the dam, as well as to pass flows when the tunnel gates are closed, a diversion sluiceway that directs water to the diversion gates, and a second sluice gate in the diversion sluiceway. The entire facility is remote (accessed via an unpaved road from the Sunol Regional Wilderness staging area) and, due to a lack of power availability, the gates must be manually operated. There is a gaging station in Alameda Creek immediately upstream of the diversion dam; the nearest Alameda Creek station below the diversion dam is immediately downstream of the creek's confluence with Calaveras Creek.

Prior to 2002, most of the flows were diverted to Calaveras Reservoir via the diversion tunnel. The maximum capacity of the diversion tunnel is about 650 cfs. Typical operation involves opening the diversion tunnel gates in early winter and leaving them open throughout the rainy season, except when Calaveras Reservoir is full. To avoid the need to spill water from Calaveras Reservoir when it is full, the SFPUC closes the gates at the diversion tunnel so that stream flow in Alameda Creek continues down its natural course. The diversion dam does not divert all flows when the diversion gates are open; due to through-flow as well as seepage through the dam and its sluice gates, flows of less than 1 cfs (and possibly somewhat higher) flow through the dam and down the creek.

TABLE 5.4.1-4
HISTORICAL RECORD OF ALAMEDA CREEK FLOW ABOVE THE DIVERSION DAM
(cubic feet per second)

Day of month	Maximum of Daily Mean Values for 11 Years of the Hydrologic Record (October 10, 1994 – September 30, 2005)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	533	212	121	75	54	14	5.8	2.6	1.4	0.74	0.83	18
2	868	387	94	60	52	13	5.8	2.4	1.3	0.99	0.82	126
3	525	1,120	89	72	208	13	5.7	2.3	1.3	0.97	0.83	63
4	234	562	392	77	133	13	5.5	2.1	1.3	0.92	0.84	18
5	521	518	463	65	84	12	4.9	2.0	1.4	0.88	0.84	300
6	211	666	238	67	64	12	4.5	2.0	1.4	0.78	0.84	89
7	432	900	168	84	45	13	4.3	2.0	1.3	0.62	1.0	124
8	447	679	163	110	29	13	4.3	1.9	1.4	0.64	84	170
9	395	628	202	135	22	12	4.3	1.9	1.5	0.64	54	43
10	1,200	229	817	80	19	12	4.2	1.9	1.5	0.64	3.9	601
11	476	121	599	225	18	11	4.1	1.8	1.3	0.81	1.6	222
12	621	253	354	180	23	11	4.0	1.8	1.2	0.92	1.5	242
13	264	483	243	123	91	10	3.8	1.8	0.95	0.80	1.4	187
14	395	672	164	91	77	9.6	3.7	1.8	0.92	0.80	1.3	206
15	637	274	134	73	66	12	3.5	1.7	1.1	0.80	1.1	204
16	457	288	116	64	49	18	3.5	1.8	0.89	0.80	1.4	584
17	175	151	104	56	39	13	3.3	1.8	0.84	0.71	354	267
18	358	264	94	51	35	11	3.2	1.8	1.1	0.76	68	74
19	461	848	88	47	32	10	3.1	1.8	0.87	0.77	21	161
20	479	733	311	43	29	9.5	3.0	1.7	0.87	0.81	25	443
21	290	863	367	39	26	8.8	3.0	1.7	1.1	0.75	13	602
22	715	545	1,090	37	25	8.1	3.0	1.7	1.1	0.76	62	591
23	754	430	903	36	23	7.6	3.0	1.6	1.2	0.77	55	224
24	693	268	495	36	22	7.1	3.0	1.6	1.2	0.80	23	104
25	792	206	281	43	20	7.0	3.0	1.6	1.3	1.5	13	63
26	679	552	180	68	19	6.8	2.9	1.6	1.4	1.0	34	50
27	616	408	126	46	18	6.4	2.8	1.6	1.4	0.92	36	45
28	376	243	203	142	20	6.2	2.8	1.5	1.4	0.92	11	101
29	263	177	146	83	23	6.1	2.8	1.5	1.4	1.4	7.8	324
30	127	–	107	64	18	5.8	3.1	1.4	1.4	1.2	20	452
31	414	–	79	–	15	–	2.7	1.4	–	0.95	–	470

Note: Flows in excess of 650 cfs are shaded; flows above 650 cfs flow past the diversion dam to the downstream reaches of Alameda Creek.

SOURCE: USGS, 2005b.

Diversions have substantially changed the hydrograph (i.e., a graph that shows the pattern of flows—both peak volumes and duration) of this reach of Alameda Creek. Pre- and post-diversion downstream flows in a typical above-normal-water-year storm are discussed below in Section 5.4.1.2, Impacts (see Figures 5.4.1-9, 5.4.1-10, and 5.4.1-11). Nearly all of the downstream flows below 650 cfs were diverted from the creek, and the peak flows were halved. The resulting hydrograph was that of a much smaller storm in a dry year. The effect of diversions on smaller storms (those with instantaneous flows of less than 650 cfs) was even more dramatic, with nearly all flows being removed from the creek downstream. The creek segment below the diversion dam essentially reverted to very low-flow conditions during these lesser storm events.

TABLE 5.4.1-5
NUMBER OF DAYS ALAMEDA CREEK EXCEEDED 650-CFS FLOW, MEASURED ABOVE THE DIVERSION DAM – 1997 TO 2007

Water Year	Hydrologic Year Type	Ranking	Number of Days with Flow Rates Exceeding 650 cfs
1997	Wet	10	11
1998	Wet	2	14
1999	Above Normal	32	2
2000	Above Normal	30	8
2001	Below Normal	50	0
2002	Below Normal	57	0
2003	N/A	N/A	2
2004	N/A	N/A	0
2005	N/A	N/A	6
2006	N/A	N/A	4
2007	N/A	N/A	1

SOURCE: USGS, 2005b.

The SFPUC estimates that, prior to lowering Calaveras Reservoir water levels (pre-2002 conditions), about 6,000 afy had been diverted from Alameda Creek to Calaveras Reservoir in years with normal rainfall, with lesser diversions in dry and below-normal years. In wet years following drought periods, higher diversion quantities could occur, and in dry years, diversions could be much lower.

As a result of Calaveras Reservoir's restricted capacity, the SFPUC has had to significantly reduce its diversions through the Alameda Creek Diversion Dam compared to its 70-year historical operation. Since 2002, both the total quantities of diverted flows and the number of days of diversions have been substantially reduced. In addition, SFPUC records indicate that the diversion valves were only opened for about 35 days in 2002 (November 13 to December 18), about 80 days in 2003 (February 13 to May 2), and 25 days in 2004 (September 29 to October 24), and were not opened for over two years (between late October 2004 and early March 2007). As a result, most flows in Alameda Creek bypassed the diversion dam and continued on into this reach between 2002 and March 2007.

Alameda Creek Below the Calaveras Creek Confluence

Alameda Creek between Calaveras Creek and San Antonio Creek is about 3.3 miles long, with an average slope of 22 feet per mile. Except for the infrequent periods of releases and/or spills from Calaveras Reservoir (see Tables 5.4.1-2 and 5.4.1-3), flows in Alameda Creek below its confluence with Calaveras Creek are similar to, but slightly greater than, those described above for Alameda Creek at the diversion dam. Typical flows are discussed below in Section 5.4.1.2, Impacts.

San Antonio Reservoir

The James H. Turner Dam, which impounds San Antonio Reservoir, was constructed in 1965, approximately one mile upstream of San Antonio Creek's confluence with Alameda Creek and approximately 2.5 miles southeast of the town of Sunol. Above its toe, the dam is about 190 feet high and has a crest elevation of 468 feet (USGS datum).

The catchment area of the reservoir is about 40 square miles. The CCSF owns most of the drainage area north and northeast of San Antonio Reservoir (as shown in Chapter 2, Figure 2.2). These lands extend eastward to include the downstream portions of each of the major contributing creeks (Indian Creek, La Costa Creek, and Williams Gulch, shown in Figure 5.4.1-2) and are considered part of the primary watershed of the reservoir. The upstream portions of the tributaries, however, are outside of CCSF ownership and include large areas of eroded and erodible lands. Stream flows into San Antonio Reservoir are highest during the winter and spring rainy season and become insignificant in summer and early fall. Average annual stream flow into San Antonio Reservoir has been estimated at 7,200 acre-feet (Bookman-Edmonston Engineering, Inc., 1995).

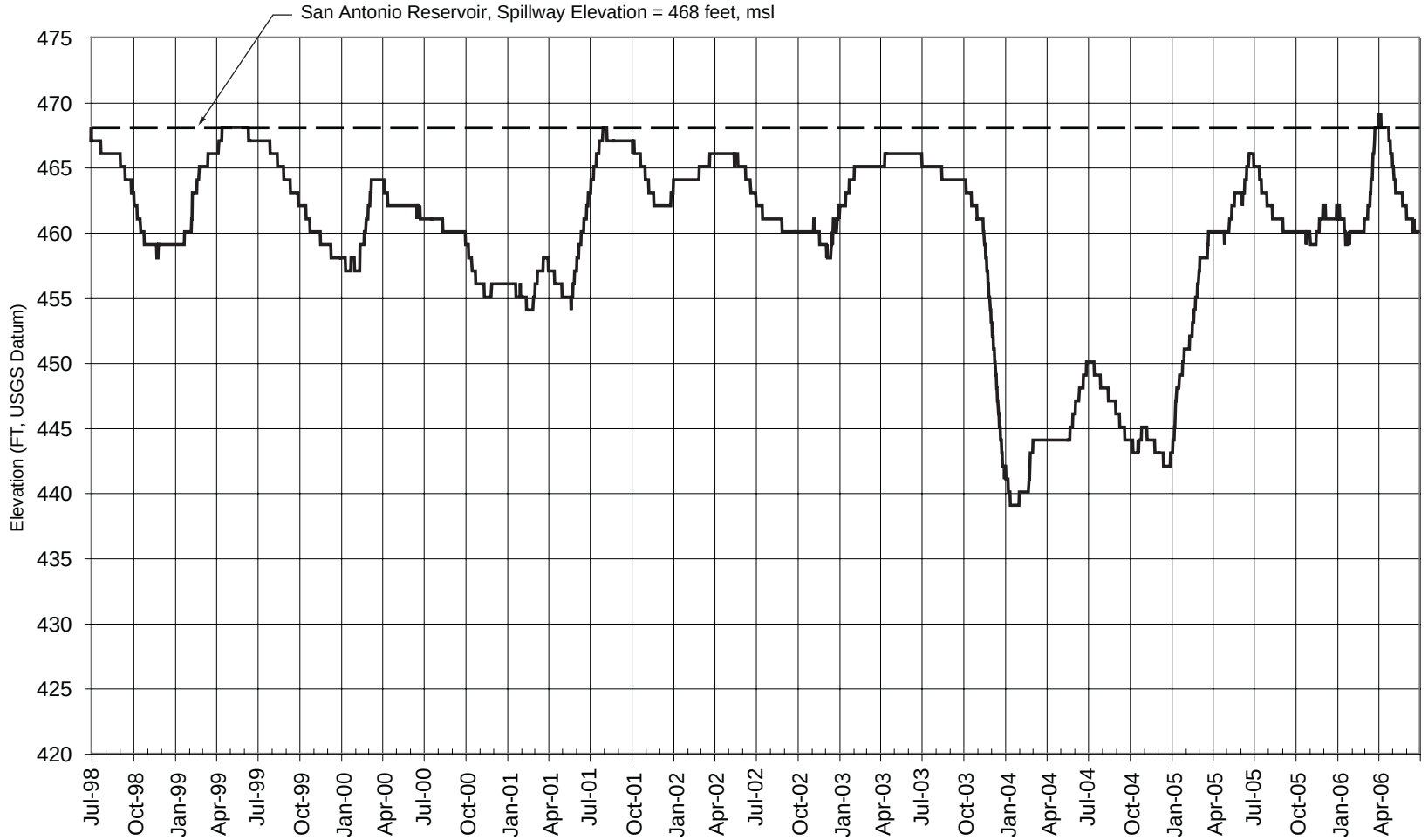
As described above, San Antonio Reservoir normally receives inflow from the San Antonio Creek watershed and imported water from the Hetch Hetchy Aqueduct (as described in Chapter 2, Section 2.2.3). In addition, the reservoir has been used to store South Bay Aqueduct emergency water, groundwater (influenced by surface water) pumped from the infiltration galleries at the Sunol Water Temple, and Calaveras Reservoir surplus flows. The initial capacity of the reservoir was 50,300 acre-feet. Sedimentation since its construction has reduced its maximum capacity by about 2 percent, to roughly 49,500 acre-feet. Average monthly storage in San Antonio Reservoir does not vary substantially from month to month or year to year, ranging from about 39,000 to 50,300 acre-feet in all conditions and months. As shown in **Figure 5.4.1-4**, reservoir levels have ranged from about 440 to 468 feet. The average annual rainfall near San Antonio Reservoir is about 20 inches per year (San Francisco Planning Department, 1999).

Reservoir Operations

The SFPUC operates San Antonio Reservoir to receive and store dechlorinated water from the Hetch Hetchy Aqueduct as well as local watershed runoff. Hetch Hetchy water can be stored in San Antonio Reservoir by diverting it from the Alameda Siphons via the San Antonio Pump Station through the San Antonio Pipeline. Although not part of normal operations, surplus water from Calaveras Reservoir can flow by gravity through the Calaveras and San Antonio Pipelines to be stored in San Antonio Reservoir.

Water from San Antonio Reservoir is treated at the Sunol Valley WTP before entering the transmission system. San Antonio Reservoir water can flow to the Sunol Valley WTP by gravity when the water level in the reservoir is above 445 feet. Below this elevation, the water must be pumped via the San Antonio Pump Station. The Sunol Valley WTP treats the water before it reenters the system by gravity-flow through the Alameda Siphons.

As part of system operations, the SFPUC can make releases from San Antonio Reservoir to San Antonio Creek, which then flow to Alameda Creek. Controlled releases through the



SOURCE: SFPUC, HH/LSM (see Appendix H)

Figure 5.4.1-4

San Antonio Reservoir, Historical Water Levels, 1998 to 2006

emergency discharge valve on Turner Dam and uncontrolled releases (spills over the spillway) are discharged to San Antonio Creek. Uncontrolled releases flow over the spillway structure, an 80-foot-long weir with a crest elevation of 468 feet. The SFPUC estimates the spillway capacity at 13,500 cfs for a reservoir water level of 480 feet.

San Antonio Creek Below San Antonio Reservoir

Modeled uncontrolled releases from San Antonio Reservoir to San Antonio Creek average about 1,700 afy, ranging from no releases in below-normal and dry years to about 8,500 acre-feet in very wet years. Actual dam operation makes adjustments to prevent spill such that less water is spilled than predicted by the model. Currently, there are no releases from June through December; the highest releases typically occur in February and March. For much of the year, this stream reach is dry. San Antonio Creek joins Alameda Creek in the lower reaches of the Sunol Valley in the vicinity of the quarries and upstream of Arroyo de la Laguna.

Alameda Creek Below the San Antonio Creek Confluence

The reach of Alameda Creek through the Sunol Valley (both upstream and downstream of the confluence with San Antonio Creek) has a low gradient, with an elevation change of about 80 feet in five river miles. The Sunol Valley is broad but is bordered in parts by steep slopes (Center for Ecosystem Management and Restoration, 2002). In the lower reaches of the Sunol Valley, Alameda Creek is bordered by numerous gravel quarries, and much of the flow in the creek is lost to groundwater.

Since October 1999, the USGS has monitored mean daily flows in Alameda Creek downstream of Welch Creek, at about the location of the Sunol WTP. Mean daily flows generally range from near zero during dry months to above 1,000 cfs in wet months. The highest mean daily flow recorded prior to lowering Calaveras Reservoir water levels was 1,070 cfs in late March. The highest mean daily flow since 2002 was 1,340 cfs in early April. During the month of May, flow rates are usually in the order of 50–100 cfs, decreasing to 20–50 cfs in June and 0–20 between July and November.

Peak flows in Alameda Creek at Welch Creek increased substantially after the closure of the diversion tunnel. In 2000 (a wet year), a peak flow rate of 2,910 cfs was recorded. If the tunnel intake had been closed, the flow would have been about 650 cfs greater.

5.4.1.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to stream flow, but generally considers that implementation of the proposed program would have a significant impact if it were to:

- Substantially alter stream flows such that they are outside the range of pre-WSIP conditions and result in substantial hydrologic changes

In addition to direct impacts resulting from changes in stream flows and reservoir levels, this PEIR also considers indirect impacts. These include impacts related to geomorphology, surface water quality, groundwater, fisheries, terrestrial biological resources, and recreational and visual resources. Each of these topics is discussed in its own section in this chapter. It should be noted that there might be cases in which significant indirect impacts could result from less-than-significant direct impacts.

Approach to Analysis

As discussed above in Section 5.4.1.1, DSOD-imposed restrictions on Calaveras Reservoir capacity substantially altered SFPUC operations and, as a result, changed the hydrologic conditions in Alameda Creek, Calaveras Creek, and Calaveras Reservoir (i.e., flow diversions from Alameda Creek have been reduced or halted and reservoir levels lowered). These hydrologic conditions will continue until the Calaveras Dam project (SV-2) is implemented, which would restore the original reservoir capacity. Therefore, these hydrologic conditions will have occurred for 10 years or more (from 2002 through approximately 2012, the target date for reservoir refill). Once the dam is rebuilt and the reservoir refilled, the SFPUC would reinitiate operations that are similar to those it implemented prior to the DSOD restrictions, and the hydrologic conditions in Alameda Creek and Calaveras Reservoir would return to those that existed prior to the DSOD restrictions; that is, the SFPUC would again divert substantial flow from Alameda Creek to the reservoir and would maintain the reservoir water levels near the maximum storage level.

The SFPUC operates the Alameda Creek Diversion Dam to divert water from Alameda Creek into Calaveras Reservoir when such water can be stored. The SFPUC closes the ACDD Tunnel when diversions are not needed. As a result of the 2001 DSOD restriction on Calaveras Reservoir, the SFPUC has had to reduce the volume of water stored in Calaveras and has therefore significantly reduced its diversions through the Alameda Creek Diversion Dam by closing the tunnel more frequently compared to its 70-year historic operation. Upon completion of the Calaveras Dam Replacement project (SV-2), the SFPUC would no longer have DSOD restrictions on storage level in Calaveras Reservoir. Compared to historical operations with full storage capacity at Calaveras, the SFPUC plans to maintain Calaveras Reservoir at a higher elevation over long periods of time, and as a result the diversion tunnel would be closed more often than historically and there would be more occasions when water bypasses the Alameda Creek Diversion Dam into Alameda Creek (see Appendix H2-2, Table 2.7-7).

For the purpose of impact analysis, CEQA Guidelines Section 15125(a)[2] considers the existing conditions baseline to be those conditions in existence at the time the environmental review is initiated, as marked by issuance of the notice of preparation (NOP). For the WSIP, the existing baseline used for the impact analysis reflects the range of hydrologic conditions that have resulted since the DSOD restrictions were imposed in December 2001 and continued through issuance of the NOP in 2005, and which are expected to continue until such time that a restored reservoir

[2] CEQA Guidelines Section 15125(a) states that an EIR must include a description of the physical environmental conditions in the vicinity of the project as they exist at the time the NOP is published, and that this environmental setting will normally constitute the baseline physical conditions by which the lead agency determines whether an impact is significant.

begins refilling. This PEIR does not use the historical range of hydrologic conditions that existed prior to the DSOD restriction as the basis of impact analysis of the WSIP impacts on stream flow.

The following section addresses the impacts of the WSIP on water levels in Calaveras and San Antonio Reservoirs and flow along Calaveras, Alameda, and San Antonio Creeks. In applying the above significance criteria, very infrequent changes in reservoir levels and/or flow are not generally considered to generate a significant effect. Changes in stream flow and changes in reservoir storage and water levels attributable to the WSIP were estimated using the Hetch Hetchy/Local Simulation Model (HH/LSM). An overview of the model is presented in Section 5.1.4. Detailed information on the model and its underlying assumptions is provided in Appendix H.

This section compares modeled existing (2005) hydrologic conditions (with Calaveras Reservoir operated at its restricted capacity and assuming current operational priorities) to modeled post-WSIP 2030 conditions. The WSIP 2030 conditions assume full implementation of all proposed WSIP facility improvement projects, including the Calaveras Dam (SV-2) and Alameda Creek Fishery (SV-1) projects, as well as implementation of fishery releases and downstream recapture of those releases. In some cases, patterns from actual flow data were used to supplement results from the modeled data in order to provide additional detail and context for assessing potential impacts. Stream reaches are discussed separately below, and their interrelationships are highlighted.

Impact Summary

Table 5.4.1-6 presents a summary of the impacts on stream flow in the Alameda Creek watershed that could result from implementation of the proposed water supply and system operations.

TABLE 5.4.1-6
SUMMARY OF IMPACTS – STREAM FLOW IN ALAMEDA CREEK WATERSHED

Impact	Significance Determination
Impact 5.4.1-1: Effects along Calaveras Creek below Calaveras Reservoir	LS
Impact 5.4.1-2: Effects on flow along Alameda Creek below the diversion dam	SU
Impact 5.4.1-3: Effects in San Antonio Reservoir and along San Antonio Creek	LS
Impact 5.4.1-4: Effects on flow along Alameda Creek below the confluence of San Antonio Creek	LS

LS = Less than Significant impact, no mitigation required
SU = Significant Unavoidable impact

Impact 5.4.1-1: Effects along Calaveras Creek below Calaveras Reservoir.

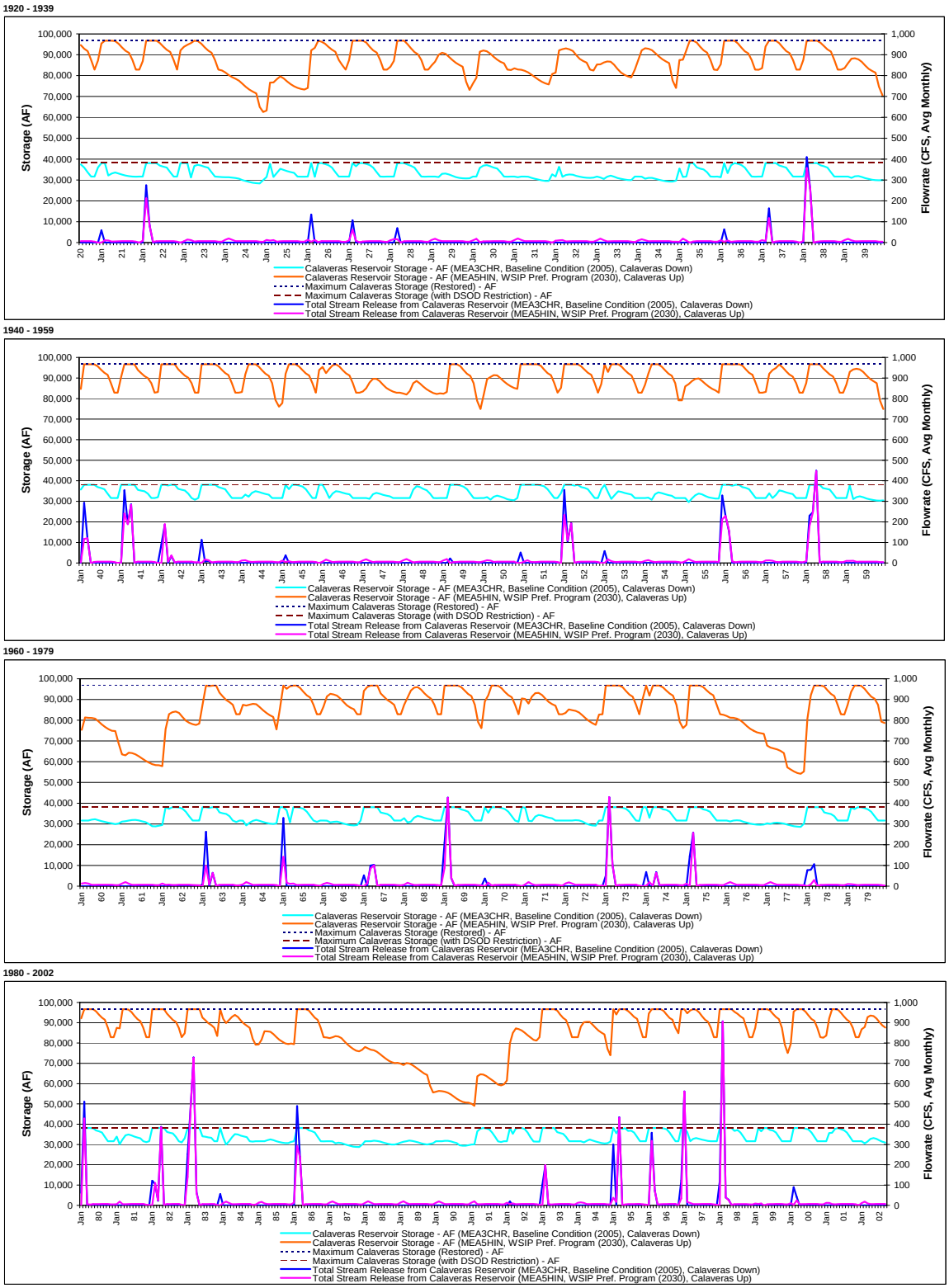
Calaveras Reservoir is currently operated to conserve local watershed runoff for integration into the SFPUC regional water supply; however, due to DSOD restrictions, the water level in Calaveras Reservoir has been considerably lower since the end of 2001 than in previous years.

Reservoir storage is constrained to approximately 37,800 acre-feet (except on a temporary basis), about 40 percent of its design capacity. Under the WSIP, Calaveras Reservoir would be restored to its full design capacity (approximately 96,800 acre-feet), which would allow the SFPUC to maximize the use of local watershed supplies. Furthermore, fishery releases from the reservoir (measured below the confluence of Alameda and Calaveras Creeks) and flow recapture would be implemented under the WSIP in accordance with the 1997 MOU. The releases from Calaveras Reservoir to Calaveras Creek would be recaptured downstream and returned to the SFPUC water supply.

Under existing and future modeled conditions, yearly Calaveras Reservoir storage operations are typically cyclical: the reservoir fills in the late winter/early spring and is depleted during the summer. During a drought, reservoir storage is further depleted by the slow, successive drawdown of reservoir storage that occurs due to required releases and the drafting of supplies to the Sunol Valley WTP that exceed runoff to the reservoir. The reservoir then refills after the drought, as the SFPUC strives to conserve local watershed runoff. Both the annual range and year-to-year range of variation in reservoir water levels would increase as the storage capacity of Calaveras Reservoir is restored.

Figure 5.4.1-5 illustrates the modeled chronological storage and stream releases from Calaveras Reservoir for both the existing condition and the WSIP using hydrologic data from the period 1920 to 2002. Releases to Calaveras Creek from Calaveras Reservoir represent both controlled releases through the cone valve and uncontrolled releases over the spillway. The graphs also show how peak flows in Calaveras Creek downstream of the dam tend to correspond to periods when Calaveras Reservoir is operating at or near capacity.

As illustrated in the graphs, the most notable change that would occur under WSIP operations is that Calaveras Reservoir would be operated at a higher water surface elevation than at present; as the graphs show, the brown line (2030 WSIP conditions) is consistently at a much higher level than the blue line (existing conditions) for the 82-year period. Reservoir storage and water levels also show greater variation than under existing conditions, as illustrated by the wider range of fluctuation of the brown line (2030 WSIP conditions) compared to the blue line (existing conditions). The graphs also show that the restored reservoir storage would reduce peak releases (and therefore flows) into Calaveras Creek downstream of the dam under all but the heaviest wet-year storms; the releases are represented by the blue line (existing conditions) and magenta line (2030 WSIP conditions) along the bottom of each graph, with the magenta line generally lower than the blue line except in the wettest years. Under actual operations to date, storage in the reservoir under restricted conditions has at times exceeded the DSOD target; as a result, more water has been temporarily held in storage than the model indicates (see Figure 5.4.1-3) and fewer releases have actually occurred than predicted by the model. This is because the model



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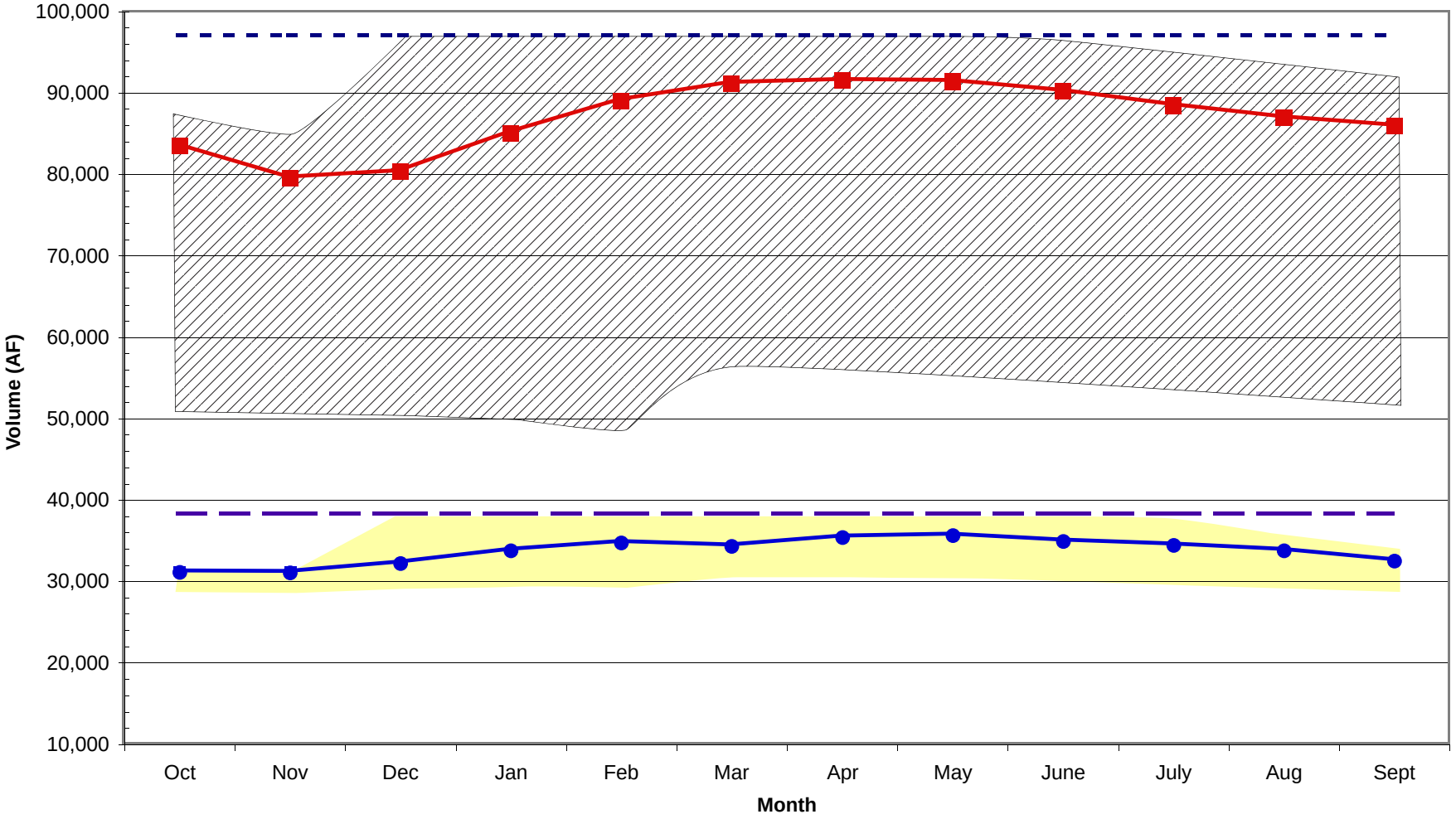
SOURCE: SFPUC, HH/LSM (see Appendix H).

Figure 5.4.1-5
Calaveras Storage and Releases to Calaveras Creek



SOURCE: SFPUC, HH/LSM (see Appendix H)

Figure 5.4.1-6
Average Monthly Storage Volume,
Calaveras Reservoir

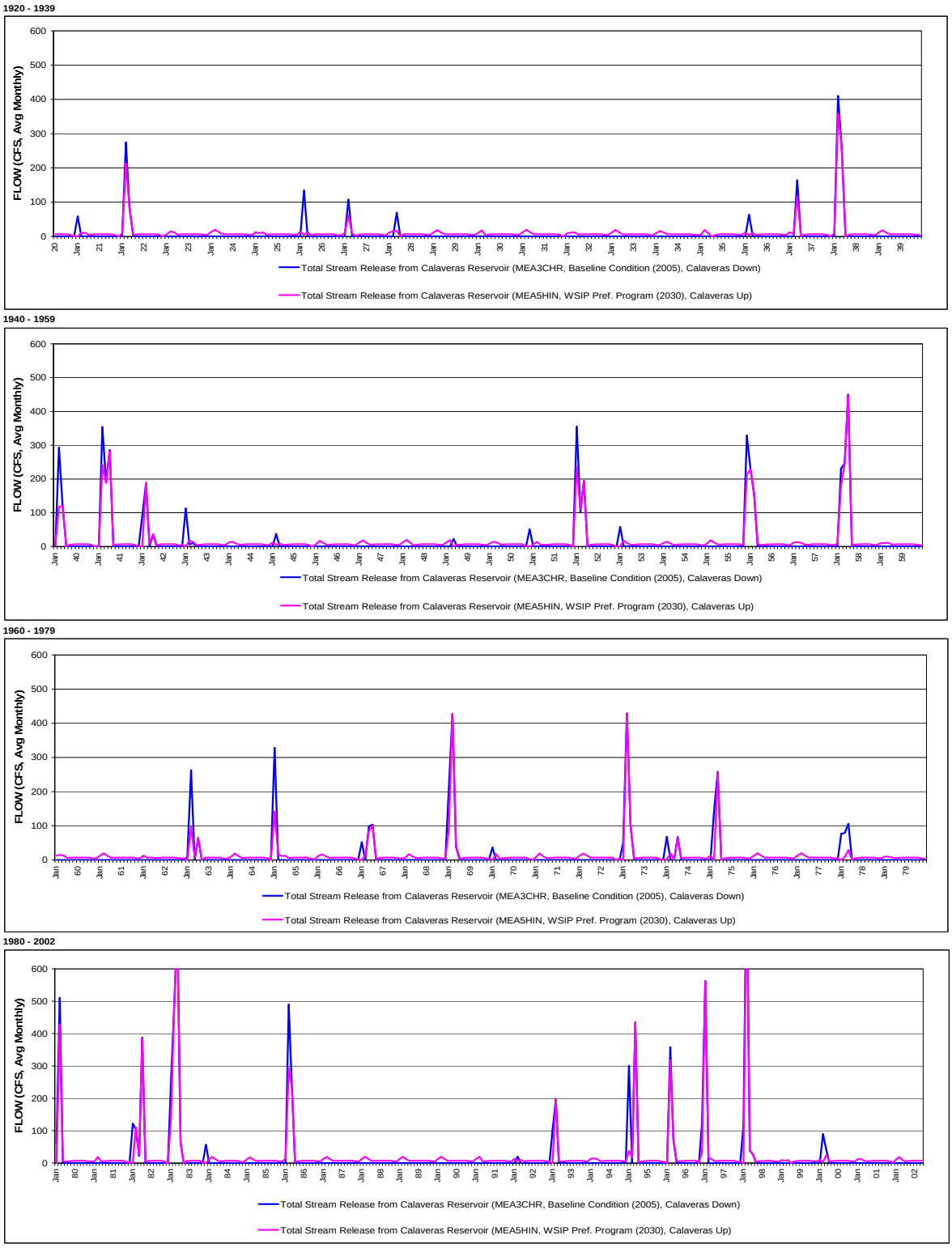
imposes absolute rules, whereas under actual conditions, the SFPUC operators must adjust operations in response to many real-time factors.

Figure 5.4.1-6 presents the estimated change in average monthly reservoir water surface elevation under existing conditions and after implementation of the WSIP. The water level in Calaveras Reservoir would be higher year-round with the WSIP; the increase in average monthly storage would be mostly attributable to completion of the Calaveras Dam project (SV-2) and the removal of the DSOD storage limitations. During rainy months, the reservoir water level would be kept near the wintertime storage objective, or roughly 20 to 30 feet higher than under existing conditions. The average water surface elevation would be substantially greater than under current conditions, but only 6 to 12 feet higher than pre-2002 conditions (prior to the DSOD restrictions).

With implementation of the WSIP, the change in operation of Calaveras Reservoir storage would affect hydrologic conditions elsewhere in the watershed. As described below, the restored capacity of Calaveras Reservoir would affect the operation of the Alameda Creek Diversion Dam and Tunnel, and thus the inflow to Calaveras Reservoir and flow to Alameda Creek below the diversion dam. The restored storage capacity would also allow for implementation of the 1997 MOU-required releases from Calaveras Reservoir in support of fisheries.

Compared to existing conditions, the WSIP would change the nature of releases from Calaveras Reservoir to Calaveras Creek. With implementation of the fishery releases (up to 6,300 afy), there would at times be releases from the reservoir under the WSIP that are not made under existing conditions. These flows would be gaged and maintained below the confluence of Alameda and Calaveras Creeks. Contributing to these flows would be: (1) flows that spill past the Alameda Creek Diversion Dam, (2) unregulated runoff from accretions (inflow) between the diversion dam and the Calaveras Creek confluence, (3) unregulated runoff between Calaveras Dam and the confluence, and (4) operational releases from Calaveras Reservoir for reservoir regulation purposes.

Figure 5.4.1-7 illustrates the modeled chronological releases of water below Calaveras Dam to Calaveras Creek for both existing conditions and with the WSIP. Operational releases from Calaveras Reservoir occur in about 40 percent of the years under the modeled existing condition and slightly less frequently under the WSIP (with the exception of 1997 MOU releases, which would occur in all years), with most of these years being classified as above-normal or wet. **Table 5.4.1-7** shows the releases from the reservoir for various representative hydrologic year types. As shown in the table, releases with the WSIP would be substantially diminished in the winter months of normal, above-normal, and wet years, with up to a 70 percent reduction. This reduction in the frequency and magnitude of releases would primarily result from removal of the DSOD storage constraint following construction of the Calaveras Dam project (SV-2). With greater operational capacity, more local runoff would be stored and used for water supply. During all months of below-normal and dry years and the majority of months in normal, above-normal, and wet years, the volume of releases would remain nearly the same or would be slightly diminished with the WSIP compared to existing conditions. However, in several scenarios, releases would be eliminated under WSIP operations.



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SOURCE: SFPUC, HH/LSM (see Appendix H).

Figure 5.4.1-7

Chronological Modeled Releases of Water Below Calaveras Dam

TABLE 5.4.1-7
ESTIMATED AVERAGE MONTHLY RELEASES FROM CALAVERAS RESERVOIR TO CALAVERAS CREEK
(cubic feet per second)

	Wet	Above Normal	Normal	Below Normal	Dry	All
Existing Condition (2005 Operations and Facilities)						
Oct	0	0	0	0	0	0
Nov	0	0	0	0	0	0
Dec	28	3	4	0	0	7
Jan	150	44	6	0	0	40
Feb	297	105	16	0	0	83
Mar	162	50	6	0	0	43
Apr	84	8	0	0	0	18
May	0	0	0	0	0	0
June	0	0	0	0	0	0
July	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sept	0	0	0	0	0	0
WSIP (2030)						
Oct	7	7	7	7	7	7
Nov	4	4	5	5	5	5
Dec	17	3	3	4	5	6
Jan	83	13	9	11	13	25
Feb	270	65	13	16	19	76
Mar	163	46	9	10	12	48
Apr	85	11	4	6	6	22
May	4	5	6	6	7	6
June	7	7	7	7	7	7
July	7	7	7	7	7	7
Aug	7	7	7	7	7	7
Sept	7	7	7	7	7	7
Difference and Percent Change, Existing Condition (2005) vs WSIP (2030)						
Oct	7	*	7	*	7	*	7	*	7	*	7	*
Nov	4	*	4	*	5	*	5	*	5	*	5	*
Dec	-11	-[39%]	0	[0%]	-1	-[25%]	4	*	5	*	-1	-[14%]
Jan	-67	-[45%]	-31	-[70%]	3	[50%]	11	*	13	*	-15	-[38%]
Feb	-27	-[9%]	-40	-[38%]	-3	-[19%]	16	*	19	*	-7	-[8%]
Mar	1	[1%]	-4	-[8%]	3	[50%]	10	*	12	*	5	[12%]
Apr	1	[1%]	3	[38%]	4	*	6	*	6	*	4	[22%]
May	4	*	5	*	6	*	6	*	7	*	6	*
June	7	*	7	*	7	*	7	*	7	*	7	*
July	7	*	7	*	7	*	7	*	7	*	7	*
Aug	7	*	7	*	7	*	7	*	7	*	7	*
Sept	7	*	7	*	7	*	7	*	7	*	7	*

* Indicates a release under the "WSIP (2030)" condition where no release under "Existing Condition (2005)" currently exists.

NOTE: "Existing Condition (2005)" is based on model run MEA3CHR. "WSIP (2030)" is based on model run MEA5HIN. An overview of the model runs is presented in Section 5.1. Detailed information on the models and underlying assumptions is provided in Appendix H.

Key
> 0%
< 0 to -5%
< -5%

SOURCE: SFPUC, HH/LSM (see Appendix H).

With implementation of the WSIP, summer base flows (flows that occur in the absence of any recent rainfall) in Calaveras Creek below the dam would increase due to the required fishery releases below Calaveras Dam (shown in Table 5.4.1-5). The maximum supplemental release of 6,300 afy might not be needed in every year due to other flows reaching the confluence; therefore, supplemental instream flow releases would range from about 2,250 afy to the full 6,300 afy.

Impact Conclusions

As indicated in the relevant tables and figures, the WSIP would substantially reduce average flows in Calaveras Creek below Calaveras Dam in the winter and early spring months of wet and above-normal precipitation years. The proposed program would also increase flows due to fishery releases in the summer months. As indicated on Figure 5.4.1-7, the changes in flow due to the WSIP would occur in years with above-normal rainfall only, and the reduced winter flows would still remain in the range of existing flows; therefore, the impact would be *less than significant*, and no mitigation measures would be required. The new summer instream releases in Calaveras Creek would constitute a beneficial flow impact.

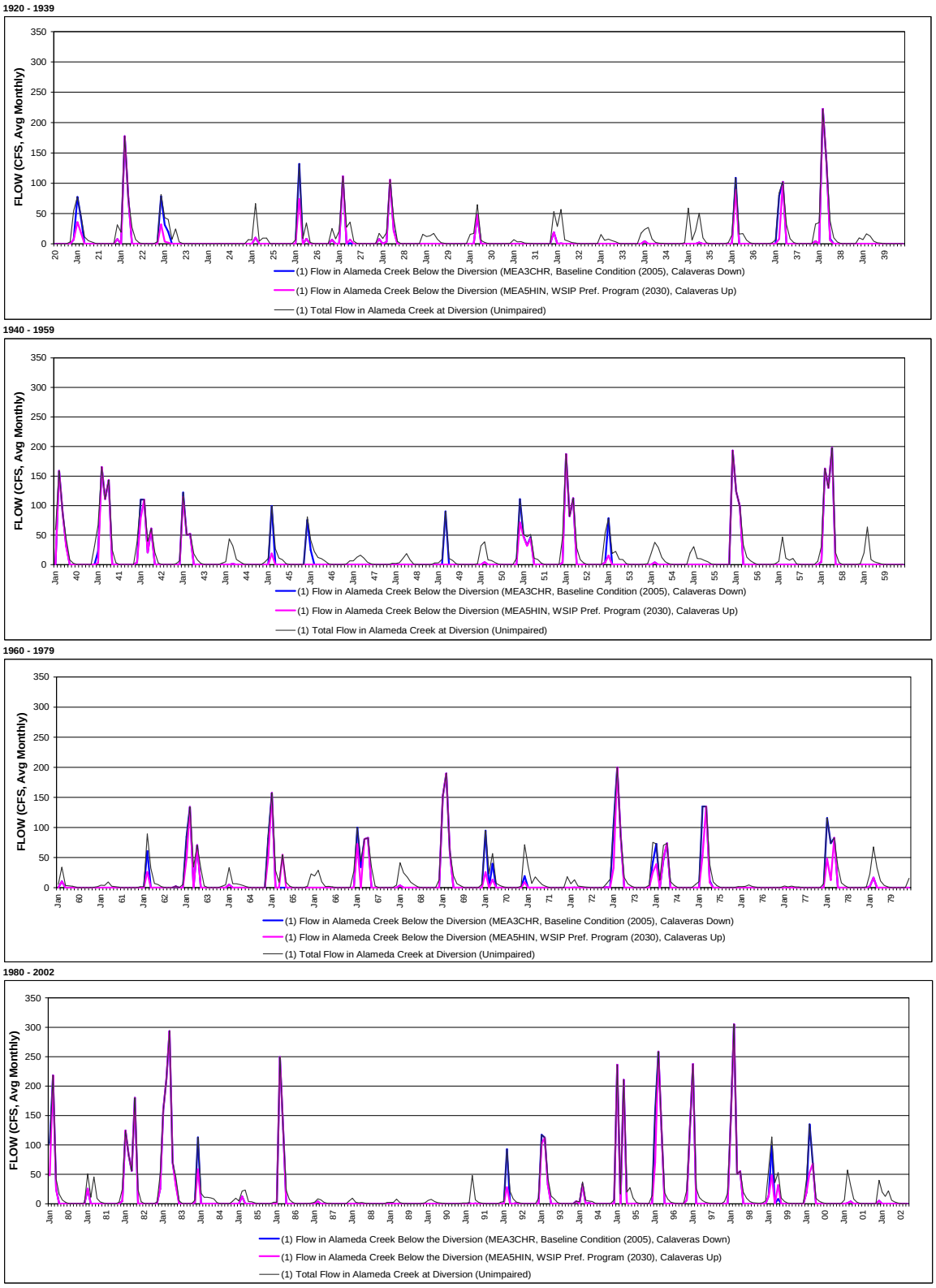
Impact 5.4.1-2: Effects on flow along Alameda Creek below the diversion dam.

The diversion of flows from Alameda Creek at the diversion dam affects two reaches of the creek: the reach between the diversion dam and the confluence with Calaveras Creek and the reach below the confluence with Calaveras Creek. Both reaches are discussed in this impact analysis.

Between the Diversion Dam and the Calaveras Creek Confluence

The Alameda Creek Diversion Dam and Tunnel divert water from the upper Alameda Creek watershed to Calaveras Reservoir. Inflow at the diversion dam is diverted into the tunnel up to the maximum capacity of the tunnel, which is estimated at about 650 cfs. Inflow to the diversion dam that exceeds the tunnel capacity (or when the tunnel gates are closed) flows past the diversion dam and continues downstream in Alameda Creek. As described above, diversions from Alameda Creek to Calaveras Reservoir have been substantially reduced because of the DSOD restrictions on Calaveras Reservoir. Currently, as indicated on Figure 5.4.1-3, Calaveras Reservoir is often filled near, or above, the maximum permitted storage level with runoff from its natural drainage and, at these times, has no capacity to accept diversions from Alameda Creek. Therefore, while the DSOD restrictions on Calaveras Dam are in effect, the SFPUC is unable to capture most local watershed runoff from upper Alameda Creek, and post-2002 flows in Alameda Creek below the diversion dam have been substantially greater than they were prior to 2002.

Modeling of future operations under the WSIP indicates that diversions would primarily occur during the December through May rainy season. The greatest diverted/reduced stream flow quantities would occur from December through March. **Figure 5.4.1-8** shows the modeled chronological average monthly spill of water past the diversion dam for the period from 1920 to 2002. As illustrated in the figure, the number of occurrences and magnitude of flows continuing down Alameda Creek past the diversion dam would be reduced with the WSIP due to more



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SOURCE: SFPUC, HH/LSM (see Appendix H).

Figure 5.4.1-8
Flows in Alameda Creek Below the Diversion Dam

frequent diversions to Calaveras Reservoir. Flows past the diversion dam would be reduced in all hydrologic year types, and nearly eliminated in below-normal and dry years.

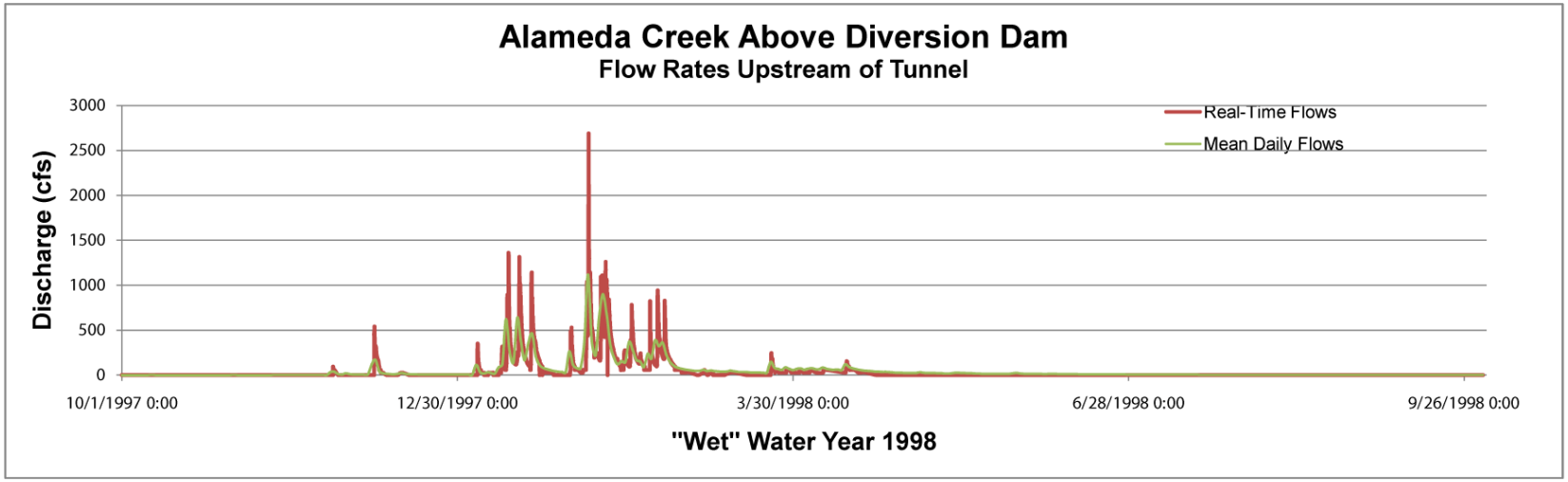
As described in Section 5.4.1.1, Setting, instantaneous gage data (15-minute readings) for the period from 1997 through 2007 indicate that flows greater than 650 cfs in Alameda Creek above the diversion dam have occurred an average of about four days per year (a total of 48 days over the 11-year period) and, in one-quarter of those years, did not occur at all. These instantaneous readings show that flows in excess of 650 cfs occur more frequently than is indicated by the daily mean flow data shown in Table 5.4.1-4. This is because many of the peak flows last for a few hours only and are obscured by 24-hour means. Daily means also underrepresent the actual volumes of water passing the diversion dam. As indicated in **Figures 5.4.1-9** and **5.4.1-10**, under the WSIP in a typical above-normal rainfall year, there would be only a few days per year when flows above the minimal seepage levels (approximately 1 cfs) would reach Alameda Creek below the diversion dam (the primary exceptions being when Calaveras Reservoir is full and diversions cease, and when large storms result in runoff substantially over 650 cfs). However, as indicated on these graphs, substantial volumes of water (sometimes over 1,000 cfs) would still flow down the creek during these peak events. Because the diversion dam facilities seep, summer and fall base flows of less than about 1 cfs would continue down the creek and would not be affected by WSIP operations.

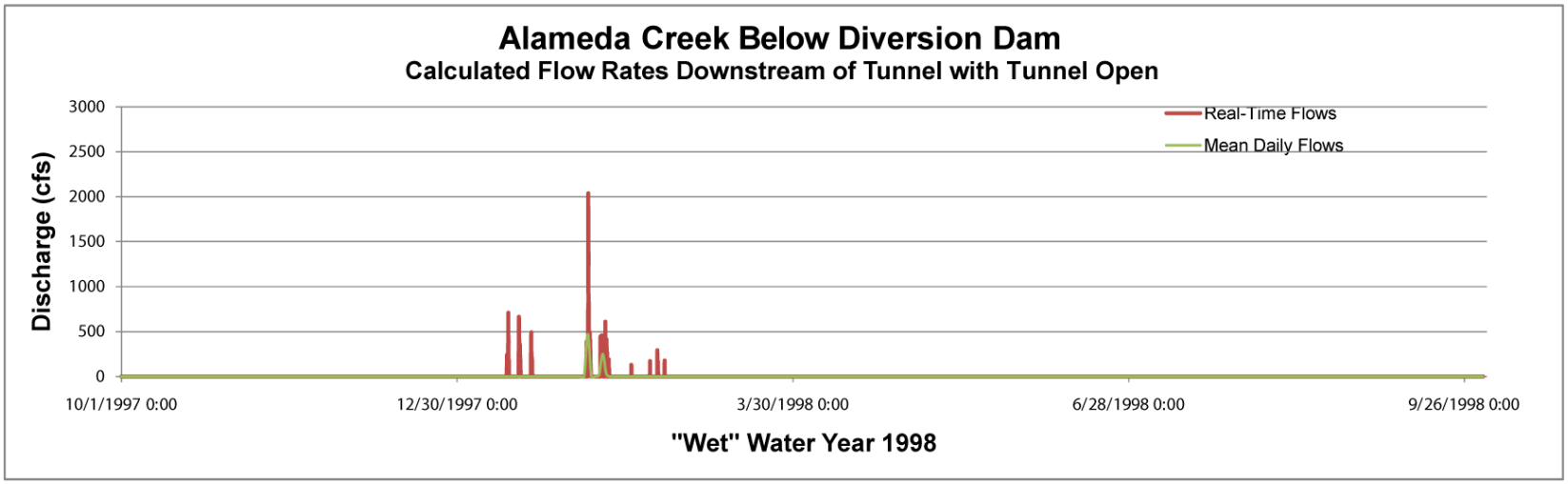
On a storm-by-storm basis, even when stream flows exceed 650 cfs, WSIP diversions would substantially reduce the flows and alter the hydrograph, leaving only brief periods of high flows in major storm events, as shown on Figures 5.4.1-5 and **5.4.1-11**. The graphs show that flows below 650 cfs (which make up several hours of the typical large storm) would be eliminated, and that flows above 650 cfs would be substantially reduced in all but the heaviest storms compared to existing conditions. Both duration and magnitude of flows in the creek downstream of the diversion dam would be substantially reduced during storm events such that, with the proposed program, flows from major storms would resemble those currently occurring during much smaller storm events, and smaller storms would not result in any flows at all.

Alameda Creek Below the Calaveras Creek Confluence

The total flow at the confluence of Alameda and Calaveras Creeks is the combination of total releases/spills from Calaveras Dam, flow spilled past the Alameda Creek Diversion Dam, and the unregulated runoff occurring between the confluence and the diversion dam and Calaveras Dam. However, because most of the flows from Arroyo Hondo and Calaveras Creek are retained in Calaveras Reservoir for water supply storage, the vast majority of Alameda Creek flows in this reach originate above the diversion dam (except when Calaveras spills or makes large releases). This is shown on **Figure 5.4.1-12**, which compares graphs of flows in Alameda Creek in an above-normal year, as gaged above the diversion dam, and below the Calaveras Creek confluence. The graphs indicate that, with the exception of one spike (which may be due to releases from Calaveras Reservoir or an erroneous gage reading), flows above the diversion dam were very similar to those measured just below the Calaveras confluence.

Table 5.4.1-8 presents modeled flow data for the Calaveras confluence in terms of the monthly average flow within year type. As shown in the table, there would be a substantial reduction (up





Upper graphic – SOURCE: USGS, 2005b
Lower graphic – SOURCE: USGS, 2005c

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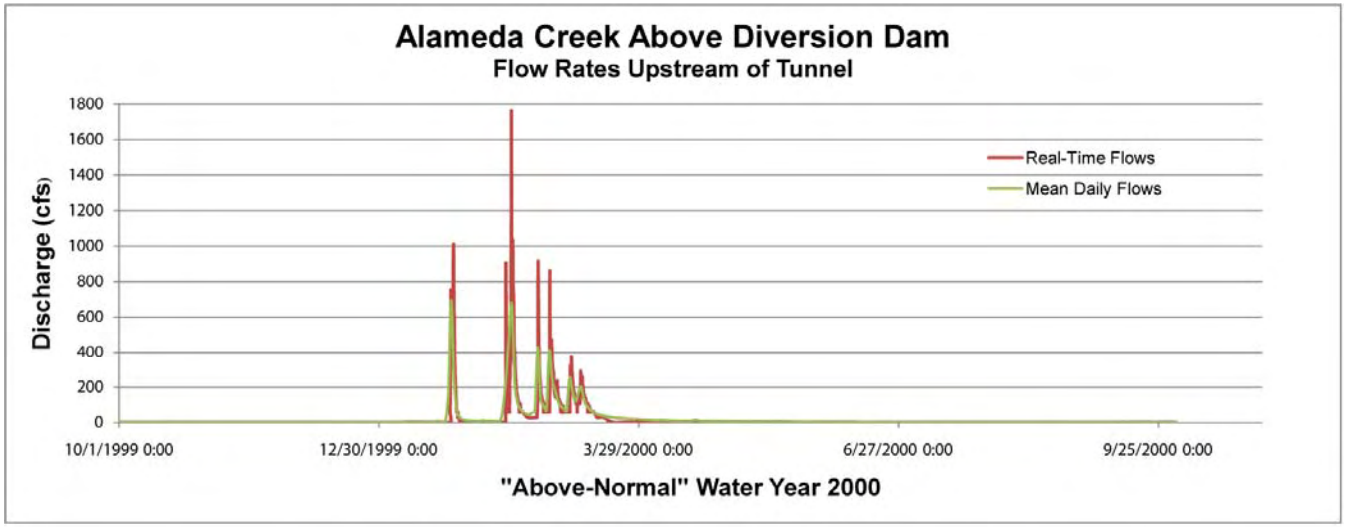
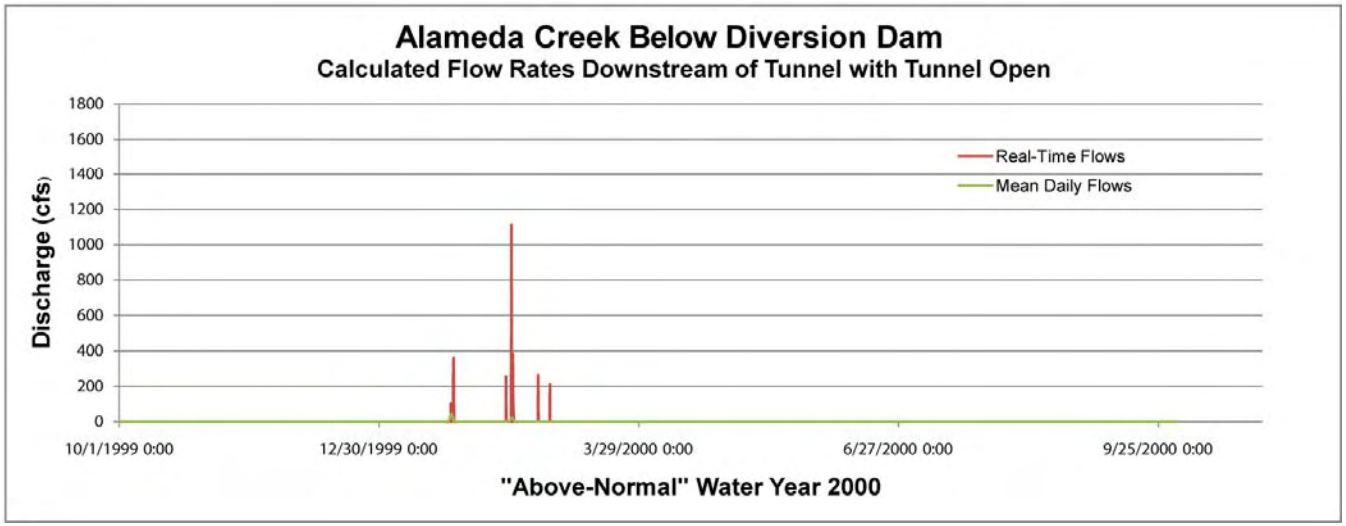
Figure 5.4.1-9
Alameda Creek Above and Below the Diversion Dam –
Flow Rates Upstream and Downstream of the Diversion Tunnel During "Wet" Water Years





Upper graphic – SOURCE: USGS, 2005b
Lower graphic – SOURCE: USGS, 2005c

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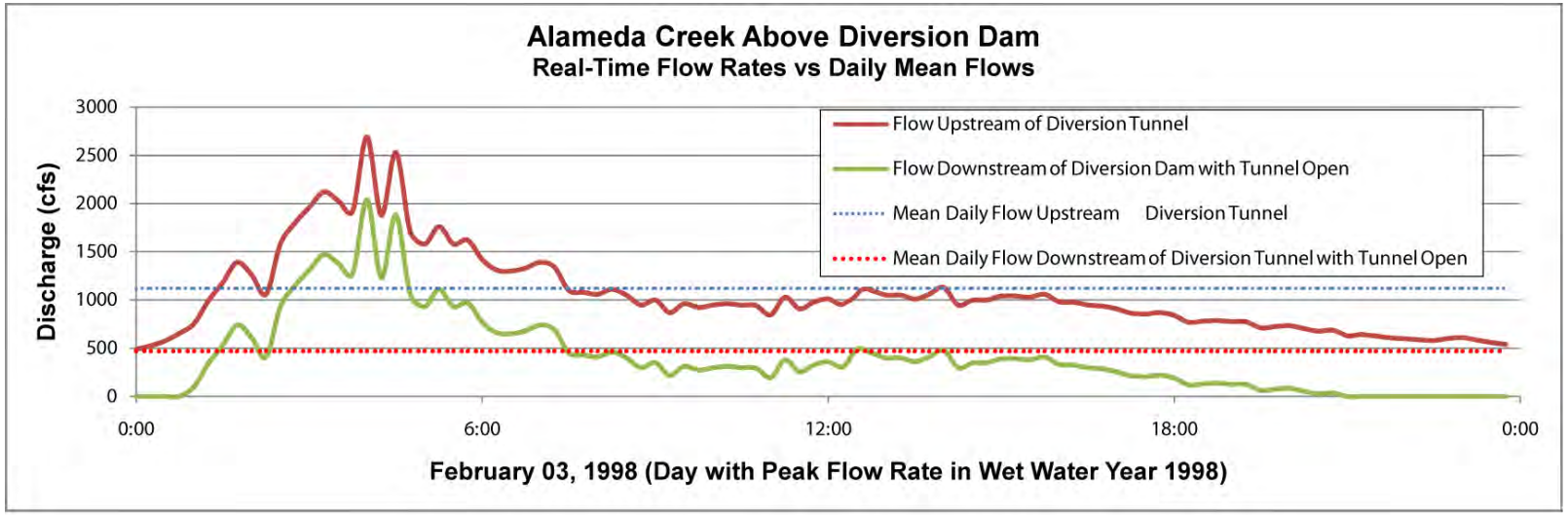
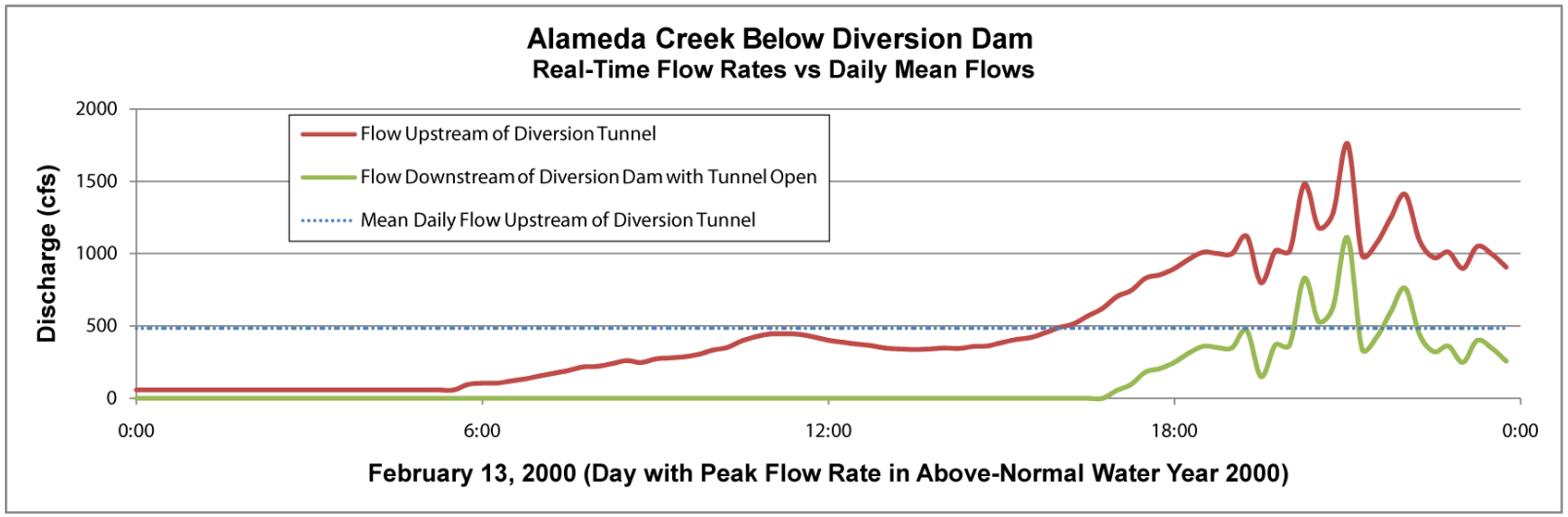
Figure 5.4.1-10
Alameda Creek Above and Below the Diversion Dam –
Flow Rates Upstream and Downstream of Tunnel During "Above-Normal" Water Years





Upper graphic – SOURCE: USGS, 2005b
Lower graphic – SOURCE: USGS, 2005c

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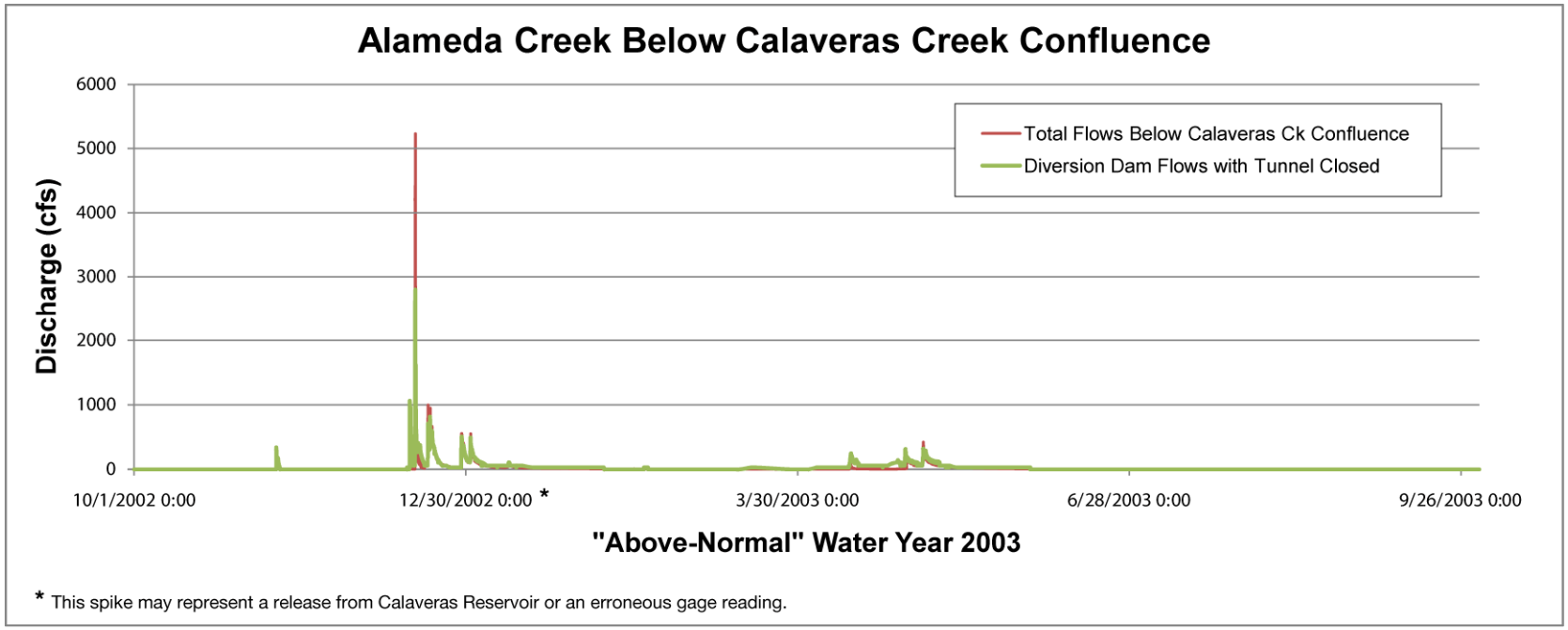
Figure 5.4.1-11
Alameda Creek Above and Below the Diversion Dam –
Real-Time Flow Rates vs Daily Mean Flows



SOURCE: USGS, 2005d

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Figure 5.4.1-12

Alameda Creek Below the Calaveras Creek Confluence

TABLE 5.4.1-8
ESTIMATED AVERAGE MONTHLY FLOW IN ALAMEDA CREEK BELOW THE CALAVERAS CREEK CONFLUENCE
(acre-feet per month)

	Wet	Above Normal	Normal	Below Normal	Dry	All
Existing Condition (2005)						
Oct	1	12	1	1	0	3
Nov	80	69	29	22	6	41
Dec	3,460	1,612	1,356	78	43	1,298
Jan	17,197	7,001	1,501	186	35	5,145
Feb	25,928	11,980	3,054	340	230	8,254
Mar	16,711	6,753	1,586	411	70	5,069
Apr	8,597	1,462	284	74	49	2,061
May	307	103	66	41	23	107
June	31	21	10	7	1	14
July	12	6	2	0	0	4
Aug	4	2	0	0	0	1
Sept	2	1	0	0	0	0
WSIP (2030)						
Oct	430	437	430	429	429	431
Nov	325	327	304	298	298	310
Dec	2,789	1,116	798	325	324	1,061
Jan	12,266	3,941	1,082	858	813	3,758
Feb	24,307	8,459	2,004	1,216	1,275	7,389
Mar	16,744	6,505	1,343	1,007	816	5,246
Apr	8,648	1,917	539	420	423	2,360
May	548	430	436	430	430	454
June	418	417	418	417	417	417
July	430	430	430	429	430	430
Aug	429	429	430	430	430	430
Sept	417	417	417	417	417	417
Difference and Percent Change, Existing Condition (2005) vs WSIP (2030)						
Oct	429	[42,900%]	425	[3,542%]	429	[42,900%]	428	[42,800%]	429	*	428	[14,267%]
Nov	245	[306%]	258	[374%]	275	[948%]	276	[1,255%]	292	[4,867%]	269	[656%]
Dec	-671	-[19%]	-496	-[31%]	-558	-[41%]	247	[317%]	281	[653%]	-237	-[18%]
Jan	-4,931	-[29%]	-3,060	-[44%]	-419	-[28%]	672	[361%]	778	[2,223%]	-1,387	-[27%]
Feb	-1,621	-[6%]	-3,521	-[29%]	-1,050	-[34%]	876	[258%]	1,045	[454%]	-865	-[10%]
Mar	33	[0%]	-248	-[4%]	-243	-[15%]	596	[145%]	746	[1,066%]	177	[3%]
Apr	51	[1%]	455	[31%]	255	[90%]	346	[468%]	374	[763%]	299	[15%]
May	241	[79%]	327	[317%]	370	[561%]	389	[949%]	407	[1,770%]	347	[324%]
June	387	[1,248%]	396	[1,886%]	408	[4,080%]	410	[5,857%]	416	[41,600%]	403	[2,879%]
July	418	[3,483%]	424	[7,067%]	428	[21,400%]	429	*	430	*	426	[10,650%]
Aug	425	[10,625%]	427	[21,350%]	430	*	430	*	430	*	429	[42,900%]
Sept	415	*	416	*	417	*	417	*	417	*	417	*

* Indicates a release under the "WSIP (2030)" condition where no release under "Existing Condition (2005)" currently exists.

NOTE: "Existing Condition (2005)" is based on model run MEA3CHR. "WSIP (2030)" is based on model run MEA5HIN. An overview of the model runs is presented in Section 5.1. Detailed information on the models and underlying assumptions is provided in Appendix H.

Key
> 0%
< 0 to -5%
< -5%

SOURCE: SFPUC, HH/LSM (see Appendix H).

to 44 percent) in wintertime flow at the confluence during above-normal and wet years. As with the upstream reach, peak flows would also be substantially reduced in drier years, primarily as a result of renewed upstream diversions. However, overall flows would be increased due to fishery releases.

Figure 5.4.1-13 illustrates the modeled chronological stream flows at the confluence for both the existing condition and with the WSIP. As shown in the figure, flow is low in many years under both existing and WSIP conditions, with rapid spikes in flow during and immediately following episodes of high rainfall. However, except in times of spills or winter releases from Calaveras Reservoir, winter and early spring flows in Alameda Creek at Calaveras Creek would be substantially reduced due to the reinstated large-scale diversions from Alameda Creek (described above). As shown in Figure 5.4.1-11, although the effects of reduced diversions would occasionally be damped by releases from Calaveras Reservoir, renewed diversions would continue to substantially reduce rainy season flows in Alameda Creek at and below its confluence with Calaveras Creek.

Under the WSIP, the SFPUC would augment flow below the confluence of Calaveras and Alameda Creeks by releasing water from Calaveras Reservoir; as a result, there would be an increase in flow at the confluence in almost all other months of wet and above-normal rainfall years and in all instances of other years. The target flow rates in Alameda Creek are shown in **Table 5.4.1-9**. The proposed program includes facilities (as part of the Calaveras Dam project, SV-2) to provide the 1997 MOU-required releases. In addition, the SFPUC is developing alternative means of recapturing a portion of the water released downstream of the Sunol Valley WTP as part of the Alameda Creek Fishery project (SV-1).

TABLE 5.4.1-9
MINIMUM FLOWS BELOW THE CONFLUENCE OF ALAMEDA AND CALAVERAS CREEKS

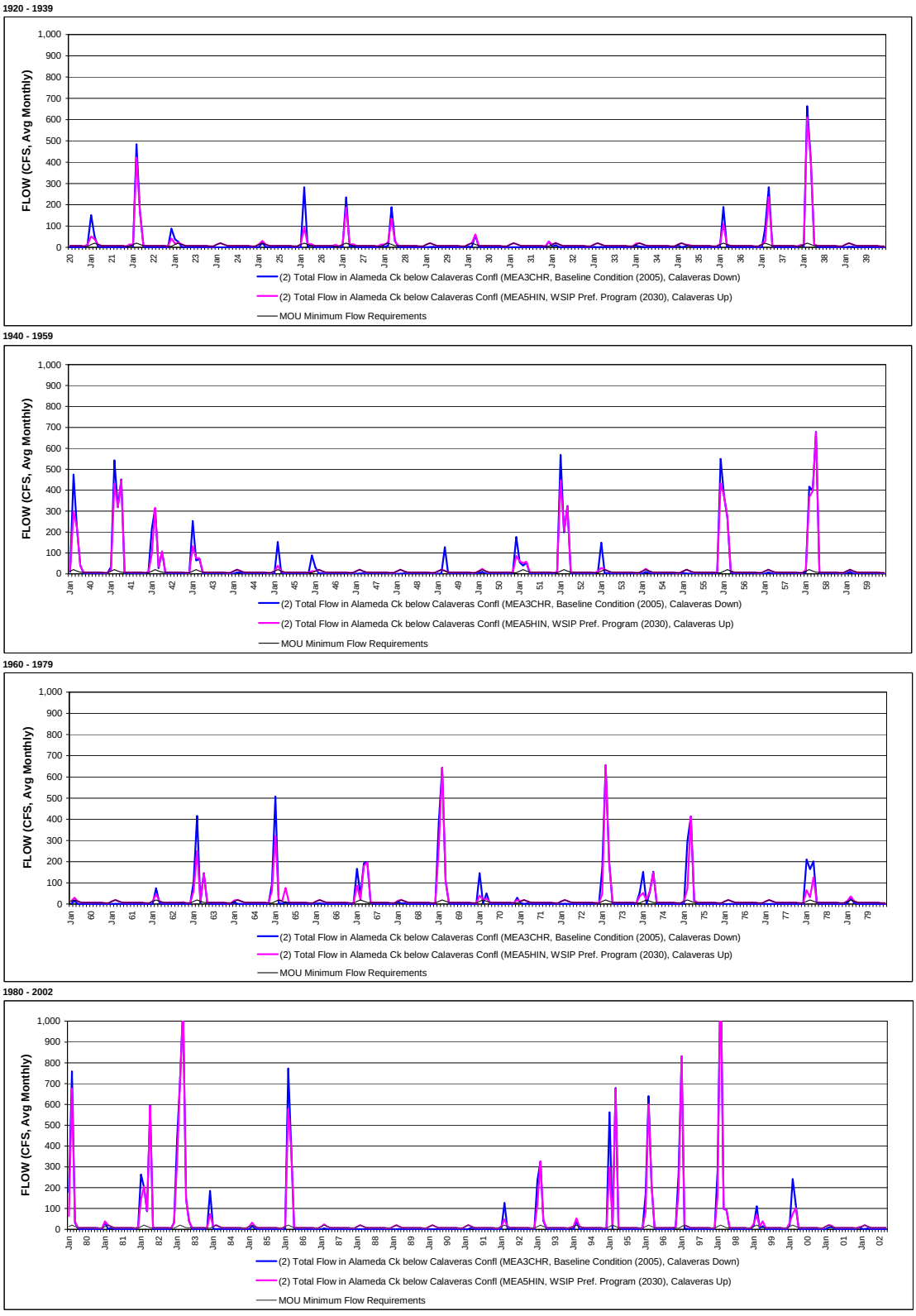
Period	5-Day Running Average (cfs)	Minimum Daily (cfs)
November 1 – January 14	5	4.5
January 15 – March 15	20	18
March 16 – October 31	7	6.3

cfs = cubic feet per second

SOURCE: CDFG, 1997.

Impact Conclusions

Implementation of the WSIP would increase diversions from Alameda Creek to Calaveras Reservoir, nearly eliminating the low and moderate (1 to 650 cfs) flows in Alameda Creek downstream of the diversion dam that currently occur when the diversion gates are closed, and substantially reducing many higher (greater than 650 cfs) flows. Under the WSIP, flows in Alameda Creek in the reach below the diversion dam to the Calaveras Creek confluence and in the reach below the confluence would be substantially reduced compared to the conditions in



SOURCE: SFPUC, HH/LSM (see Appendix H).

Figure 5.4.1-13
Flow in Alameda Creek below the Calaveras Creek Confluence

existence since December 2001, when the DSOD imposed storage capacity restrictions on Calaveras Reservoir. This reduction of stream flows and alteration of the stream hydrograph is considered a substantial hydrologic effect and, as a result, this impact is *significant and unavoidable*. Measure 5.4.1-2, Diversion Tunnel Operation, requires the SFPUC to close the diversion dam and cease Alameda Creek diversions to Calaveras Reservoir as soon as possible each year, once the reservoir is at desired levels, such that the later-season storm flows not needed to refill Calaveras Reservoir are allowed to flow down Alameda Creek past the diversion dam to the lower reaches. Although this measure could help reduce the impact, it would not fully mitigate it; therefore, this impact would remain significant and unavoidable for the reaches of Alameda Creek below the diversion dam to its confluence with Calaveras Creek and below the confluence. However, after implementation of the WSIP, flow in this 2.85-mile reach of Alameda Creek would approximate conditions experienced between 1935 and 2001. In addition, in some years, flows in Alameda Creek below the diversion dam would be greater due to revised reservoir operations. The reestablishment of the diversions is necessary to achieve the SFPUC water supply objectives, and full mitigation could not be accomplished without foregoing the needed diversions.

This impact conclusion applies only to flow effects and not to the indirect impacts associated with these flow changes. Indirect effects are addressed in subsequent sections of this chapter; as discussed, these effects are either less than significant, or mitigation has been identified to reduce them to a less-than-significant level.

As a result of the 2001 DSOD restriction on Calaveras Reservoir, the SFPUC has had to reduce the volume of water stored in Calaveras and has therefore significantly reduced its diversions through the Alameda Creek Diversion Dam by closing the tunnel more frequently compared to its 70-year historic operation. Upon completion of the Calaveras Dam Replacement project (SV-2), the SFPUC would no longer have DSOD restrictions on storage levels in Calaveras Reservoir. Compared to historical operations with full storage capacity at Calaveras, the SFPUC plans to maintain Calaveras Reservoir at a higher elevation over longer periods of time, and as a result the Alameda Creek Diversion Tunnel would be closed more often than historically and there would be more occasions when water bypasses the diversion dam into Alameda Creek (see Appendix H2-2, Table 2.7-7). Therefore, in the reach below the confluence with Calaveras Creek, the increased dry-season releases that would occur under the WSIP in accordance with the 1997 MOU would be a beneficial effect.

Impact 5.4.1-3: Effects in San Antonio Reservoir and along San Antonio Creek.

The overall operation of San Antonio Reservoir with the WSIP would remain the same as under existing conditions. San Antonio Reservoir would continue to be operated to conserve local watershed runoff for integration into the SFPUC water supply and, when possible, would continue to store imported water from the Hetch Hetchy system to maximize carryover storage. As described below, the HH/LSM indicates small changes in reservoir releases; however, those

changes are within the range of operator discretion, and actual operations may be closer to existing operations.

Figure 5.4.1-14 illustrates the modeled chronological operation of San Antonio Reservoir for both the existing condition and with the WSIP. The figure shows the reservoir's storage, inflow from the Hetch Hetchy system, and releases to San Antonio Creek for each condition. As illustrated in the figure, San Antonio Reservoir storage operations are typically cyclical: the reservoir fills in the late winter/early spring and is depleted during the summer. During a drought, reservoir storage would be additionally depleted by the slow, successive drawdown due to drafting to the Sunol Valley WTP in excess of watershed runoff and replenishment by Hetch Hetchy flows.

Typically, San Antonio Reservoir would remain slightly fuller under the WSIP than under modeled existing conditions because the restored capacity of Calaveras Reservoir would provide additional local water supply to serve customer demand, reducing the need to use water from San Antonio Reservoir. WSIP operations involve keeping local reservoirs higher for delivery reliability and system maintenance purposes. This supply would be used to maintain the Sunol Valley WTP's minimum throughput of 20 mgd and to satisfy water demand in excess of Hetch Hetchy flows. The exception to this higher storage would occur every fifth year, when planned maintenance for the Mountain Tunnel would reduce Hetch Hetchy flows to the Bay Area during the winter. During this period, San Antonio Reservoir would be drawn to replace the flows not provided from the Hetch Hetchy system. The reservoir would refill to typical operating levels within one to two years after the maintenance period.

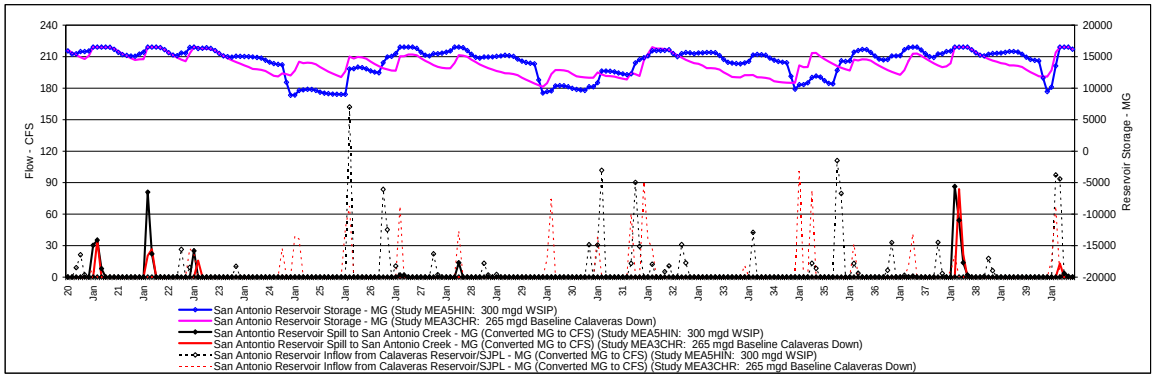
The change in operation of San Antonio Reservoir storage would result in minor changes to other components of watershed hydrology. As described below, the increased storage in San Antonio Reservoir would affect the operation of diversions to the Sunol Valley WTP and imports from Hetch Hetchy. The increased storage capacity would also affect the release of spills from San Antonio Reservoir and subsequently the downstream flows in Alameda Creek.

As indicated in the table, the WSIP would have no effect on flow in San Antonio Creek in dry, below-normal, and normal years. The proposed program would result in minor increases and decreases in winter and spring flows in some above-normal years. Occasionally, the WSIP could result in spills to San Antonio Creek that would not occur under existing conditions. These occasional spills would occur because the reservoir would be drawn down less often due to the restoration of Calaveras Reservoir storage capacity, the fishery releases that would be recaptured, and local reservoirs that would be kept slightly fuller for delivery reliability and system maintenance purposes.

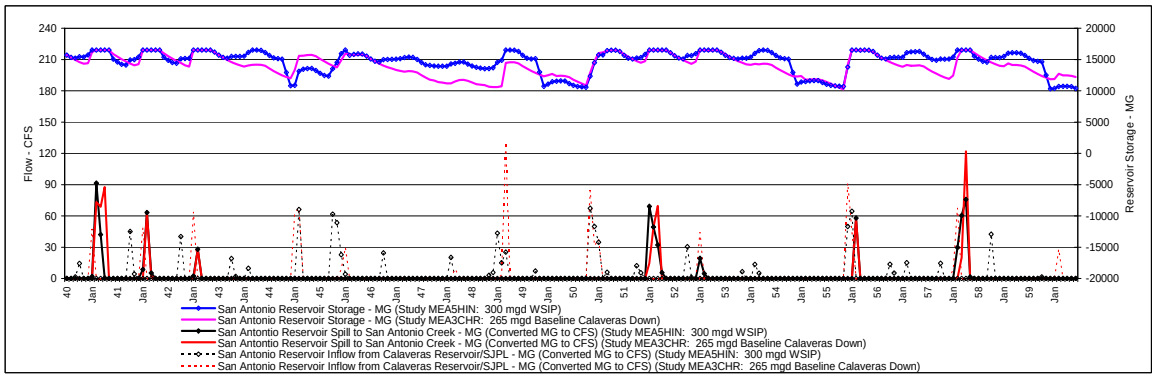
Figure 5.4.1-15 illustrates the modeled chronological release of water below Turner Dam under the existing condition and with the WSIP. Releases from San Antonio Reservoir to San Antonio Creek have historically been rare and would continue to be rare with the WSIP. Releases past the dam are modeled to occur in about 20 percent of the years under the existing condition and at about the same frequency with the WSIP—mostly in above-normal or wet years. The change in releases would occur primarily during January, February, and March of these years, with increases in average monthly flows of up to 15 cfs in some months countered by decreases of up

San Antonio Reservoir

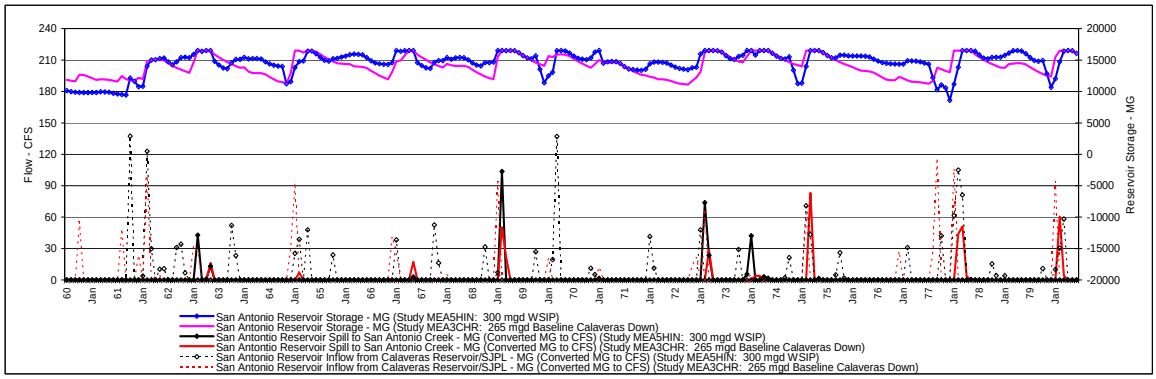
1920 - 1939



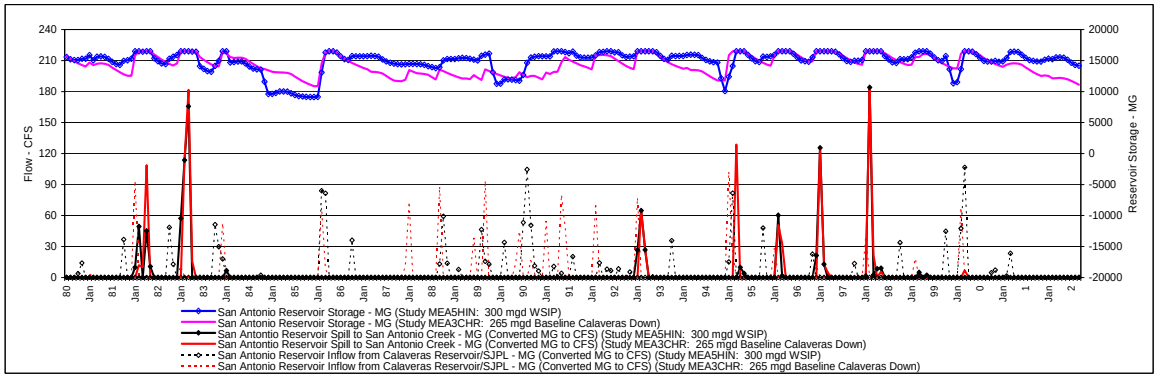
1940 - 1959



1960 - 1979



1980 - 2002



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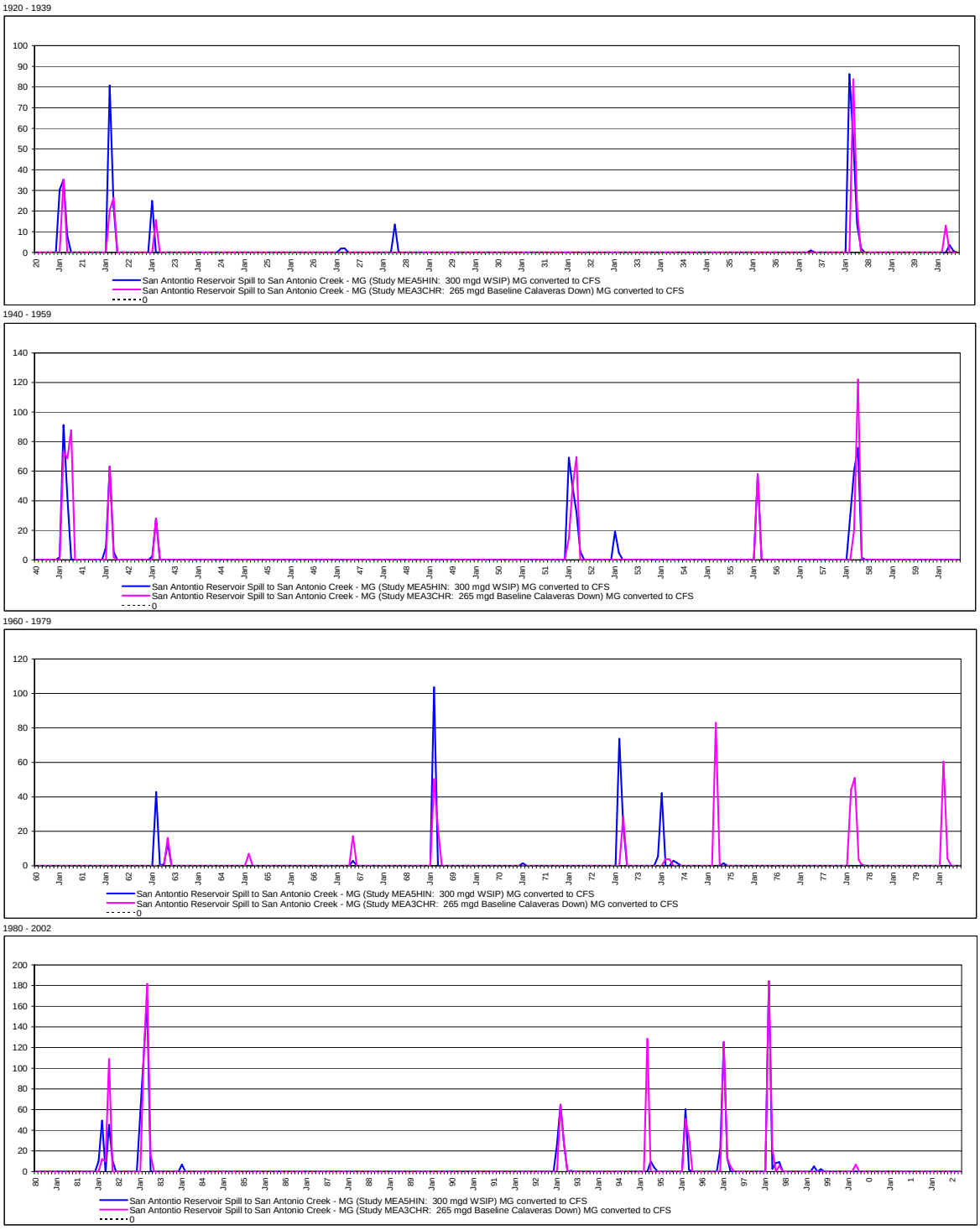
SOURCE: SFPUC, HH/LSM (see Appendix H).

Figure 5.4.1-14
Chronological Operation of San Antonio Reservoir



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SOURCE: SFPUC, HH/LSM (see Appendix H).

Figure 5.4.1-15

San Antonio Reservoir Releases to San Antonio Creek

to 16 cfs in others. It should be noted that under actual operations, these changes in modeled average monthly flows could take the form of a few days of larger releases.

Table 5.4.1-10 presents the modeled average monthly releases from San Antonio Reservoir under the existing condition and with the WSIP. The table also shows the difference in flow between the existing and WSIP conditions. Differences in releases could occur during the rainy season; the magnitude of the differences varies greatly compared to modeled existing flows, sometimes increasing and sometimes decreasing. Although the model predicts small releases in wet months, in reality the projected releases of less than an average monthly flow of 35 cfs (2,000 acre-feet) could likely be avoided through flexibility in actual day-to-day operations that cannot be represented by the HH/LSM (meaning that there would have been no flow released under those circumstances).

Impact Conclusions

Because the modeled flow changes in San Antonio Creek are within the current range and would be quite small, this impact would be *less than significant*, and no mitigation measures would be required.

Impact 5.4.1-4: Effects on flow along Alameda Creek below the confluence of San Antonio Creek.

The flow at the confluence of Alameda and San Antonio Creeks is a function of: (1) flows arriving at the confluence of Alameda and Calaveras Creeks, which are dependent on releases from Calaveras Dam, flow spilled past the Alameda Creek Diversion Dam, and the unregulated runoff occurring between the confluence and the diversion dam and Calaveras Dam, (2) unregulated runoff from the watershed between the two confluences, and (3) flow entering Alameda Creek from San Antonio Creek, which is regulated by releases from Turner Dam. In addition, the creek can seasonally either lose (dry season) or gain (rainy season) flows to and from the groundwater and nearby gravel pits. Depending on its design and location, the recapture facility to be constructed under the Alameda Creek Fishery project (SV-1) could also draw groundwater flows from the creek.

Figure 5.4.1-16 illustrates the modeled flow at the confluence during the various rainfall scenarios for the existing condition and with the WSIP. **Table 5.4.1-11** presents modeled flows at the confluence in terms of the average monthly flow within hydrologic year type. As shown in the figure and table, there would be a substantial (8 to 52 percent) reduction in flow volumes at the confluence during January, February, and March of normal or wetter years, depending on the rainfall distribution. The majority of this effect would occur due to the reduction in spills from Calaveras Reservoir and, to a lesser degree, increased diversions from the Alameda Creek Diversion Dam during these periods. However, in April of normal years, the modeled data indicate a moderate increase in total flow volumes (about 14 percent), again due to the change in operation of Calaveras Reservoir, as described above.

TABLE 5.4.1-10
ESTIMATED AVERAGE MONTHLY RELEASES FROM SAN ANTONIO RESERVOIR TO SAN ANTONIO CREEK
(cubic feet per second)

	Wet	Above Normal	Normal	Below Normal	Dry	All
Existing Condition (2005)						
Oct	0	0	0	0	0	0
Nov	0	0	0	0	0	0
Dec	0	0	0	0	0	0
Jan	9	0	0	0	0	2
Feb	42	16	0	0	0	11
Mar	40	14	0	0	0	11
Apr	22	0	0	0	0	4
May	1	1	0	0	0	0
June	0	0	0	0	0	0
July	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sept	0	0	0	0	0	0
WSIP (2030)						
Oct	0	0	0	0	0	0
Nov	0	0	0	0	0	0
Dec	1	0	0	0	0	0
Jan	17	7	2	0	0	5
Feb	57	18	0	0	0	15
Mar	24	4	0	0	0	5
Apr	10	0	1	0	0	2
May	2	1	0	0	0	1
June	0	0	0	0	0	0
July	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sept	0	0	0	0	0	0
Difference and Percent Change, Existing Condition (2005) vs WSIP (2030)						
Oct	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
Nov	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
Dec	1	*	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
Jan	8	[89%]	7	*	2	*	0	[0%]	0	[0%]	3	[150%]
Feb	15	[36%]	2	[13%]	0	[0%]	0	[0%]	0	[0%]	4	[36%]
Mar	-16	-[40%]	-10	-[71%]	0	[0%]	0	[0%]	0	[0%]	-6	-[55%]
Apr	-12	-[55%]	0	[0%]	1	*	0	[0%]	0	[0%]	-2	-[50%]
May	1	[100%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	1	*
June	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
July	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
Aug	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
Sept	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]

* Indicates a release under the "WSIP (2030)" condition where no release under "Existing Condition (2005)" currently exists.

NOTE: "Existing Condition (2005)" is based on model run MEA3CHR. "WSIP (2030)" is based on model run MEA5HIN. An overview of the model runs is presented in Section 5.1. Detailed information on the models and underlying assumptions is provided in Appendix H.

Key
> 0%
< 0 to -5%
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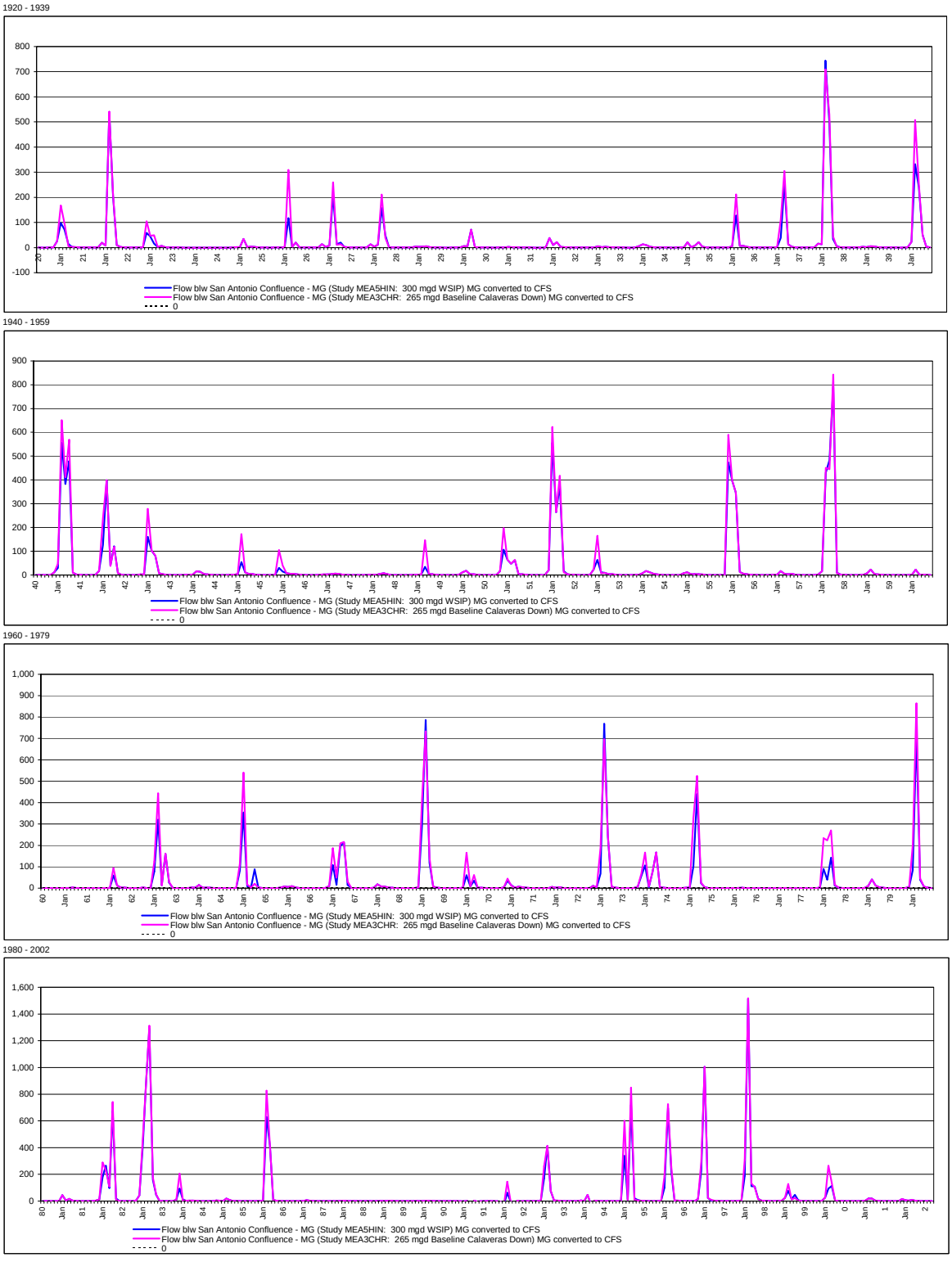
SOURCE: SFPUC, HH/LSM (see Appendix H).



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SOURCE: SFPUC, HH/LSM (see Appendix H)

Figure 5.4.1-16
Chronological Flows in Alameda Creek at the Confluence with San Antonio Creek

TABLE 5.4.1-11
ESTIMATED AVERAGE MONTHLY FLOW IN ALAMEDA CREEK
BELOW THE SAN ANTONIO CREEK CONFLUENCE
(cubic feet per second)

	Wet	Above Normal	Normal	Below Normal	Dry	All
Existing Condition (2005)						
Oct	0	0	0	0	0	0
Nov	2	2	1	1	0	1
Dec	61	30	25	2	1	24
Jan	303	122	28	5	1	91
Feb	523	242	61	10	5	167
Mar	326	132	30	10	2	99
Apr	176	29	7	2	1	42
May	9	4	2	1	1	3
June	1	1	0	0	0	0
July	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sept	0	0	0	0	0	0
WSIP (2030)						
Oct	0	0	0	0	0	0
Nov	2	2	1	1	0	1
Dec	50	19	13	2	1	17
Jan	229	75	14	5	1	64
Feb	505	174	29	10	5	143
Mar	308	113	18	10	2	89
Apr	162	35	8	2	1	41
May	9	4	2	1	1	3
June	1	1	0	0	0	0
July	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sept	0	0	0	0	0	0
Difference and Percent Change, Existing Condition (2005) vs WSIP (2030)						
Oct	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
Nov	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
Dec	-11	-[18%]	-11	-[37%]	-12	-[48%]	0	[0%]	0	[0%]	-7	-[29%]
Jan	-74	-[24%]	-47	-[39%]	-14	-[50%]	0	[0%]	0	[0%]	-27	-[30%]
Feb	-18	-[3%]	-68	-[28%]	-32	-[52%]	0	[0%]	0	[0%]	-24	-[14%]
Mar	-18	-[6%]	-19	-[14%]	-12	-[40%]	0	[0%]	0	[0%]	-10	-[10%]
Apr	-14	-[8%]	6	[21%]	1	[14%]	0	[0%]	0	[0%]	-1	-[2%]
May	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
June	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
July	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
Aug	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
Sept	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]

NOTE: "Existing Condition (2005)" is based on model run MEA3CHR. "WSIP (2030)" is based on model run MEA5HIN. An overview of the model runs is presented in Section 5.1. Detailed information on the models and underlying assumptions is provided in Appendix H.

Key
> 0%
< 0 to -5%
< -5%

SOURCE: SFPUC, HH/LSM (see Appendix H).

Impact Conclusions

Flow in Alameda Creek below the confluence of San Antonio Creek would be altered as a result of the WSIP in winter months of normal or wetter years; however, the change in flows would be substantially dampened by inflows from other tributaries in the Sunol Valley and would not result in any adverse hydrologic effects. Therefore, impacts on Alameda Creek below the confluence of San Antonio Creek would be *less than significant*, and no mitigation measures would be required.

There would be no change in flows in most other months of normal or wetter years and in all months of drier years, because the fishery releases would be recaptured at a location upstream from the confluence of Alameda and San Antonio Creeks.

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U.S. Geological Survey (USGS), Stream Gage Data for Station 11173510 Alameda C BL Calaveras C NR Sunol, CA, National Water Information System website, http://nwis.waterdata.usgs.gov/nwis/nwisman/?site_no=11180750&agency_cd=USGS, accessed November 2005d.

5.4.2 Geomorphology

The following setting section describes the geomorphology of the streams in the Alameda Creek watershed that could be affected by the WSIP. The impact section (Section 5.4.2.2) provides a description of the changes in stream channel form and erosion that would result from WSIP-induced changes in stream flow, as described in Section 5.4.1.

5.4.2.1 Setting

Geomorphology and Sediment Transport

The SFPUC's Alameda watershed upstream of Niles Canyon is comprised of two general landform (geomorphic) regions: the "canyon areas" above the Sunol Valley WTP, and the Sunol Valley. The geomorphology of the canyon areas can be further divided into reservoirs and stream channels. The fluvial geomorphologic conditions[1] of each of these areas are summarized below.

The Sunol Valley has lower gradients than the canyon reaches, and the channel bed and banks are primarily comprised of sediments. There are several grade controls (where erosion is restricted by a solid feature such as a bedrock outcrop, weir, or dam) in the Sunol Valley and downstream; two of these, Sunol and Niles Dams, were recently lowered by the SFPUC to calculated pre-dam streambed elevations. A bedrock outcrop about 1,000 feet below the Sunol Dam site also controls channel morphology and stream downcutting (Weiss Associates, 2004).

An average of approximately 270,000 tons (160,000 cubic yards) of sediment is transported by Alameda Creek annually. At the Sunol dam site, these sediments are about one-quarter to one-third sand and two-thirds to three-quarters gravel. These sediments are transported by high flows in the creek; for example, it has been estimated that the 3.5-year flow in Alameda Creek at the Sunol Dam site (approximately 7,000 cfs) transports a volume of sediment equal to about 25 percent of the average annual sediment load in the creek (Weiss Associates, 2004). Sediment transport curves developed by Weiss Associates for Alameda Creek near Niles indicate minimal sediment transport with flows of less than 20 cfs, and an increase from 10 to 1,000 tons/day when stream flows increase from 100 to 1,000 cfs. At 2,000 cfs, sediment loads approach 10,000 tons/day. At Niles Canyon, there is virtually no bedload transport[2] with flows under 1,000 cfs, and 2,500 to 6,000 tons/day with flows of 10,000 cfs (Weiss Associates, 2004).

The ACFCWCD removes about 300,000 cubic yards of sediments from their flood control channel downstream of Niles Canyon every 10 years; this constitutes about 19 percent of the total creek sediment load. The remaining sediments deposit in parts of the flood control channel that are not subject to maintenance and/or are eventually transported to San Francisco Bay (Weiss Associates, 2004). It should be noted that these are long-term averages, and annual sediment loads could vary widely depending on runoff events and watershed conditions.

1 The term "fluvial geomorphologic conditions" refers to changes in the shape of the stream channels and associated erosional and depositional features (e.g., canyons, streambeds, stream banks, floodplains), and the hydrologic and geologic processes and conditions contributing to or affecting those changes.

2 Bedload refers to the amount of sediment, cobbles, gravel, and rocks transported along the stream bottom (as opposed to suspended in the stream flow).

Much of this sediment is generated in the Vallecitos, Arroyo Mocho, Arroyo Valle, and Arroyo de la Laguna watersheds, outside of the SFPUC watersheds. These watersheds include large alluvial valleys, where erosion due to natural channel meandering as well as land management practices can generate substantial sediment volumes. Although substantial sediment generation can occur from the steep slopes in the upper watersheds (upstream of Calaveras and San Antonio Dams), much of this sediment is trapped behind these dams.

The stream channel portions of the canyon areas include stretches of bedrock channels interspersed with lower gradient areas, such as the Calaveras Valley, where the channel bottom and sides are comprised primarily of sediments. Substantial quantities of sediment have accumulated in Calaveras and San Antonio Reservoirs. In the upstream reach of Alameda Creek, the SFPUC discharges approximately 900 cubic yards per year of sediment accumulated behind the Alameda Creek Diversion Dam via 50-cfs flow releases through the sluice gates. This indicates that, in the narrower, steeper reaches of the creek, smaller flows are adequate to transport accumulated suspended sediments. Such smaller flows may also affect the local geomorphic conditions of the small alluvial flats, banks, and terraces adjacent to the stream channels above Sunol Valley.

5.4.2.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to geomorphology, but generally considers that implementation of the proposed program would have a significant impact if it were to:

- Substantially change the topography such that ecological, hydrologic, or aesthetic functions are adversely affected, or substantially change any unique geologic or physical features of the site or area

- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation or adversely affect the ecological, hydrologic, or aesthetic functions of the site or area

Although the “substantial change in topography” criterion is typically applied to upland areas, it is considered applicable to stream channel/bank topography in this instance because of the sensitivity of the resources that depend on the topography of those features (i.e., riparian vegetation and fisheries). For a stream channel, the relevant aspect of topography to be evaluated are those associated with channel form and the related movement and distribution of sediment.

Approach to Analysis

This impact section discusses projected changes in sediment transport and geomorphology, reservoir storage, and related reservoir water levels resulting from WSIP implementation. In addition to potential direct impacts, these sediment transport changes could cause indirect environmental impacts in areas for which the CEQA Guidelines Appendix G identifies

significance criteria, including flooding potential, erosion, water quality, fisheries, aquatic and riparian resources and related special-status species, and recreation and visual resources. These potential impacts are addressed in the respective sections of this PEIR.

This assessment of potential effects is based on generalized channel bed/bank characteristics and consideration of proposed changes in stream flow that would result from the WSIP.

Impact Summary

Table 5.4.2-1 presents a summary of the impacts on sediment transport and geomorphology in the Alameda Creek watershed that could result from implementation of the proposed water supply and system operations.

TABLE 5.4.2-1
SUMMARY OF IMPACTS – GEOMORPHOLOGY OF THE ALAMEDA CREEK WATERSHED

Impact	Significance Determination
Impact 5.4.2-1: Effects on channel formation and sediment transport along Calaveras Creek	LS
Impact 5.4.2-2: Effects on channel formation and sediment transport along Alameda Creek downstream of the diversion dam	LS
Impact 5.4.2-3: Effects on channel formation and sediment transport along San Antonio Creek downstream of San Antonio Reservoir	LS

LS = Less than Significant impact, no mitigation required

Impact 5.4.2-1: Effects on channel formation and sediment transport along Calaveras Creek.

There are currently no uncontrolled releases (spills) from Calaveras Reservoir. With the WSIP, uncontrolled releases would occur during heavy rains, particularly later in the rainfall season when the reservoir is full. Therefore, the WSIP could result in increased erosion, sediment transport, and deposition downstream of Calaveras Dam during heavy rainfall events compared to existing conditions. However, these higher flows, and therefore sediment transport, are similar to the long-term conditions that formed the current channel. Therefore, impacts on channel formation and sediment transport along Calaveras Creek would be *less than significant*, and no mitigation measures would be required.

Impact 5.4.2-2: Effects on channel formation and sediment transport along Alameda Creek downstream of the diversion dam.

Increased use of the diversion tunnel under the WSIP would reduce peak flows in Alameda Creek downstream of the diversion dam by up to 650 cfs compared to existing conditions; lesser flows

(under 500 to 600 cfs) would also be diverted, which could reduce erosion, sediment transport, and deposition in the channel reach downstream of the diversion dam. However, substantial quantities of sediments would still be transported down the creek by high flows (over 650 cfs) during heavy rains. The annual sluicing of sediments accumulated behind the diversion dam would continue with the WSIP. Therefore, this impact would be *less than significant*, and no mitigation measures would be required.

Impact 5.4.2-3: Effects on channel formation and sediment transport along San Antonio Creek downstream of San Antonio Reservoir.

Current spills from San Antonio Reservoir are minimal and would continue to be minimal. Therefore, impacts on fluvial geomorphologic characteristics would be *less than significant*, and no mitigation measures would be required.

References – Geomorphology

Weiss Associates, *Final Report for Channel Geomorphology Study, Niles and Sunol Dam Removal Project,* Alameda County, California. October 12, 2004.

5.4.3 Surface Water Quality

The following setting section describes surface water quality in streams and reservoirs in the Alameda Creek watershed that could be affected by the WSIP. The impact section (Section 5.4.3.2) provides a description of the changes in water quality in streams and reservoirs that would result from WSIP-induced changes in stream flow and reservoir water levels.

5.4.3.1 Setting

Calaveras Reservoir

Calaveras Reservoir collects and stores water from the local watershed; this water is subsequently treated at the Sunol Valley WTP and distributed for municipal use. Reservoir inflow is dominated by winter rainfall events. Because the reservoir stores local runoff only, water quality is fairly consistent. However, the reservoir stratifies during the warm months, which leads to changes in water quality depending on the time of year and depth within the reservoir. When the reservoir stratifies during the late summer and fall, the bottom, lower layer (the "hypolimnion") is aerated to increase oxygen levels, thereby reducing the concentrations of dissolved iron, manganese, and hydrogen sulfide in the raw water (Weiss Associates, 2003).

Calaveras Reservoir exhibits characteristics typical of "mesotrophic"[1] waters, which include the following:

- Moderate nutrient levels and microbiological activity
- Oxygen concentrations that may vary considerably
- Variable light penetration
- Shallow to deep lake with sloping sides
- Potentially fertile soils, heavily vegetated and/or disturbed watershed (SFPUC, 2002)

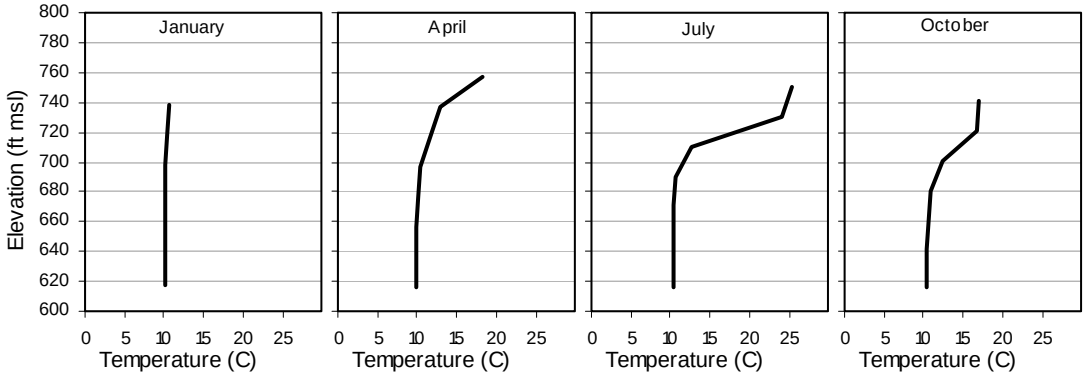
The biggest water quality concerns in the reservoir are turbidity and algae control. Algal blooms can result in consumer complaints regarding odor and taste and can also limit production at the Sunol Valley WTP due to increases in filter head loss. Several algal blooms have caused the reservoir to be temporarily removed from production, and an algae bloom in October 2003 was treated with copper sulfate. The reservoir is sampled every two weeks for basic water quality parameters; algal growth is usually indicated by increasing surface dissolved oxygen (DO) levels and a rise in pH, with June and October generally being the months of greatest concern. Problems with algal growth often resolve themselves as zooplankton feed on the algae; however, zooplankton may not be completely effective in controlling blue-green algae (SFPUC, 2002). The growth of blue green algae is occasionally managed with low doses of copper sulfate, which is the only herbicide used in the reservoir. Treatment with copper sulfate can reduce DO levels associated with the decay of dead algae (SFPUC, 2002).

Reservoir water temperature is considered a key water quality parameter with respect to aquatic life. Calaveras Reservoir water temperatures are typically isothermal[2] during December through

[1] The ratio of watershed to surface area is 60:1, which places the lake in the "potentially mesotrophic" group.

February, which indicates complete mixing of the reservoir. From March through November, the reservoir typically stratifies, with the most intense period between June and October; during this time, the thermocline[3] is 20 to 40 feet below the water surface, with water temperatures reaching 24 to 26 degrees Celsius (°C) in the upper level of the water (the "epilimnion"), and 10 to 14 °C in the hypolimnion (Weiss Associates, 2003).[4]

Figure 5.4.3-1 presents water temperature profiles for Calaveras Reservoir during 1998. These data were collected before the DSOD limited the operational capacity of the reservoir due to seismic concerns, and thus represent a "full" reservoir.



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SOURCE: SFPUC, HH/LSM (Appendix H)

Figure 5.4.3-1
Temperature Profiles for Calaveras Reservoir, 1998

Water quality conditions in the reservoir are shown in **Table 5.4.3-1**. When Calaveras Reservoir is isothermal, DO concentrations are near saturation; however, when the reservoir stratifies, DO concentrations in the hypolimnion historically dropped to less than 1 mg/L while remaining near saturation in the epilimnion. The values for pH ranged from 6.6 to 8.3, and turbidity remained below 5 nephelometric turbidity units (NTU) throughout most of the year. The SFPUC commissioned a feasibility study to select a technology for effectively maintaining the DO concentration within the hypolimnion at levels protective of water quality (DO > 2 mg/L) and fish habitat (DO > 5 mg/L) (Merritt-Smith Consultants, 2003). The technology selected was an "unconfined small bubble soaker hose diffuser" consisting of approximately 1,000 feet of diffuser operated from a liquid oxygen supply based on the lake shoreline. The oxygen is distributed along the full length of the line deep within the reservoir during operation, thus spreading the oxygen

2 Refers to constant temperature in the water column; this conditions is present when the reservoir is not stratified, typically during the winter months.
3 The boundary between the warmer surface waters and cooler waters below.
4 To convert Fahrenheit to Celsius (Centigrade), subtract 32 and divide by 1.8. To convert Celsius (Centigrade) to Fahrenheit, multiply by 1.8 and add 32.

TABLE 5.4.3-1
SUMMARY OF WATER QUALITY IN CALAVERAS RESERVOIR

Parameter	Value	Status
Nitrate – winter average (mg/L)	0.13	Mesotrophic[c] to Eutrophic[d]
Orthophosphate – winter average (mg/L)	0.018	Mesotrophic
Total Phosphorus – winter average (mg/L)	0.06	Mesotrophic to Eutrophic
Secchi Depth[a] – growth season average (feet)	22.2	
Secchi Depth – growth season minimum (feet)	13.0	Mesotrophic
Chlorophyll *a* – annual average (µg/L)	4	Eutrophic
Chlorophyll *a* – annual peak (µg/L)	18	Eutrophic
Anoxia[b] presence	None	Eutrophic
Anoxia duration (days)	0	Mesotrophic to Eutrophic
Anoxic extent (acre-feet)	0	Eutrophic

µg/L = micrograms per liter; mg/L = milligrams per liter

a Secchi depth is a parameter used to determine the clarity of surface waters. High secchi depth readings indicate clearer water that allows sunlight to penetrate deeper.
b Anoxia generally refers to low-oxygen conditions in the hypolimnion.
c A body of water that has a moderate amount of dissolved nutrients.
d A body of water that is rich in dissolved nutrients (as phosphates) that stimulate the growth of aquatic plant life, resulting in the depletion of dissolved oxygen.
SOURCE: SFPUC, 2002.

over a large area to achieve high oxygen transfer efficiencies and reduce oxygen expenditures. The oxygenation system has been implemented in Calaveras Reservoir and maintains DO values in the hypolimnion at between 2 and 5 mg/L (Merritt-Smith Consultants, 2003).

Calaveras Reservoir under low storage conditions remains sufficiently deep (approximately 80 to 90 feet) to experience persistent seasonal thermal stratification. The reservoir becomes strongly stratified by late June and generally develops a thermocline at approximately 30 feet of depth, with the hypolimnion occupying the bottom 40 or so feet of the reservoir profile. The historical depth to the thermocline was similar, but the reservoir maintained a notably deeper hypolimnion.

San Antonio Reservoir

San Antonio Reservoir receives both local runoff (including inflow from Calaveras Reservoir) and Hetch Hetchy water, and its water quality is therefore more variable than that of Calaveras Reservoir. Like Calaveras Reservoir, San Antonio Reservoir exhibits characteristics typical of mesotrophic[5] waters; however, the moderate algal biomass present in San Antonio Reservoir is more typical of eutrophic[6] waters (SFPUC, 2002).

As in Calaveras Reservoir, the biggest water quality concerns in San Antonio Reservoir are turbidity and algae control; the SFPUC has occasionally applied copper sulfate to control algal blooms in San Antonio Reservoir, –but has ceased use of copper sulfate until it receives

5 The ratio of watershed to surface area is 30:1, which places the lake in the "potentially mesotrophic" group.
6 Generally warm and shallow waters, with high nutrient levels and high microbiological activity.

applicable permits from the Regional Water Quality Control Board (RWQCB). **Table 5.4.3-2** summarizes San Antonio Reservoir's water quality parameters, including the nutrient status and associated level of microbiological activity.

TABLE 5.4.3-2
SUMMARY OF WATER QUALITY IN SAN ANTONIO RESERVOIR

Parameter	Value	Status
Nitrate – winter average (mg/L)	0.104	Mesotrophic
Orthophosphate – winter average (mg/L)	0.028	Mesotrophic
Total Phosphorus – winter average (mg/L)	0.060	Eutrophic
Secchi Depth[a] – growth season average (feet)	11.8	
Secchi Depth – growth season minimum (feet)	3.8	Eutrophic
Chlorophyll *a* – annual average (µg/L)	3.187	Eutrophic
Chlorophyll *a* – annual peak (µg/L)	14.68	Eutrophic
Anoxia[b] presence	Regularly	Eutrophic
Anoxia duration	Average approximately 90 days/year	Mesotrophic to Eutrophic
Anoxic extent	Entire hypolimnion	Eutrophic

µg/L = micrograms per liter; mg/L = milligrams per liter

[a] Secchi depth is a parameter used to determine the clarity of surface waters. High secchi depth readings indicate clearer water that allows sunlight to penetrate deeper.
[b] Anoxia generally refers to low-oxygen conditions in the hypolimnion.

SOURCE: SFPUC, 2002.

Occasional transfers of large quantities of South Bay Aqueduct water into San Antonio Reservoir have degraded the reservoir water by adding contaminants, including total dissolved solids, total organic carbon, and bromides. The last such transfer, which occurred during the 1990–1991 drought, significantly degraded water quality in the Alameda system.

Alameda Creek Below the Diversion Dam

Water quality in Alameda Creek is generally good and is protective of beneficial uses. In terms of aquatic life, the key water quality parameter is temperature, which is directly related to hydrologic flow conditions. **Table 5.4.3-3** summarizes weekly water temperature data collected by the ACWD near Sunol, above Arroyo de la Laguna, from 1997 through 2005. The ACWD continuously samples, analyzes, and monitors the quality of water in Alameda Creek at a special monitoring facility located at the mouth of Niles Canyon near Mission Boulevard and at other key locations throughout the watershed (ACWD, 2007). Average monthly water temperatures show an expected seasonal trend (i.e., cooler during the winter and warmer during the summer).

Water temperatures in Alameda Creek have been shown to vary widely in Niles Canyon, with average daily temperatures generally peaking in late August in the 20 to 30 °C range (68 to 86 degrees Fahrenheit), and daily temperature fluctuations ranging between 1 and 11 °C, depending on geographic location and the degree of riparian shading (San Francisco Planning Department, 2005).

TABLE 5.4.3-3
SUMMARY OF TEMPERATURE DATA, ALAMEDA CREEK NEAR SUNOL, 1997–2005
(degrees Celsius)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1997	10	13	15	18	21	23	–	–	–	–	–	10
1998	11	11	14	16	16	18	23	26	22	15	13	11
1999	7	11	13	16	17	23	–	–	–	–	–	–
2000	13	13	15	16	22	25	22	21	–	18	13	11
2001	10	11	17	18	22	–	–	–	–	–	15	12
2002	12	12	13	17	18	21	19	22	21	21	15	10
2003	–	–	–	–	–	–	–	22	–	–	–	12
2004	13	12	15	16	18	20	19	–	–	–	–	–
2005	9	13	12	13	18	22	23	24	21	19	14	11
Average	11	12	14	16	19	22	21	23	21	18	14	11

SOURCES: ACWD (raw data); Merritt-Smith Consultants (data reduction).

Water temperatures in Niles Canyon reflect seasonal meteorological conditions, with cool temperatures in winter, warm temperatures in summer, and intermediate temperatures in the spring and fall. Under predevelopment conditions, a naturally high groundwater table in the Sunol Valley may have provided base flow during the low-flow periods. Subsurface accretions such as these can provide thermal benefits during summer periods, because groundwater temperatures tend to be relatively constant at approximately the mean annual air temperature of the local area (Holmes, 2000). The degree of predevelopment groundwater/stream interaction is unknown, and the extent of any potential thermal benefit is likewise uncertain. Nonetheless, under current conditions, the flow of subsurface water into mining pits during gravel mining operations has lowered the groundwater table to the extent that Alameda Creek at the head of Niles Canyon may retain only very low flows during the summer period (Bookman-Edmonston Engineering, Inc., 1995). A review of temperature studies presented by Hanson (2003) indicates that water temperatures in Alameda Creek are at or close to the equilibrium temperature (i.e., in equilibrium with the atmosphere) by the time flows reach Niles Canyon. Thus, in summer periods, water temperatures typically exceed 25 ^{o}C for multiple consecutive days. Although there is topographic and riparian shading in the canyon, local meteorological conditions are not sufficiently moderated by these shading sources to provide consistently low water temperatures through the summer. There are most likely local cool patches where hyporheic flow (water that interchanges between the stream and subsurface media) provides some moderation of water temperatures. However, such areas are not believed to be widespread or to provide extensive, persistent cool water. In addition, most of the summer and fall flows in Alameda Creek below its confluence with Arroyo de la Laguna originate from the South Bay Aqueduct. This South Bay Aqueduct water may be warmer and is higher in total dissolved solids (TDS) than the flows in Alameda Creek originating from the Sunol Valley watershed.

Increased flows may moderate maximum daily temperatures by increasing the thermal mass of the stream (i.e., the quantity of cooler water in the stream that would be subject to warming by the air).

Table 5.4.3-4 provides a summary of TDS data for the same location and period as for temperature, above. Unlike temperature, TDS does not exhibit a seasonal trend. TDS is an indicator of the overall content of inorganic materials in the water. As shown in the table, TDS is well below the secondary maximum contaminant level for drinking water (established to protect aesthetic quality) of 500 mg/L. Nitrate averages were 0.8 mg/L (as N) over the 1997–2005 period; the primary drinking water standard is 10 mg/L.

TABLE 5.4.3-4
SUMMARY OF TDS DATA, ALAMEDA CREEK NEAR SUNOL, 1997–2005
(milligrams per liter)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1997	–	–	190	266	280	268	–	–	–	–	–	306
1998	233	148	180	195	235	260	279	284	283	309	233	381
1999	313	228	259	276	309	298	–	–	–	–	–	–
2000	361	286	209	305	304	315	319	320	–	331	359	367
2001	486	389	361	367	355	–	–	–	–	–	338	277
2002	186	258	273	278	278	278	291	260	323	334	368	332
2003	–	–	–	–	–	–	–	365	–	–	–	407
2004	313	299	366	307	322	343	348	–	–	–	–	–
2005	246	297	205	192	247	256	290	281	304	302	337	314
Average	305	272	255	273	291	288	305	302	303	319	327	341

SOURCES: ACWD (raw data); Merritt-Smith Consultants (data reduction).

Regulatory Considerations

As described in Section 5.2, the San Francisco Bay RWQCB regulates water quality in the San Francisco Bay region under the Porter-Cologne Water Quality Control Act. Beneficial uses of surface waters in the Alameda Creek watershed as well as impaired water bodies are shown in **Table 5.4.3-5**. The beneficial uses of the water bodies generally apply to all tributaries.

5.4.3.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to surface water quality, but generally considers that implementation of the proposed program would have a significant surface water quality impact if it were to:

- Substantially impair a water body's ability to support beneficial uses designated by the State Water Resources Control Board or Regional Water Quality Control Board
- Otherwise substantially degrade water quality

TABLE 5.4.3-5
ALAMEDA DRAINAGE WATER QUALITY REGULATIONS

Water Body	
	Designated Beneficial Uses
Alameda Creek	AGR, COLD, GWR, MIGR, REC-1, REC-2, SPWN, WARM, WILD
Arroyo Hondo	COLD, FRSH, MUN, REC-1, REC-2, SPWN, WARM, WILD
Calaveras Reservoir	COLD, MUN, REC-1 (limited), REC-2, SPWN, WARM, WILD
San Antonio Reservoir	COLD, MUN, REC-1 (limited), REC-2, SPWN, WARM, WILD
	Clean Water Act Section 303(d) List of Impaired Water Bodies
Alameda Creek	Pollutant: Diazinon Potential Sources: Urban runoff/storm sewers Total Maximum Daily Load Priority: High

Beneficial Uses Key:

MUN (Municipal and Domestic Supply); AGR (Agriculture); REC-1 (Body Contact Recreation); REC-2 (Noncontact Recreation); WARM (Warm Freshwater Habitat); COLD (Cold Freshwater Habitat); MIGR (Fish Migration); SPWN (Fish Spawning); WILD (Wildlife Habitat); NAV (Navigation); GWR (Groundwater Recharge); FRSH (Freshwater Replenishment); SHELL (Shellfish Harvesting); COMM (Ocean, Commercial, and Sport Fishing); EST (Estuarine Habitat); IND (Industrial Service Supply).

SOURCE: SWRCB, 2003.

Approach to Analysis

Changes in water quality are based on qualitative analyses of potential water quality effects due to changes in flows within creeks and changes in reservoir levels, as predicted by the HH/LSM. An overview of the model is presented in Section 5.1, and the model assumptions are provided in Appendix H.

Impact Summary

Table 5.4.3-6 presents a summary of the impacts on surface water quality in the Alameda Creek watershed that could result from implementation of the proposed water supply and system operations.

TABLE 5.4.3-6
SUMMARY OF IMPACTS – SURFACE WATER QUALITY
IN ALAMEDA CREEK WATERSHED STREAMS AND RESERVOIRS

Impact	Significance Determination
Impact 5.4.3-1: Effects on water quality in Calaveras Reservoir	LS
Impact 5.4.3-2: Effects on water quality in San Antonio Reservoir	LS
Impact 5.4.3-3: Effects on water quality along Calaveras, San Antonio, and Alameda Creeks	LS

LS = Less than Significant impact, no mitigation required

Impact Discussion

Impact 5.4.3-1: Effects on water quality in Calaveras Reservoir.

Under the WSIP, Calaveras Reservoir would be replaced and its original capacity restored (see Chapter 3 for a description of reservoir operations under the WSIP). Compared with existing conditions, the reservoir would be maintained at a higher storage level. In addition, the new dam outlet works would allow greater flexibility to manage both in-pool and downstream conditions by providing a wider range of controlled releases, selective withdrawal, and improved spill management. Maintaining higher overall storage compared with DSOD-imposed levels would create a larger hypolimnion, leading to similar or greater cold/cool water volumes.

Temperature. The temperature impact under proposed operations is expected to be minimal. Maintaining higher overall storage volumes would create a larger hypolimnion, leading to similar or greater cold/cool water volume. Historical summer cool water pool volumes on the order of 25,000 to 35,000 acre-feet could again be expected with the proposed program. Seasonal thermal stratification dynamics would follow a similar pattern, with the onset of stratification occurring in April, and fall destratification largely complete by November. April through October stream releases would average approximately 3,800 acre-feet (13 percent of the cool water pool[7]). In all hydrologic year types except for the wettest years, the April through October release volume would range from approximately 2,850 to 3,050 acre-feet (9 to 10 percent of the cool water pool), while in the wettest year the release volume would be approximately 7,400 acre-feet (25 percent of the cool water pool). These release volumes would not deplete the cool water pool and would not lead to substantial changes in the thermal structure of the reservoir.

Dissolved Oxygen. Historically (i.e., before the 2002 DSOD restriction), Calaveras Reservoir experienced seasonal anoxia (DO concentrations less than 2 mg/L) during summer and early fall thermal stratification. In an effort to maintain aquatic habitat for fish and to minimize water quality impacts under this reduced reservoir storage condition, an oxygenation system was installed to ensure DO concentrations of up to 5 mg/L in the hypolimnion during summer periods. The oxygenation system has the flexibility to be operated in a larger reservoir and would continue to be operated when the dam is replaced. Thus, DO conditions would be equal to or improved over the existing condition, with DO concentrations maintained to eliminate low-oxygen conditions in the hypolimnion.

Water Quality – Nutrients. As described above in Section 5.4.3.1, Setting, Calaveras Reservoir is mesotrophic; implementation by the SFPUC of oxygenation technology has maintained or improved water quality within the reservoir and would continue to do so under the WSIP. Proposed reservoir storage and operations would not affect the maintenance of water quality; with the oxygenation system in place, overall nutrient levels would likely be lower and algal biomass reduced compared with existing conditions. Furthermore, the restored reservoir capacity would result in greater natural sedimentation relative to the current condition, which would attenuate turbidity spikes during heavy runoff.

7 The assumed cool water pool volume is 30,000 acre-feet.

Impact Conclusions

Overall, implementation of the proposed WSIP water supply and system operations would maintain or improve water quality parameters in Calaveras Reservoir. Therefore, impacts on water quality in Calaveras Reservoir would be *less than significant*, and no mitigation measures would be required.

Impact 5.4.3-2: Effects on water quality in San Antonio Reservoir.

Under the WSIP, controlled releases from San Antonio Reservoir would be maintained at zero, while uncontrolled releases (spills) would be reduced under future operations (compared with the modeled existing condition). As noted above, drawdown would be less (i.e., the reservoir would generally be maintained at a higher storage volume); supply to the Sunol Valley WTP would change from historical operations, with larger inflows in the rainy season and lower inflows in the dry season. Maintaining higher overall storage could create a slightly larger hypolimnion, leading to similar or larger cold/cool water volumes during summer periods.

Temperature. The temperature impact under proposed operations is expected to be minimal. Maintaining higher overall storage would create a larger hypolimnion, leading to similar or larger cold/cool water volumes. Historical summer cool water pool volumes were on the order of 12,000 to 20,000 acre-feet and are expected to be similar under future operations. Seasonal thermal stratification dynamics would follow a similar pattern, with the onset of seasonal stratification occurring in April, and fall destratification largely complete by November.

Dissolved Oxygen. Historically, San Antonio reservoir experienced seasonal anoxia (DO concentrations less than 2 mg/L) during summer and early fall thermal stratification. DO conditions are expected to be similar under future operations.

Water Quality – Nutrients. As described above in Section 5.4.3.1, San Antonio Reservoir is mesotrophic; Merritt-Smith Consultants (2003) determined that oxygenation was an appropriate measure to maintain and possibly improve this status. However, this technology has not been implemented. Future operations are expected to minimize inputs of lower quality water from State Water Project sources (i.e., the Delta), which could improve reservoir water quality. Overall nutrient and algae levels under the WSIP are expected to be similar to current conditions.

Impact Conclusions

Overall, implementation of the proposed WSIP water supply and system operations would maintain water quality parameters in San Antonio Reservoir. Therefore, impacts on water quality in San Antonio Reservoir would be *less than significant*, and no mitigation measures would be required.

Impact 5.4.3-3: Effects on water quality along Calaveras, San Antonio, and Alameda Creeks.

Calaveras Creek

The primary source of Calaveras Creek flow is Calaveras Reservoir releases. There are no appreciable tributaries between Calaveras Dam and the Alameda Creek confluence.

Temperature. Water temperatures under future operations are expected to be similar to existing conditions. Winter temperatures are expected to be low due to seasonally wet and cool conditions. During the warmer periods of the year, water temperatures are expected to be similar in normal, above-normal, and wet years because release quantities would be the same. In below-normal and dry years, water temperatures are expected to be similar or lower under future operations because flows would be increased, while release temperatures would stay approximately the same. This increased flow would not lead to an appreciable thermal benefit far downstream, because eventually the waters would warm, attaining equilibrium with local meteorological conditions (see Alameda Creek, below).

Studies conducted for the 1997 MOU between the CDFG and CCSF contemplated that a 7-cfs release from Calaveras Reservoir would result in cooler temperatures for the upper half of the stream reach between the Alameda/Calaveras River confluence and the Sunol Valley WTP. Furthermore, the existing oxygenation system, which is also planned to be used in future operations, would maintain desired DO conditions in reservoir waters, which would further enhance DO conditions in the downstream reach.

Dissolved Oxygen. DO conditions below Calaveras Dam would depend on water quality conditions in the reservoir. Because oxygenation has been implemented in Calaveras Reservoir since 2002 and would continue to be implemented with the WSIP, DO conditions downstream of the dam would be similar to current conditions.

Water Quality – Nutrients. Any improvements in water quality conditions in Calaveras Reservoir would also occur in released waters downstream of the dam. The trapping of nutrients in the reservoir sediments upstream could reduce nutrients in downstream waters. In addition, oxidation of ammonia to nitrate in the reservoir (“nitrification”) would minimize the potential for excess ammonia releases from the reservoir. These benefits would maintain low oxygen demands (due to the nitrification of ammonia to nitrate) as well as a low potential for un-ionized ammonia, which can be harmful to aquatic life.

San Antonio Creek

The WSIP would not change release mechanisms at the Turner Dam on San Antonio Reservoir. Controlled releases would be maintained at zero, while modeled uncontrolled releases would increase in January and February, but decrease in March and April. Because reservoir temperature, DO, and levels of nutrients and associated constituents are not expected to change, significant adverse impacts related to these water quality parameters are not expected.

Alameda Creek

Two reaches of Alameda Creek are discussed below:

- Reach 1 – from the diversion tunnel to Alameda Creek's confluence with Calaveras Creek
- Reach 2 – from the confluence with Calaveras Creek downstream

Reach 1

Temperature. Water temperatures in Alameda Creek in the vicinity of the diversion dam reflect seasonal meteorological conditions (cool winter, warm summer, and intermediate spring and fall temperatures). Reach 1 would experience lower flows under future operations. The bulk of the flow changes would occur from December through April, with modest changes in May during the wetter years. In general, Alameda Creek flows below the diversion tunnel to the creek's confluence with Calaveras Creek would be lower under future operations.

Dissolved Oxygen. Although minimal DO data exist for Alameda Creek throughout much of its watershed, DO conditions in the creek are presumed to be consistent with other wildland creeks of the Bay Area (i.e., near saturation and in equilibrium with the atmosphere). Under future operations, these conditions are not expected to change.

Water Quality – Nutrients. Alameda Creek upstream of the diversion dam is largely an undeveloped watershed with no storage reservoirs. This fact, coupled with flow changes that would be largely limited to December through April (when primary production is low), suggests that water quality impacts due to future operations are not likely to change nutrient conditions in this reach.

Reach 2

Temperature. Below the Alameda Creek confluence with Calaveras Creek, lower Calaveras Creek temperatures associated with future operations of Calaveras Dam would also affect Alameda Creek temperatures. The effects would be moderated because of mixing with Alameda Creek flows. Cooler waters in Calaveras Creek would commingle with Alameda Creek flows and generally approach equilibrium temperature in response to local meteorological conditions as waters traversed this reach. During winter periods, water temperatures would be the same under future conditions. During summer periods, flows from Calaveras Creek might be less than equilibrium temperature (i.e., cooler than Alameda Creek waters) at the confluence. The result is that proposed Calaveras Creek flows could reduce Alameda Creek water temperatures; however, it is likely that these waters would warm towards equilibrium over the next several miles.

Dissolved Oxygen. Both Alameda and Calaveras Creeks are expected to have DO conditions at or near saturation under existing and future conditions. Deviations from saturation concentration could occur in response to primary production (photosynthesis and respiration of algae), but these conditions are not expected to change under proposed operations. Overall, DO conditions in Alameda Creek are not expected to change substantially under future operations.

Water Quality – Nutrients. Any reduction in nutrients and algae in Calaveras Reservoir would also occur in released waters downstream of the dam, and potentially in Alameda Creek as well. The impact of these reductions in Alameda Creek below the confluence of Calaveras Creek is uncertain. Nutrient and algae conditions in Alameda Creek are expected to be similar under future operations.

As described above, the WSIP would not substantially degrade water quality parameters in Alameda and Calaveras Creeks; therefore, impacts on these conditions would be less than significant.

Impact Conclusions

Overall, impacts on water quality along Calaveras, San Antonio, and Alameda Creeks would be *less than significant*, and no mitigation measures would be required.

References – Surface Water Quality

Alameda County Water District (ACWD), website, http://www.acwd.org/sources_of_supply.php5, accessed June 11, 2007.

Bookman-Edmonston Engineering, Inc., prepared for San Francisco Water Department, *Alameda Creek Water Resources Study,* Appendix A-5 of the *Alameda Watershed Management Plan*, 1995.

Hanson Environmental, Inc., *Supplemental Air and Water Temperature Monitoring Within Alameda Creek*, December 25, 2003.

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San Francisco Public Utilities Commission (SFPUC), *Reservoir Water Quality Management Plans*, March 2002.

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5.4.4 Groundwater

The primary groundwater resources in the Alameda Creek watershed are in the Livermore and Sunol Valleys, and farther downstream in the Niles Cone area near the town of Niles. In CCSF-owned watershed areas upstream of the Livermore and Sunol Valleys, small amounts of localized groundwater can be found in the shallow alluvial areas that are interspersed with steeper bedrock sections along watercourses. Groundwater in these areas is often through-flow associated with flows in the streams. Because the proposed program would not affect upstream areas in the Livermore Valley or lower areas in the Niles Cone (which is below the SFPUC's infiltration galleries), this section focuses on describing the groundwater conditions and potential WSIP impacts in the Sunol Valley.

5.4.4.1 Setting

Local Geology

The Alameda Creek watershed generally comprises northwest-trending ridges and intervening valleys, the orientations of which are strongly controlled by the structural grain of the underlying bedrock (refer to Chapter 4, Section 4.3, Geology, Soils, and Seismicity). For the purposes of visualizing the groundwater system in the program area, the geologic units can be divided into two main types. The deepest bedrock is characterized by well-compacted and lithified marine sedimentary rocks (Panoche Formation). Because of their compact nature, low permeability, and strong structural deformation, these rocks are considered non-water-bearing or, at best, very low water-yielding (Ludhorff and Scalmanini, 1993).

In contrast, the younger surficial deposits are unconsolidated to only slightly compacted. These units are nonmarine, alluvial fan, and stream channel deposits of interbedded gravel, sand, silt, and clay beds. The lower portion of this sequence, the Livermore Gravels, is more consolidated than the upper portion and is less water-bearing. The upper coarser-grained sand and gravel beds have high porosity and permeability and are considered water-bearing and high water-yielding. The upper alluvial deposits range from 30 to 60 feet thick and probably constitute the most significant groundwater aquifer in the program area (Luhdorff and Scalmanini, 1993).

Hydrogeology

The upper aquifer described above is "unconfined," meaning that the water table fluctuates in response to recharge (precipitation in the wet season) and discharge (evapotranspiration[1] in the dry season). Significant alluvial deposits have been removed by gravel mining upstream from the location of the former Sunol Dam.

Historical groundwater observations by quarry operators suggest that the majority of groundwater inflow occurs from the upper alluvium within about 50 feet of the ground surface (Luhdorff and Scalmanini, 1993). The water-bearing capability and permeability of the deeper zone, the

[1] The return of water from the soil and from plants to the atmosphere by evaporation and transpiration.

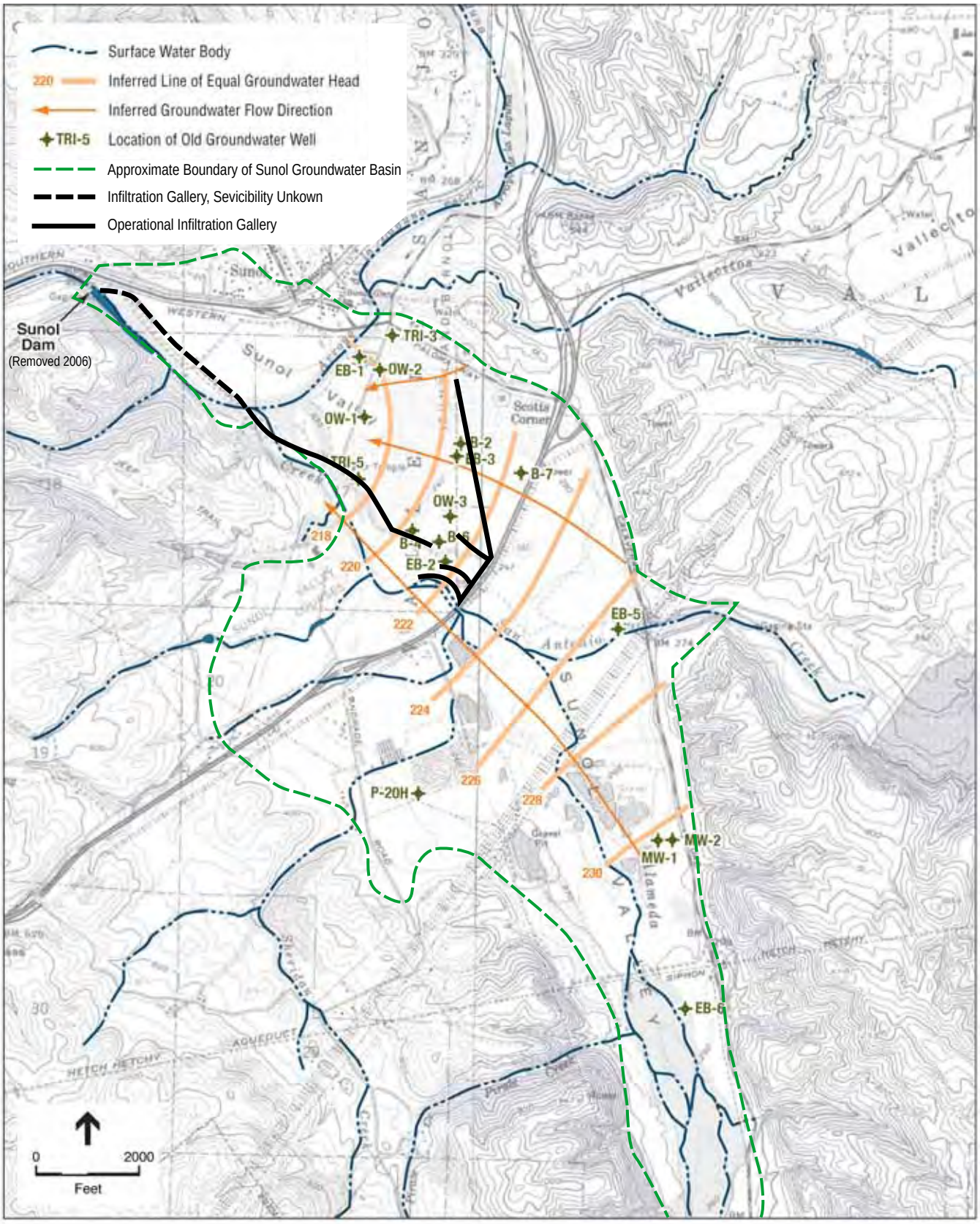
Livermore Gravels, is lower than that of the shallow alluvium. The contact between the relatively impermeable Livermore Gravels and the highly permeable shallower zone decreases the potential for recharge of the Livermore Gravels via alluvium. Prior to development, groundwater recharge of Sunol Valley alluvium occurred primarily as seepage from the Alameda Creek stream channel and percolation of direct precipitation. Groundwater levels would have been highest during and just after the rainy season and lowest during summer and until the beginning of the wet season. Discharge from the basin would have consisted primarily of groundwater seepage to the channels of Alameda Creek and Arroyo de la Laguna at the downstream end of the valley (Bookman-Edmonston Engineering, Inc., 1995). Prior to construction of Sunol Dam, which artificially raised the water table, groundwater levels in the downstream end of the valley were lower than those observed today.

Sunol Infiltration Galleries

Sunol Dam was built around 1899 by the Spring Valley Water Company to maintain hydraulic head[2] within the shallow alluvium upstream of the dam, adjacent to and underlying the Alameda Creek bed. These deposits host the Sunol infiltration galleries. The infiltration galleries are comprised of a series of concrete tunnels along with perforated pipe placed in the shallow alluvium under Alameda Creek, perpendicular to the creek banks; the galleries provide a location for temporary aquifer recharge (deposit) and recovery (withdrawal) (see **Figure 5.4.4-1**). Historically, surface water from Alameda Creek, particularly peak storm flows, were detained behind both permanent and temporary dams and seeped into the gravels for recovery by the infiltration galleries. The infiltration galleries were not designed to "draw down" groundwater levels, but rather to intercept surface water from Alameda Creek. In this way, short-duration high flows in Alameda Creek resulting from heavy rainfall events were diverted and temporarily stored before being recovered over a longer time period by the infiltration galleries. Dependable yield from the infiltration galleries was 5 mgd, but under flood conditions the fully operational galleries could produce well over 20 mgd (SFPUC, 1960).

After completion of the Calaveras Pipeline in 1934, flows of stored water from Calaveras Reservoir were reduced, and the yield of the infiltration galleries declined. Recharge to the galleries was further reduced in 1965 when construction of San Antonio Dam eliminated supply from San Antonio Creek. In addition, beginning in the late 1960s, gravel mining began altering groundwater flow patterns in the valley. As a result of the quarry operations, groundwater levels in portions of the valley are lower than during the first half of the last century, and flows formerly captured and diverted into the infiltration galleries have decreased in recent years (Bookman-Edmonston Engineering, Inc., 1995). Sunol Dam was removed in September 2006. Removal of this dam is likely to further decrease flows captured in the infiltration galleries.

[2] Hydraulic head is the pressure of the water column and elevation difference. Fluids flow down a hydraulic gradient, from points of higher to lower hydraulic head.



SOURCE: Hydroconsult Engineers, Inc., 2005;
Adapted from Luhdorff and Scalmanini, 1993.
Maptech USGS base map

SFPUC Water System Improvement Program . 203287

Figure 5.4.4-1
Sunol Groundwater Basin Groundwater Elevations and Flow Directions

Other than the infiltration galleries, only incidental groundwater development, consisting of a small number of wells for water supply, occurred in the Sunol Valley until recent times. The Sunol Valley Golf Course uses up to 1 mgd of local groundwater. The SFPUC recently installed a new irrigation supply system for the golf course.

Groundwater Observations

Available groundwater data for the Sunol Valley are limited. Investigations conducted in 1986 by the ACWD and in 1989 by the Mission Valley Rock Company involved the installation of several small-diameter monitoring wells throughout the valley. Water levels were measured at the time of installation, but since then have not been routinely measured. Luhdorff and Scalmanini measured water levels in existing wells several times in 1992 and 1993. The ground surface elevations of the wells were estimated, either by survey or reference to available topographic maps.

Generally, comparison of seasonally collected water levels showed relatively small variations from spring to fall. Luhdorff and Scalmanini (1993) concluded that overall groundwater levels in the Sunol Valley range from 20 to 30 feet below ground surface, with probable localized depressions around gravel quarries. The inferred groundwater level contours, using 1992 data, approximately parallel the ground surface contours of the valley floor, and generally indicate a direction of groundwater flow parallel to Alameda Creek. As indicated in Figure 5.4.4-1, groundwater levels are lowest at the northwestern end of the valley, near the Sunol Water Temple, and are highest in the southern, upper end of the Sunol Valley. Groundwater was thus determined to flow in a northwesterly direction, with a focus at the entrance to Niles Canyon.

Geomatrix Consultants measured levels in the three groundwater monitoring wells installed in the shallow alluvium deposits (to an approximate depth of 25 feet) and in Alameda Creek above Sunol Dam between April 2004 and April 2005 (San Francisco Planning Department, 2005). The data indicate a steady decline in groundwater levels adjacent to Sunol Dam (approximately 300 feet from the dam) over the summer months (a 5- to 6-foot decline in six months). As noted above, Sunol Dam was recently removed, which eliminates its influence on groundwater levels and is projected to lower those levels by about 5 feet in the vicinity of the dam.

Groundwater between Interstate 680 and the entrance to Niles Canyon flows to the northwest, gradually sweeping to a southwest flow direction in the immediate vicinity of Sunol Dam (see Figure 5.4.4-1). The presence and flow direction of groundwater is complicated by the infiltration galleries, stream confluences, and, formerly, the Sunol Dam. Comparison of ground surface contour values with the inferred water table surface suggests that Alameda Creek is a “losing” waterway for the majority of its course through the Sunol Valley (i.e., water from Alameda Creek recharges the groundwater table via infiltration through the streambed). However, in the vicinity of the confluence between Arroyo de la Laguna and Alameda Creek, this recharge relationship reverses, with groundwater beginning to contribute to Alameda Creek flow. This portion of Alameda Creek is thus classified as a “gaining” stream. By Sunol Dam, groundwater to creek discharge is well established.

Groundwater in the northwesternmost portion of the Sunol Valley is recharged to a large degree by flow from Arroyo de la Laguna. Arroyo de la Laguna, as it crosses the Sunol Valley on its way to the confluence with Alameda Creek, recharges the general groundwater table to the northwest, and the general groundwater table and infiltration galleries to the southeast. In this capacity, Arroyo de la Laguna has the potential to act as an intermediate sub-groundwater divide.

Groundwater in Niles Canyon

The local hydrogeology in Niles Canyon is best envisioned as occurring in two separate and distinct geological units. The broader, and from a resource perspective, lesser aquifer is contained within the Panoche Formation bedrock. The other aquifer is hosted in alluvial deposits immediately beneath and adjacent to Alameda Creek. The alluvial deposits form the floodplain adjacent to the creek; however, the floodplain is limited in extent by the bedrock slopes of Niles Canyon.

The shallow alluvial aquifer system is well connected to surface water in Alameda Creek. It is reasonable to assume that the amount of groundwater in the shallow aquifer is dependent on the water level in Alameda Creek, and that there is a shallow groundwater gradient directing flow toward Alameda Creek. The shallow groundwater gradient could change on a short-term basis as the limited aquifer responds to precipitation and recharge of shallow groundwater, and as the water level in Alameda Creek fluctuates. The range of seasonal groundwater fluctuation at the site of Niles Dam is expected to be about 1 to 3 feet. The floodplain at Niles Dam was slightly elevated from the water table year-round, producing a condition that may help support a riparian community. Niles Dam was removed in September 2006. The removal of this dam is expected to slightly lower groundwater levels.

The bedrock is not considered a significant aquifer host due to the expected low yields. Furthermore, groundwater in the bedrock would not be strongly influenced by changes and fluctuations in Alameda Creek hydrology, as the hydraulic connection between the two is likely limited.

Groundwater Quality

Groundwater within the Sunol Valley area is calcium-magnesium bicarbonate water, with concentrations of individual constituents at generally low levels. Total dissolved solids are low (from about 350 to 500 mg/L), as are nitrate concentrations (from 1 to 6 mg/L), with the exception of some localized and elevated nitrate and total dissolved solids concentrations in shallow groundwater due to historical agricultural practices (Bookman-Edmonston Engineering, Inc., 1995).

5.4.4.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to groundwater, but generally considers that implementation of the proposed program would have a significant groundwater impact if it were to:

- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of preexisting nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted)

- Substantially impair a water body's ability to support beneficial uses designated by the State Water Resources Control Board or Regional Water Quality Control Board

- Otherwise substantially degrade water quality

Approach to Analysis

Information on potentially affected groundwater bodies was obtained from published sources and through interviews with individuals who are knowledgeable about the hydrogeology of the area or involved with groundwater management in the potentially affected area. Impact assessments were performed by reviewing WSIP-induced changes in stream flow and examining their potential to affect groundwater levels or quality.

Impact Summary

Table 5.4.4-1 presents a summary of the impacts on groundwater bodies in the Alameda Creek watershed that could result from implementation of the proposed water supply and system operations.

TABLE 5.4.4-1
SUMMARY OF IMPACTS –
GROUNDWATER BODIES IN THE ALAMEDA CREEK WATERSHED

Impact	Significance Determination
Impact 5.4.4-1: Changes in groundwater levels, flows, quality, and supplies	LS

LS = Less than Significant impact, no mitigation required

Impact 5.4.4-1: Changes in groundwater levels, flows, quality, and supplies.

Compared to current conditions, increased diversions and storage under the WSIP would reduce peak flows in Alameda Creek between the diversion dam and the confluence with San Antonio Creek. Seasonally, the WSIP would reduce flows in the high-flow months and increase flows in the low-flow months due to fishery releases. It would also increase storage in Calaveras Reservoir. The overall effect of these changes in groundwater supplies downstream in the Sunol aquifer areas is expected to be minor (either slightly positive or slightly negative), depending on the year's rainfall and seasonal conditions. The WSIP would reduce potential infiltration in the Sunol groundwater basin by reducing peak flows in wet years. However, impacts on groundwater in the Niles Cone would be dampened by inflow from non-SFPUC watershed streams and aquifers, removal of the

Sunol and Niles Dams, and ongoing withdrawals at the infiltration galleries above the water temple; as a result, impacts are expected to be minimal. The program's minor changes in groundwater levels would not affect groundwater quality. This impact would be *less than significant*, and no mitigation measures would be required.

References – Groundwater

Bookman-Edmonston Engineering, Inc., prepared for San Francisco Water Department, *Alameda Creek Water Resources Study*, Appendix A-5 of the *Alameda Watershed Management Plan*, 1995.

Luhdorff and Scalmanini Consulting Engineers, prepared for San Francisco Water Department, *Ground-Water and Aggregate Resources Sunol Valley*, 1993.

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San Francisco Public Utilities Commission (SFPUC), Sunol Filter Beds and Pleasanton Well Field. Available online at http://sfwater.org/printContent.cfm/C_ID/797/, accessed January 11, 2005, Drawing F-342A, Niles Canyon Properties Sunol Portion, May 1960.

5.4.5 Fisheries

The following setting section describes the fishery resources within the streams and reservoirs of the Alameda Creek watershed that could be affected by the WSIP. The impact section (Section 5.4.5.2) provides a description of the effects of WSIP-induced changes in stream flow and reservoir levels on fishery resources.

5.4.5.1 Setting

Alameda Creek and some of its major tributaries historically contained populations of anadromous steelhead and resident rainbow trout (*Oncorhynchus mykiss*) that supported a local recreational fishery. As described below, water supply projects, gravel mining, urban development, and flood control modifications have reduced this historical fishery; however populations of these and other fish species still inhabit certain reaches of Alameda Creek and its tributaries.

Aquatic Habitats

Alameda Creek flows from its headwaters at Oak Ridge to South San Francisco Bay. The creek has historically been divided into three distinct reaches: upper Alameda Creek and its tributaries, Niles Canyon reach and tributaries such as Arroyo del la Laguna, and lower Alameda Creek. Alameda Creek is characterized by long runs and glides and relatively short, shallow riffles (Hanson Environmental, 2002a). Alameda Creek and its tributaries have highly variable seasonal streamflows (see Section 5.4.1 for further description of stream flow).

The substrate ranges from silt and sand with small cobbles to gravel and larger boulders. The lower reach of the creek is characterized by extensive urban development and has been channelized (rip-rapped) for floodwater conveyance. Portions of Alameda Creek are shaded by mixed riparian forest at the margins of the creek. This vegetation is extensive in the Niles Canyon reach, where it occupies the first terrace from the edge of the creek (i.e., ordinary high water) to approximately 6 to 8 feet above ordinary high water (San Francisco Planning Department, 2005).

Flows in the mainstem Alameda Creek and its tributaries are flashy with high flows during the winter and spring and low flows during the summer and fall. In the past, portions of Alameda Creek, particularly the Niles Canyon, Sunol Valley, and lower reach have had low and intermittent streamflows during the summer of dry years. Similar intermittent stream flow conditions have occurred in the tributaries, with the greatest frequency of intermittent flows occurring in the lower elevation alluvial sections during dry years. The seasonal hydrology of Alameda Creek has changed over the past several decades with the addition of upstream storage reservoirs and flow augmentation from managed releases from the State Water Project's South Bay Aqueduct for groundwater recharge and deliveries to local urban communities.

In addition, major alterations to the creek and its tributaries, including the channelization of the lower 12 miles of the creek for flood control; the construction of San Antonio, Calaveras, and Del Valle Reservoirs for water supply; and the construction of a concrete drop structure to stabilize the channel around the Fremont BART weir have made spawning habitat within the

watershed inaccessible for some returning anadromous fishes such as steelhead and Chinook salmon (*Oncorhynchus tshawytscha*) (Gunther et al., 2000).

Upper Alameda Creek

Upper reaches of Alameda Creek include higher elevation steeper gradient stream reaches typically bordered by riparian vegetation. Summer water temperatures are typically cooler than those observed further downstream. Bedrock outcroppings influence channel features in several areas including the Little Yosemite reach. The upper reach supports a reproductive population of resident rainbow trout.

Niles Canyon

Prior to the development of water conveyance facilities, Alameda Creek in Niles Canyon was likely an intermittent to perennial stream characterized by low flows during late summer and fall. Aquatic habitats within Niles Canyon likely functioned as a migratory corridor for anadromous fishes such as steelhead and Pacific lamprey (*Petromyzon marinus)* (Gunther et al., 2000). SFPUC fishery monitoring has documented successful lamprey spawning and rearing within Niles Canyon in recent years (ACA, 2004). However, construction and operation of dams, diversions, and other structures that function as fish migration barriers (e.g., the Sunol and Niles Dams and the grade control structure at the BART weir) have prevented anadromous fishes such as steelhead migrating into Alameda Creek and through Niles Canyon from reaching coldwater habitat further upstream within the watershed (Gunther et al., 2000). The Sunol and Niles Dams were partially removed in September 2006, eliminating them as obstacles to fish passage.

The Alameda County Water District (ACWD) augments summer flows, particularly summer releases from Del Valle Reservoir through Arroyo de la Laguna into Niles Canyon. Although the stream temperatures within the reach are probably higher than predevelopment flows, augmented flows potentially provide atypical fast-water habitat that may provide habitat and food for native and non-native fishes. Thus, some evidence suggests that suitable steelhead/rainbow trout habitat occurs in Niles Canyon (Gunther et al., 2000; Smith, 1999; and McEwan, 1999). Results of water temperature monitoring within the Niles Canyon reach of Alameda Creek during 2001-2002 (Hanson Environmental, 2002) showed summer temperatures in excess of 75 °F which would significantly affect the ability of juvenile and adult steelhead/rainbow trout to oversummer within the canyon reach. Monitoring conducted by Hanson Environmental in 2001 and 2002 also shows that water in Alameda Creek is in thermal equilibrium by the time it flows to the Niles Canyon reach of the river, likely due to the prolonged solar warming occurring from the Sunol Regional Wilderness to the Niles Canyon reach. More suitable summer water temperatures were observed further upstream.

Arroyo de la Laguna, Arroyo Mocho, and Arroyo Valle

Arroyo de la Laguna, Arroyo Mocho, and Arroyo Valle are major tributaries to Alameda Creek that drain watersheds in the Livermore-Amador Valley. These tributary creeks are characterized by highly variable seasonal hydrology. Land use changes over the past 150 years have substantially altered the characteristics and hydrology of these creeks. The creeks have been modified to provide flood control capacity within the urbanized areas of the valley and are also used for water conveyance and groundwater recharge. Arroyo Valle and Arroyo Mocho

historically supported resident trout fisheries in the upper watersheds, primarily through routine fingerling plantings from hatcheries including the Mount Whitney Hatchery. Adult steelhead were periodically caught in Arroyo Valle and lower Alameda Creek, although the occurrence of records of adult steelhead in Arroyo Valle suggests that only a small number of fish may have occurred (on an infrequent basis) within this portion of the watershed, periodically under favorable environmental and hydrologic conditions (Hanson et al., 2004). No records of adult steelhead being caught by recreational anglers were found for Arroyo Mocho. It is unlikely that either watershed historically provided consistent suitable habitat conditions for steelhead passage, spawning, and/or juvenile rearing to support self-sustaining populations. Arroyo Mocho channel form would have made adult steelhead migration unlikely prior to channelization based upon historic geomorphic conditions within the lower reaches of the Arroyo Mocho channel. Historically, steelhead passage in Arroyo Valle occurred infrequently, in response to high flow events that provided suitable surface water connectivity between Arroyo Valle and lower Alameda Creek.

Arroyo Hondo

Arroyo Hondo, a tributary to Calaveras Creek upstream from Calaveras Reservoir, is known to contain self-sustaining populations of resident rainbow trout. These resident trout populations may have been derived from coastal steelhead trapped in the upper watershed after Calaveras Dam was constructed (Gunther et al., 2000). The trout spawn and rear in the lower mile of Arroyo Hondo, and then some return to Calaveras Reservoir or remain in Arroyo Hondo where they reside for the rest of the year (Entrix, 2003; SFPUC, 2003). Spawning habitat for the reservoir population may be limited by a historic landslide that prevents upstream migration and spawning at locations more than one mile upstream from Calaveras Reservoir (SFPUC, 2004). Resident rainbow trout also successfully spawn and rear in Arroyo Hondo upstream of the landslide.

Currently, the SFPUC conducts two annual fishery monitoring projects in Arroyo Hondo, an expanded aquatic resource monitoring project, and a predation study. The SFPUC plans to begin a reservoir trout population size study in 2007.

Lower Alameda Creek

The lower reach of Alameda Creek is characterized by in stream pools formed by inflatable rubber dams used to convey water from the creek into lateral gravel quarry pits used for groundwater recharge by ACWD. The rubber dams are typically deflated during periods of high flows and increased turbidity. Substrate is typically fine sand and silt. Summer water temperatures are relatively high. The reach provides habitat for warmwater fish such as largemouth bass. The lower 12 miles of the creek is primarily managed as a flood control facility. The channel is armored by riprap. Sediment removal and channel regrading is periodically required to maintain flood conveyance capacity.

Steelhead/Rainbow Trout

Regulatory Status

Steelhead/rainbow trout[1] is a federally listed threatened species (NMFS, 2006). Critical habitat, which was designated for this species by the National Marine Fisheries Service (NMFS) in February 2000, included the Alameda Creek watershed. However, in April 2002 NMFS withdrew the critical habitat designation pending further economic impact analysis (NMFS, 2002). In September 2003, the NMFS formally withdrew the critical habitat designation for the Central California Coast ESU as well as 18 other ESUs (NMFS, 2002). In June 2004, the NMFS proposed including resident rainbow trout in the Central California Coast ESU due to genetic similarities between resident and migratory trout within the Alameda Creek watershed upstream of ACWD Rubber Dam 1 (NMFS, 2004). The NMFS subsequently determined that resident rainbow trout inhabiting Alameda Creek should not be included in the ESU for anadromous steelhead (NMFS, 2006). Instead, NMFS determined to list as threatened only those rainbow trout/steelhead that exist below the lowest impassible barriers in the Alameda Creek watershed (i.e., the BART Weir). Thus, the resident rainbow trout that occur in the creek above the BART Weir are not designated as a listed species.

The SFPUC would be required to obtain a Clean Water Act Section 404 permit from the US Army Corps of Engineers (USACE) to construct the Calaveras Dam Replacement project (SV-2) downstream of the existing dam. Before issuing a Section 404 permit, the USACE is required under Section 7 of the ESA to consult with NMFS and the USFWS on designated species to obtain a biological opinion of no jeopardy and an incidental take statement. NMFS also advised the SFPUC that while the USACE would need to initiate a Section 7 consultation with NMFS on the Calaveras Dam Replacement project, it was unlikely that operation of Calaveras Dam would adversely affect steelhead in the area below the BART Weir by making conditions unsuitable for successful steelhead spawning, egg incubation, or juvenile rearing. For this reason, NMFS advised that the steelhead issues above the BART Weir would not be addressed in the Calaveras Dam Replacement project Section 7 consultation, and that incidental take coverage for steelhead in the upper watershed would have to be obtained through a habitat conservation plan (HCP) or through a re-initiated USACE consultation on the Calaveras Dam Replacement project after the lower passage problems are remedied.

Life History

O. mykiss have a dynamic life history. All *O. mykiss* hatch in the gravel substrate of coldwater streams. After hatching, the young fry emerge from the gravel and start feeding in the stream. Some begin to disperse downstream in the months following their emergence, but most continue to rear in the stream. Following a rearing period of at least one year, juveniles follow a variety of life-history patterns, including residents (nonmigratory) at one extreme and individuals that migrate to the open ocean (anadromous) at another extreme. Intermediate life-history patterns include fish that migrate within the stream (potamodromous), fish that migrate only as far as estuarine habitat, and fish that migrate to near-shore ocean areas.

[1] Rainbow trout and steelhead are the same species of trout (*O. mykiss*). The freshwater variety are rainbow trout, and trout that migrate from the ocean to spawn in freshwater (i.e., anadromous) are steelhead.

Juveniles that become migratory typically do so after one or two years of rearing, but sometimes longer. Physiological changes in these fish (called smolts) ultimately allow them to make a transition from freshwater to seawater. Smolts migrate to the ocean, spend a variable amount of time there (typically one to two years), grow rapidly, and return to spawn, generally in the stream where they hatched. Steelhead are unusual among the other Pacific salmonids in that they do not all die after spawning. Some return immediately to the ocean, and others return after holding for a period in freshwater. Within a given stream, some *O. mykiss* do not migrate to the sea, and the proportion may vary considerably depending on local circumstances. These fish reach sexual maturity and spawn without entering the ocean and are often known as resident or stream rainbow trout (Gunther et al., 2000).

Anadromous steelhead exhibit two basic life-history forms. Stream-maturing steelhead enter spawning streams before they are sexually mature, generally during the period between spring and early fall, and spend several months in the stream before they are ready to spawn. Ocean-maturing steelhead enter spawning streams during the fall and winter in a fully mature state and spawn relatively soon after entering freshwater (Gunther et al., 2000). Both forms may occur in the same river system with little or no genetic distinction. Details on the life history of steelhead inhabiting the Alameda Creek watershed are unknown, however the low summer flows and seasonally elevated water temperatures within many of the reaches may have limited opportunities for stream-maturing adult steelhead to have successfully oversummered in many areas. Steelhead habitat requirements are associated with distinct life-history stages, including migration from the ocean to inland reproductive and rearing habitats, spawning and egg incubation, rearing, and seaward migration of smolts and spawned adults. Habitat requirements and life-history timing can vary widely over the steelhead's natural range (Barnhart, 1986; Pearcy, 1992; and Busby et al., 1996; cited in Gunther et al., 2000).

Resident and Migratory Populations

Populations of resident rainbow trout have been reported above the Calaveras Reservoir on several occasions since 1905, in Arroyo Hondo, Isabel Creek, and Smith Creek (Leidy, 1984). Young-of-year *O. mykiss* have been observed in Stonybrook Creek and Sinbad Creek, tributaries to Alameda Creek (Gunther et al., 2000). However, electrofishing in Sinbad Creek in 1997 and 1998 failed to capture any *O. mykiss*. Stonybrook Creek is regarded as potential *O. mykiss* habitat based on the presence of several age classes of resident individuals, including young-of-year (Gunther et al., 2000).

There is some evidence that a native, locally adapted *O. mykiss* stock survives in the Alameda Creek watershed (Gunther et al., 2000). Resident rainbow trout were collected below Niles Dam in 1927 and in Stonybrook Creek, a tributary to Alameda Creek, in 1955. Sampling by the ACWD in 1999 documented the presence of reproducing populations of resident trout in Arroyo Mocho and two tributaries to Alameda Creek, Welch and Pirate Creeks (Buchan et al., 1999). Recent sampling by the East Bay Regional Park District documented the presence of reproducing trout populations in Stonybrook Creek and Alameda Creek in the Sunol Regional Wilderness (Leidy, 2003).

Sightings of migratory steelhead have been reported downstream of the BART weir. In recent years, individual steelhead were captured near the BART weir by citizen groups and released at the mouth of Niles Canyon upstream of the ACWD inflatable diversion dams. One of these fish, a pregnant female, was tracked to Stonybrook Creek, upstream of Niles Dam (Gunther et al., 2000). There are also reports of migratory steelhead spawning in Alameda Creek downstream of the middle inflatable dam, and in 1998 fertilized eggs were collected from the area immediately downstream of the BART weir. The eggs hatched successfully, and the resulting fry were released into Alameda Creek in Sunol Park (Gunther et al., 2000).

Genetic testing by Nielson (2003) was based on a small sample size, but suggests that the present self-sustaining populations of resident rainbow trout may have been derived from migratory steelhead that were isolated in the upper part of the watershed by natural processes or by construction of Calaveras Dam (NMFS, 2004). The presence of migratory barriers, notably the BART weir, prevents upstream movement of migratory steelhead.

Temperature is an important factor affecting habitat quality and availability for migratory and resident trout, particularly during the oversummer rearing period (Gunther et al., 2000; Hanson Environmental 2002b). Temperature in Alameda Creek is discussed in Section 5.4.3. The upper lethal temperature for Pacific salmonids is in the range 23.9 to 25 °C for continuous long-term exposure (Gunther et al., 2000). Some researchers indicate an upper lethal temperature for Pacific salmonids as low as 22.9 °C (Hanson, 2003); however, steelhead can survive for short periods at elevated temperatures, especially if abundant food and dissolved oxygen exists. Recent temperature data suggest that summer and early-fall temperatures in Niles Canyon are within the range considered to be highly stressful or unsuitable for juvenile steelhead (Hanson Environmental, 2002b).

Spawning

The presence of self-sustaining resident rainbow trout populations with multiple age class structure within the watershed provides evidence of consistent successful reproduction (Gunther et al., 2000). The best potential spawning (and rearing) habitat in the watershed exists in the upper reaches of Alameda Creek, upstream tributaries, and the Arroyo Mocho canyon.

Steelhead/rainbow trout, like all Pacific salmon, select spawning sites with specific features. These features include gravel substrate with sufficient flow velocity to maintain circulation through the gravel and provide a clean, well-oxygenated environment for incubating eggs. Preferred gravel substrate is in the range of 0.25 to 2.5 inches in diameter, and flow velocity is in the range of 1 to 3 feet per second. Steelhead will use substrate with larger gravel (up to 4 inches) than will resident trout. Sites with preferred features for spawning occur most frequently in the pool tail/riffle head areas, where flow accelerates out of the pool into the higher gradient section below. In such an area, the female steelhead will create a pit, or redd, by undulating her tail and body against the substrate. This process also disturbs fine sediment in the substrate and lifts it into the current to be carried downstream, cleaning the nest area. Survival of fertilized eggs through hatching and emergence from the gravel is most often limited by radical changes in flow that can dislodge eggs from the substrate, result in sedimentation, or dewater incubation sites (Gunther et al., 2000).

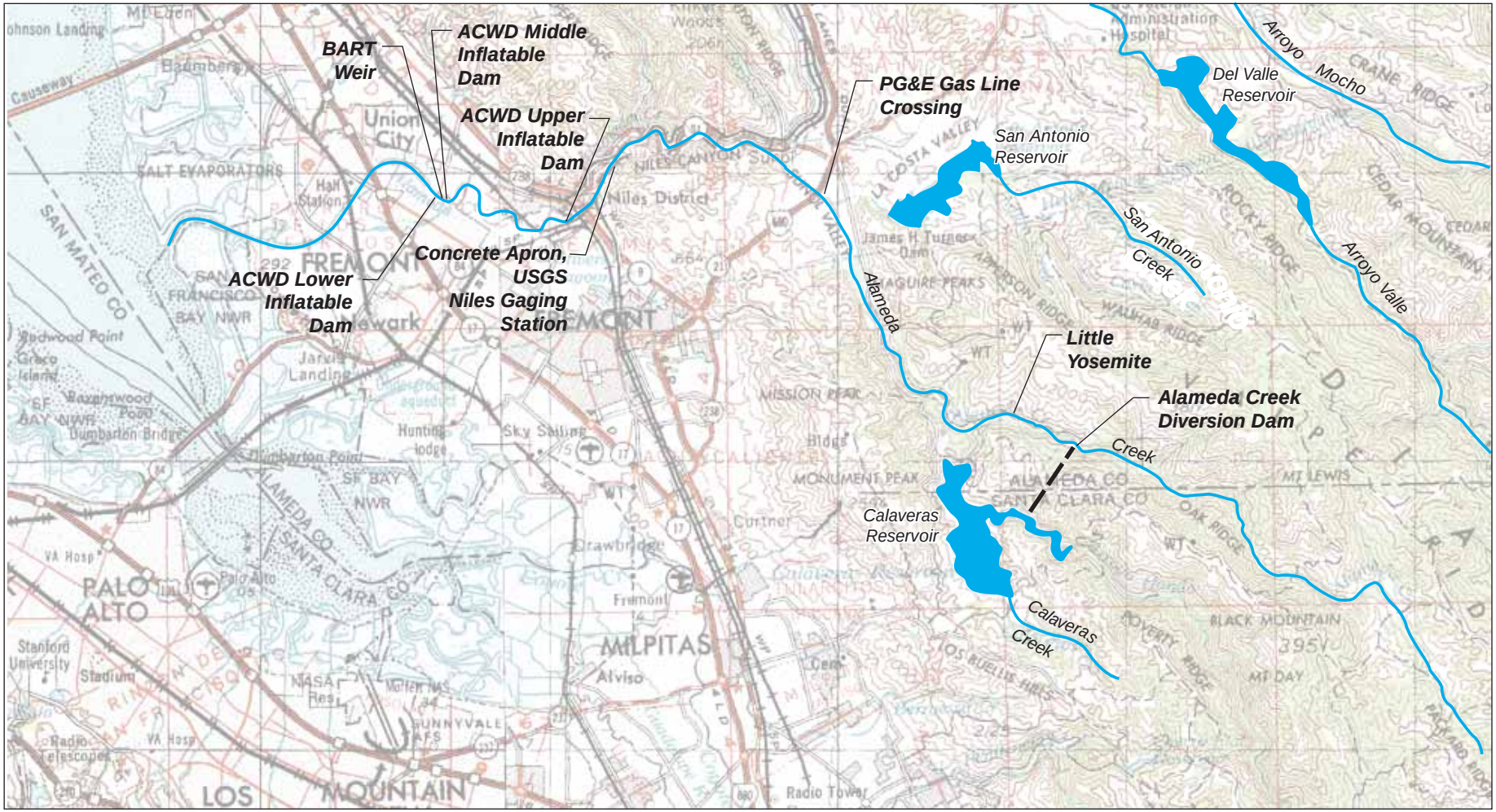
Areas of the watershed that support resident trout all show evidence of successful spawning, as indicated by the presence, abundant in places, of young-of-year trout. Suitable substrate conditions for spawning and egg incubation are found at some level in all stream reaches potentially supporting steelhead. Given the high potential fecundity of steelhead, factors other than availability of spawning habitat are likely to be more limiting; however, reconnaissance surveys conducted to date are not of sufficient detail to quantify the overall extent and quality of suitable substrate (Gunther et al., 2000). It is possible that more detailed observations would reveal opportunities for improving spawning habitat and enhancing production of steelhead juveniles. However, the availability of spawning habitat does not appear to preclude steelhead from completing their life cycle in the Alameda Creek watershed (Gunther et al., 2000).

Juvenile Rearing

Rearing habitat is limited in most of the areas potentially supporting steelhead by low summer stream flow and exposure to seasonally elevated water temperatures (Gunther et al., 2000). This natural condition under which steelhead in these reaches evolved has been exacerbated by urban development. However, areas exist with suitable water temperature for rearing *O. mykiss*, particularly in the upper canyon reaches of the creek and larger tributaries (Gunther et al., 2000; Hanson Environmental 2002b). In some of the stream reaches supporting the greatest numbers of resident trout, low summer stream flow results in relatively small, infrequent, isolated pools (e.g., the reach of Alameda Creek located upstream and downstream of the diversion dam). More pools or larger pools would be expected to allow greater numbers of trout to survive the low-flow period (Gunther et al., 2000), but this is a natural condition in these reaches and one to which steelhead/rainbow trout have adapted. Availability of late-summer habitat may limit the abundance of steelhead/rainbow trout within the watershed, but it does not preclude them from completing their life cycle (Gunther et al., 2000).

Rainbow Trout/Steelhead Migration and Barriers

As described above, Alameda Creek historically hosted a steelhead run, with spawning occurring in the upper reaches of the watershed. That steelhead run was eliminated by the placement of several obstructions to migration within the Alameda Creek channel over the past century. These obstructions include the Alameda County Flood Control and Water Conservation District's BART Weir located about 9.5 miles upstream from the creek's confluence with San Francisco Bay; Alameda County Water District (ACWD) rubber dams (ranging in location from about two miles upstream of the Bay to just below Niles Canyon), the USGS gaging station weir in Niles Canyon, and the PG&E drop structure in the Sunol Valley (see **Figure 5.4.5-1**). In addition, the Calaveras, San Antonio, and Alameda Creek Diversion Dams (all owned by the City and County of San Francisco and operated by the SFPUC) and Del Valle Dam (owned and operated by the California Department of Water Resources) are all impassable barriers in the upper part of the watershed. The SFPUC removed above-ground portions of two relict diversion dams located on the creek (Sunol Dam and Niles Dam) in September 2006. Other migration barriers along the creek also have been or are in the process of being removed: two swimming hole dams in the Sunol Regional Wilderness park were removed in the past few years; and the ACWD is



5.4.5-8

SOURCE: ESA + Orion; USGS 1969

SFPUC Water System Improvement Program . 203287

Figure 5.4.5-1
Potential Barriers to Fish Migration
in Alameda Creek Watershed

evaluating plans to remove or provide fish passage at their rubber dams and is currently installing a positive barrier fish screen on an unscreened diversion from the creek.

Despite the recent removal of these structures, currently, steelhead can migrate upstream only as far as the BART Weir. Since 2000, up to seven fish have been found at the base of the BART Weir annually during the migration season. (The area below the weir is monitored by the Alameda Creek Alliance for migrating fish). When found, these steelhead are collected, transported upstream, and released into the creek near Niles Canyon where several have been observed migrating upstream into tributary creeks. The NFMS rule regarding the listing of Alameda Creek steelhead as threatened under the Federal ESA (California Central Coast Distinct Population Segment), finalized in January 2006, applies only to the anadromous form of *O. mykiss* and therefore is limited to populations below the BART Weir.

Steelhead will not have unimpeded access to the upper Alameda Creek Watershed until passage is provided at the remaining downstream barriers to fish migration. The locations of passage barriers within the watershed are shown in Figure 5.4.5-1. These barriers and the status of planning to address passage at these locations is described below:

- Alameda County Flood Control and Water Conservation District's BART Weir – several studies have been conducted regarding potential designs to provide passage at this location. The most recent effort is a report (Wood Rogers, 2006) that outlines options ranging from total removal of the structure ("roughened channel") to three ladder and screen alternatives. The range of low flows estimated to allow suitable passage for adult steelhead among these four options is 10-50 cfs. However, other barriers (e.g., ACWD middle and upper rubber dams, PG&E Drop Structure – see below) within Alameda Creek may be impassable at these low flows. There is currently no schedule or budget for this project, and environmental review has yet to begin.

- ACWD middle and upper rubber dams – design of fish passage options and/or operational changes are being studied. There is currently no schedule or budget, and environmental review has yet to begin. (CH2MHill, 2001)

- USGS Niles gaging station weir/concrete apron – has been identified as potential barrier (passage impediment) at some flow levels. The Northern California Council Federation of Fly Fishers (NCCFFF) has developed a preliminary study (Federation of Fly Fishers, 2004), which includes a preliminary finding that the apron/weir fails to comply with existing fish passage criteria and would be a severe impediment to upstream migration of steelhead. However, this conclusion has been questioned by other experts, and NCFFF is continuing its studies.

- PG&E Drop Structure – protects a natural gas pipeline under the creek. No studies have been conducted to date regarding fish passage options, and there is no schedule or budget for this project. The SFPUC proposed to coordinate planning for a passage project at this location with PG&E in its Sunol Valley Quarry request for proposals. The SFPUC has yet to make a selection from those responding to the RFP, but the selected entity will be required to provide funds towards this effort.

- The SFPUC's Alameda Creek Diversion Dam could block migration to any migrating steelhead that travel upstream of the Little Yosemite area.

- A number of low-flow passage impediments exist within Alameda Creek including shallow riffles, short falls and bedrock plunge pools, and other small structures.

The SFPUC also is conducting preliminary studies of passage issues in the watershed: (1) natural barriers in the watershed, including the landslide in the Arroyo Hondo above Calaveras Reservoir, and the Little Yosemite reach of Alameda Creek; (2) Calaveras Dam; (3) Alameda Creek Diversion Dam; and (4) critical riffles on Alameda Creek, focusing on the Sunol Valley/Quarry reach.

In addition, the Calaveras, San Antonio, and Alameda Creek Diversion Dams (all owned by the City and County of San Francisco and operated by the SFPUC) and Del Valle Dam (owned and operated by the California Department of Water Resources) are all impassable barriers in the upper part of the watershed. The SFPUC removed above-ground portions of two relict diversion dams located on the creek (Sunol Dam and Niles Dam) in September 2006.

Flows to Support Rainbow Trout/Steelhead

In addition to migration barriers, reduced winter and spring flows in Alameda Creek above the BART Weir also would limit migration and spawning if steelhead were to gain access upstream. The Alameda Creek Fisheries Restoration Workgroup (Workgroup), formed for the purpose of restoring steelhead to Alameda Creek, will be undertaking a series of flow studies to determine the flows necessary to support steelhead in the watershed. The Workgroup includes the SFPUC, Alameda County Flood Control and Water Conservation District, Alameda County Resource Conservation District, Alameda County Water District (ACWD), Alameda Creek Alliance, California State Coastal Conservancy, California Department of Fish and Game, East Bay Regional Park District, National Marine Fisheries Service (NMFS), Natural Resources Defense Council, Pacific Gas and Electric Company (PG&E), and the Zone 7 Water Agency (Zone 7).

These agencies developed a Memorandum of Understanding (MOU) in April 2006 that describes the commitment and process to jointly fund and conduct flow studies to estimate the range, magnitude, timing, duration, frequency and location of flows necessary to restore steelhead within the creek, while also considering other native fishes and riparian communities, in the Alameda Creek watershed while minimizing the potential impacts to agencies responsible for supplying drinking water to Bay Area communities. In December 2006, a consultant was selected to manage the flow studies.

These flow studies are intended to result in a flow strategy that will meet with approval from the state and federal regulatory agencies and satisfy regulatory requirements. This strategy, when combined with other aspects of a fisheries restoration program, is intended to provide long-term assurances and certainties for restoring and maintaining native fishes, as well as providing water agencies and other utilities and special districts with long-term assurances and certainties for continued water supply and other infrastructure operations in the watershed. The flow studies are being conducted in three phases:

Phase 1 will include a review of relevant existing information on hydrologic and geomorphic conditions and fish habitat in the watershed. Based on this foundation, the Workgroup will agree on a detailed work plan for the tasks needed to estimate the range, magnitude, timing, duration, frequency and location of flows necessary to restore a population of steelhead to the creek (while

also considering their effects on other native fishes and riparian communities). That work plan, scheduled to be completed by June 2007, will be conducted in the second phase of the studies.

Phase 2 will focus on developing a common understanding of the existing conditions in the watershed and collecting the additional data necessary to estimate the flows needed to restore steelhead in the Alameda Creek watershed. This assessment will be based on the review of existing hydrologic and geomorphic conditions and the estimated flows needed to support steelhead throughout their lifecycle in the watershed. Results from Phase 2 will form the foundation from which flow proposals that will support steelhead can be developed and analyzed. The Workgroup currently anticipates that Phase 2 will be completed by January 2009.

The scope and schedule for Phase 3 will be determined following completion of Phases 1 and 2, and is expected to include the development and analyses of specific flow alternatives, including operational, engineering, and natural resource strategies, with the intent of achieving the restoration goals identified in Phase 2.

The SFPUC plans to incorporate these strategies into its Alameda Watershed Habitat Conservation Plan, which will provide coverage for regional water system operations within the Alameda Creek Watershed under the Federal Endangered Species Act (ESA, Section 10) for covered species, including steelhead.

The design of the fish passage projects, particularly for the BART Weir and the ACWD rubber dams, would be closely coordinated with the Workgroup's flow studies. Passage alternatives range from total removal of barriers to ladder/screen construction projects, and the flows required to provide passage at different times of the year would vary widely until a specific design is selected for each location. It is also critical for these designs to be considered in the context of existing and future water supply operations by ACWD, SFPUC, and Zone 7.

Potential Steelhead Restoration

For the purposes of full disclosure the PEIR provides this discussion of steelhead in lower Alameda Creek, and the potential for steelhead to be restored to the upper reaches of Alameda Creek (above the BART Weir). However, because this steelhead access does not currently exist and there is no current steelhead migration above the BART Weir, there would be no impact on steelhead migration, spawning, or juvenile rearing upstream of the BART Weir as a result of WSIP implementation. Further, as described in the preceding discussion, since a number of steps are required before steelhead migration further upstream can occur, it is speculative to assess the specific impacts that system operation under the WSIP might have on the potential future restoration of steelhead. Thus, no impact analysis or conclusion is developed in this PEIR. If and when steelhead are restored, the SFPUC will be required to conform its system operations to comply with the applicable Endangered Species Act requirements.

Other Fish Species

Chinook Salmon

Chinook salmon remains within archaeological sites in the lower Alameda Creek floodplain (Gunther et al., 2000). These fish could have been captured in San Francisco Bay or other

locations and transported to the site. Historically, Alameda Creek could have supported small runs of Chinook salmon, as have been observed in other South Bay tributaries. In recent years, small numbers of Chinook salmon adults have been recovered from the Alameda Creek flood control channel downstream of the BART weir, as well as from other streams tributary to South San Francisco Bay that were not previously known to support salmon runs. It is generally believed that management of hatchery production has resulted in salmon straying to streams that have not traditionally supported them (Gunther et al., 2000).

Other Species

Approximately seventeen native fish species have been collected in nontidal portions of the Alameda Creek watershed during the past century (**Table 5.4.5-1**). Several other species may also have occurred in the watershed based on collections in tidal portions, evidence from archaeological investigations, and other accounts. Many collections include widely distributed species typical of streams in the region, such as California roach (*Hesperoleucus symmetricus*), hitch (*Lavinia exilicauda*), Sacramento sucker, Sacramento pikeminnow (*Ptychocheilus grandis*), steelhead/rainbow trout, Pacific lamprey (*Lampeta tridentata*), and prickly sculpin (*Cottus asper*) (Gunther et al., 2000). Two species, speckled dace (*Rhinichthys Osculus*) and riffle sculpin (*Leptocottus armatus*), have appeared in only one or two collections. Speckled dace were reported to occur in Arroyo Hondo and Isabel Creek (two Calaveras Creek tributaries above Calaveras Reservoir) by Snyder in 1905, and in Alameda Creek at the confluence with Calaveras Creek by Shapovalov in 1938 (Leidy, 1984).

In surveys conducted between 1972 and 1977, Scoppettone and Smith (1978; Gunther et al., 2000) did not find speckled dace in these areas. Riffle sculpin collected in Alameda Creek at the junction with Calaveras Creek in 1938 by Shapovalov (Gunther et al., 2000) is the only report of the species in the Alameda Creek watershed. Scoppettone and Smith (1978) sampled for riffle sculpin at sites with cool, permanent water in Isabel, Smith, Arroyo Hondo, Arroyo Mocho, and Alameda Creek, but found none. Of the 15 remaining species, all were collected as recently as 2002 (Leidy, 2007). The SFPUC has also conducted an annual fishery survey within the watershed since 1998.

The two species not collected in 1981 were Pacific lamprey and Sacramento blackfish (Gunther et al., 2000). Pacific lamprey have been recently netted in the flood control channel section. Sacramento blackfish have been reported in the ACWD quarry lakes. Sacramento perch, one of the species collected in 1981, are native to California. Aceituno et al. (1976) believed that Sacramento perch were stocked in Calaveras Reservoir some time after 1925 and spread to the stream from there. However, Gobalet (1990) reports Sacramento perch from fish remains at an archaeological site adjacent to Arroyo de la Laguna. In any case, the species has been collected in Niles Canyon since 1953 and currently maintains populations in the off-channel percolation ponds adjacent to the flood control channel (Gunther et al., 2000).

TABLE 5.4.5-1
FISH SPECIES OBSERVED IN THE ALAMEDA CREEK WATERSHED

Common Name ***Scientific Name***	**1905 Synder**	**1927 Follet**	**1934 Seale**	**1938 Shapovalov**	**1953 Follett**	**1955 Follett**	**1957–1958 Follett**	**1961 Hopkirk**	**1972 Follet**	**1973 CDFG**	**1977 Scoppettone and Smith**	**1984 Leidy**	**2007 Leidy**
Native Species													✓
Pacific lamprey (*Petromyzon marinus*)						✓	✓			✓			✓
California roach (*Hesperoleucus symmetricus*)	✓		✓				✓	✓			✓	✓	✓
Hitch (*Lavinia exilicauda*)	✓		✓			✓			✓	✓		✓	✓
Sacramento blackfish (*Orthodon microlepidotus*)			✓			✓	✓	✓	✓	✓			✓
Sacramento squawfish (pikeminnow) (*Ptychocheilus grandis*)	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓
Speckled dace (*Rhinichthys Osculus*)				✓									
Sacramento sucker (*Catostomus occidentalis*)	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓
Steelhead/rainbow trout (*Oncorhynchus mykiss*)		✓				✓	✓				✓		✓
Threespine stickleback (*Gasterosteus aculeatus*)			✓							✓		✓	✓
Sacramento perch (*Archoplites interruptus*)					✓	✓	✓		✓	✓	✓	✓	✓
Prickly sculpin (*Cottus asper*)	✓	✓	✓			✓	✓			✓	✓	✓	✓
Riffle sculpin (*Leptocottus armatus*)				✓									✓
Tule perch (*Hysterocarpus traski*)	✓	✓	✓									✓	✓
Hardhead (*Mylopharodon conocephalus)*													✓

TABLE 5.4.5-1 (Continued)
FISH SPECIES OBSERVED IN THE ALAMEDA CREEK WATERSHED

Common Name *Scientific Name*	1905 Synder	1927 Follet	1934 Seale	1938 Shapovalov	1953 Follett	1955 Follett	1957–1958 Follett	1961 Hopkirk	1972 Follet	1973 CDFG	1977 Scoppettone and Smith	1984 Leidy	2007 Leidy
Native Species (cont.)													✓
Chinook salmon (*Oncorhynchus tshawytscha*)													✓
Shiner perch (*Cymatogaster aggregata*)													✓
Longjaw mudsucker (*Gillichthys mirabilis*)													✓
Staghorn sculpin (*Leptocottus armatus*)													✓
Starry flounder (*Platichthys stellatus*)													✓
Introduced													
Goldfish (*Carassius auratus*)										✓			✓
Carp (*Cyprinus carpio*)						✓	✓		✓	✓	✓	✓	✓
Golden shiner (*Notemigonus crysoleucas*)												✓	✓
White catfish (*Ictalurus catus*)						✓							✓
Black bullhead (*Ictalurus melas*)												✓	✓
Brown bullhead (*Ictalurus nebulosus*)							✓	✓					✓
Mosquito fish (*Gambusia affinis*)								✓		✓	✓	✓	✓
Inland silverside (*Menidia beryllina*)												✓	✓
Green sunfish (*Lepomis cyanellus*)								✓		✓		✓	✓
Bluegill					✓	✓	✓				✓		✓

(*Lepomis macrochirus*)

TABLE 5.4.5-1 (Continued)
FISH SPECIES OBSERVED IN THE ALAMEDA CREEK WATERSHED

Common Name ***Scientific Name***	**1905 Synder**	**1927 Follet**	**1934 Seale**	**1938 Shapovalov**	**1953 Follett**	**1955 Follett**	**1957–1958 Follett**	**1961 Hopkirk**	**1972 Follet**	**1973 CDFG**	**1977 Scoppettone and Smith**	**1984 Leidy**	**2007 Leidy**
Introduced (cont.)													
Smallmouth bass (*Micropterus dolomieui*)					✓			✓				✓	✓
Largemouth bass (*Micropterus salmoides*)					✓			✓				✓	✓
Black Crappie (*Pomoxis nigromaculatus*)								✓					✓
Bigscale logperch (*Percina macrolepida*)												✓	✓
Threadfiin shad (*Dorosoma petenense*)													✓
Channel catfish *(Ictalurus punctatus)*													✓
Rainwater killfish *(Lucania parva)*													✓
Striped bass *(Morone saxatilis)*													✓
Redear sunfish *(Lepomis microlophus)*													✓
Redeye bass *(Micropterus coosae)*													✓
Yellowfin goby *(Acanthogobius flavimanus)*													✓

SOURCE: Gunther et al., 2000; Leidy, 2007.

5.4.5.2 Impacts

Significance Criteria

The City and County of San Francisco has not formally adopted significance standards for impacts related to fisheries, but generally considers that implementation of the proposed program would have a significant fisheries impact if it were to:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFG or USFWS
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites
- Have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of an endangered, rare, or threatened species

Approach to Analysis

The effects of the WSIP on river flow and water levels in reservoirs were determined using the Hetch Hetchy/Local Simulation Model, as described in Section 5.4.1. A professional fish biologist assessed the effects of flow, reservoir level, and water temperature changes on fishery resources in the Alameda Creek watershed.

As described in Section 5.1.3, Approach to Analysis for Chapter 5 Water Supply and System Operations, and further discussed in Section 5.4.1, the existing conditions baseline used for impact analysis is based on current flow conditions in Alameda Creek that have occurred since the beginning of 2002 as a result of the DSOD restrictions on the storage capacity of Calaveras Reservoir. The proposed future condition assumes full implementation of the WSIP, including restoration of Calaveras Reservoir storage.

Impact Summary

Table 5.4.5-2 presents a summary of the impacts on aquatic habitats and fishery resources that could result from implementation of the proposed WSIP water supply and system operations.

Impact Discussion

Impact 5.4.5-1: Effects on fishery resources in Calaveras Reservoir.

The storage volume within Calaveras Reservoir under proposed WSIP operations would typically be substantially greater than under current conditions. This increase in storage offers the potential

TABLE 5.4.5-2
SUMMARY OF IMPACTS –
FISHERIES IN ALAMEDA CREEK WATERSHED STREAMS AND RESERVOIRS

Impact	Significance Determination
Impact 5.4.5-1: Effects on fishery resources in Calaveras Reservoir	B
Impact 5.4.5-2: Effects on fishery resources along Calaveras Creek below Calaveras Dam and along Alameda Creek below confluence with Calaveras Creek	B
Impact 5.4.5-3: Effects on fishery resources along Alameda Creek downstream of Alameda Creek Diversion Dam	PSM
Impact 5.4.5-4: Effects on fishery resources in San Antonio Reservoir	B
Impact 5.4.5-5: Effects on fishery resources along San Antonio Creek below San Antonio Reservoir	LS
Impact 5.4.5-6: Effects on fishery resources along Alameda Creek below confluence with San Antonio Creek	LS

LS = Less than Significant impact, no mitigation required
PSM = Potentially Significant impact, can be mitigated to less than significant
B = Beneficial impact

for increased coldwater pool volume, which could benefit coldwater fish species downstream of the reservoir. A greater coldwater pool volume within the reservoir is expected to sustain colder temperatures, particularly during summer months, and improve the quality and availability of habitat downstream of the dam. In addition, increased reservoir storage would increase the volume of habitat available for resident fish species inhabiting the reservoir, including both warmwater and coldwater fish species. The increased reservoir habitat may increase the abundance of non-native predators such as largemouth bass that prey on resident native species.

The increase in reservoir elevation under the proposed program could also provide greater opportunities for connectivity and migration of fish between the reservoir and upstream tributary habitat. As a result of these factors, increased reservoir storage under proposed operations is considered a *beneficial impact* on fishery resources.

Impact 5.4.5-2: Effects on fishery resources along Calaveras Creek below Calaveras Dam and along Alameda Creek below confluence with Calaveras Creek.

Under existing conditions, no instream flow releases have been specifically made to support fishery habitat within either Calaveras or Alameda creeks downstream of Calaveras Dam. As part of the proposed WSIP operations, instream flow releases would be made consistent with the 1997 MOU. Providing instream flow releases represents an environmental benefit to habitat quality and availability for resident rainbow trout and other fish inhabiting Calaveras Alameda creeks. As noted above, the Workgroup is identifying flow studies and analyses that may be used in the future to refine streamflow conditions within the creek. As a result of providing instream flow

releases under the WSIP, the proposed program provides an environmental benefit to fishery habitat. Therefore, the proposed operations would have a less-than-significant impact, and in some cases a beneficial impact, on fishery resources in this reach of the creek.

Hydrologic modeling indicates that, in general, releases from Calaveras Dam to Calaveras Creek would be altered under WSIP operations in two ways. Under current conditions (with Calaveras Reservoir operating below design levels), peak winter flows, typically in the range of 300 to 400 cfs, that are made through controlled releases from the cone valve at the dam during January and February, are generally greater than winter flows would be under future operations with the WSIP. Under the proposed operations, instream flow releases from Calaveras Dam to Calaveras Creek would include summer releases that would not occur under current operations. Changes in instream flow releases to Calaveras Creek have the potential to support riparian vegetation along the stream channel. Instream flow releases would occur between the confluence of Calaveras and Alameda Creeks and further downstream to provide habitat for resident trout and other fishery resources. These flows are proposed to be recaptured downstream. A reduction in the magnitude of peak winter flows under the WSIP when compared to current peak flows was considered in the geomorphic analysis (Section 5.4.2) to be less than significant because high flow that could transport substantial quantities of sediment would still occur during heavy rains. The changes in flow conditions under the WSIP throughout the year, including increased average winter releases or bypasses and year-round releases or bypasses, would provide a fishery benefit through increased habitat quality and availability within Alameda Creek downstream of the confluence with Calaveras Creek compared to existing conditions.

Instream flow releases predicted to occur under WSIP operations year-round, including instream flow releases in the summer under the WSIP, would result in *beneficial impacts* on habitat quality and availability for fishery resources within Calaveras and Alameda creeks compared to existing conditions.

Impact 5.4.5-3: Effects on fishery resources along Alameda Creek downstream of Alameda Creek Diversion Dam.

Alameda Creek within the reach between the diversion dam and the confluence with Calaveras Creek provides habitat for spawning and oversummering resident trout. Flows during the summer months are very low and stream habitat is fragmented. The natural low-flow summer conditions also occurred prior to construction of the diversion dam. During the low-flow period, trout and other fishes reside primarily in isolated pools. Alluvial gravels provide substrate for trout spawning, and the occurrence of multiple age classes of trout within the area demonstrates successful reproduction.

Due to restricted storage in Calaveras Reservoir, the SFPUC is generally not diverting most of the winter and spring flows to the reservoir, and those flows continue to flow down Alameda Creek past the diversion dam. As detailed in Section 5.4.1, the diversion dam has been operated infrequently during the past five years while Calaveras Reservoir storage has been reduced but is

anticipated to be operated far more frequently in the future after Calaveras Reservoir storage is returned to normal operating levels. Under existing conditions, the flows in the creek support fishery habitat downstream of the diversion dam over the past five years and are expected to continue until Calaveras Reservoir storage is restored in approximately 2012.

As described in Section 5.4.1, under the WSIP, reservoir operations would be restored, and the diversion dam would be operated to divert most flows that currently flow down upper Alameda Creek (up to a maximum diversion of approximately 650 cfs) through the diversion tunnel and into the reservoir. Under the proposed program, there is no requirement for maintaining minimum instream flows within Alameda Creek at the diversion dam to support fishery habitat downstream of the dam. The proposed diversion of most Alameda Creek flows below 650 cfs would result in a significant change in hydrologic conditions in Alameda Creek downstream of the diversion dam when compared to existing conditions. Diversion of most or all flows during the late winter and spring months could adversely affect the ability of resident rainbow trout to spawn and for eggs to successfully incubate in this reach. In the future, with Calaveras Reservoir storage operating at higher levels for longer periods under the WSIP, diversions to storage are expected to be reduced and the frequency and magnitude of spills from the reservoir increased.

The diversion dam is equipped with control gates but does not include a positive barrier fish screen or other protective devise that would exclude trout or other fish from being entrained through the diversion structure into Calaveras Reservoir. Trout and other fish species inhabit Alameda Creek upstream of the diversion dam and may be diverted from the creek into the reservoir under the WSIP, preventing fish passage to downstream reaches of Alameda Creek. Calaveras Reservoir provides habitat and therefore fish diverted from Alameda Creek may not be lost from the population but rather would inhabit the reservoir. Passage through the diversion dam, however, has the potential to result in increased stress, physical abrasion, and vulnerability of fish to predation mortality within the reservoir, and other potentially adverse effects. Passage of fish over the diversion dam downstream in Alameda Creek may also result in stress and potential injury to trout and other fish species. No studies have been conducted to document the frequency or significance of entrainment of fish from Alameda Creek into Calaveras Reservoir or the potential significance of future changes in the diversion structure operations under the proposed project conditions for affecting fish entrainment. Based upon results of hydrologic and operational modeling that demonstrate future conditions with the proposed program would substantially increase the frequency and magnitude of water diverted from Alameda Creek through the diversion dam, and results of studies documenting the vulnerability of fish to entrainment at unscreened water diversions, the potential impact of operating the unscreened diversion dam on fishery resources in the future is considered potentially significant.

CDFG Code Section 5980 contains requirements for water diversions greater than 250 cfs that do not affect listed salmonid species that applies to the Alameda Creek Diversion Dam. This code section requires diversion operators to provide an intake screen or other suitable method for avoiding and minimizing fish entrainment, if needed. The code section stipulates that CDFG may have partial responsibility for funding the design and construction of a fish screen. The CDFG code also provides opportunities for a water diversion operator to consult with CDFG, using

information on the diversion and adjacent habitat conditions, to determine whether or not a fish screen would be required.

These impacts of diversion dam operations on trout spawning and egg incubation during the winter and spring, and on the increased vulnerability to entrainment from Alameda Creek into Calaveras Reservoir under the WSIP, are potentially significant compared to existing conditions with Alameda Creek flows bypassing the diversion tunnel to a much greater degree. Although trout and other fish passing through or over the diversion dam would be vulnerable to stress and injury, fish entrained into the diversion dam would be removed from Alameda Creek, but would be able to inhabit Calaveras Reservoir.

A reduction in peak flows in the future with Calaveras Reservoir in full operation also has the potential to affect the frequency and magnitude of channel-forming flows that support geomorphic processes within the creek; however, this effect on fishery habitat is considered less-than-significant because flows in excess of about 650 cfs would be bypassed at the diversion dam and continue downstream within Alameda Creek. As discussed in Section 5.4.2 (Geomorphology) this effect is considered to be less than significant because high flows would continue to be produced by heavy rains within the watershed, as would the sediment-clearing sluicing flows. At the same time, the diversion of higher flows up to about 650 cfs at the diversion dam could provide a fishery benefit by reducing the likelihood that eggs incubating in redds downstream of the diversion dam would be vulnerable to scour and erosion and would be expected to contribute to improved reproductive success of those fish spawning within the reach.

In the summer season, the SFPUC operations under the DSOD restrictions imposed in December 2001 and facilities on Alameda Creek allow seepage and through-flow to occur through the diversion dam and down the creek. This practice allows adequate flows to support oversummering of resident trout in Alameda Creek between the diversion dam and confluence with Calaveras Creek. The proposed program would continue this practice, therefore potential impacts on habitat during the summer would be less-than-significant.

Overall, WSIP-related impacts on fishery habitat along Alameda Creek immediately downstream of the diversion dam would be *potentially significant*. Implementation of Measure 5.4.5-3a: Minimum Flows for Resident Trout on Alameda Creek, which would require the SFPUC to develop operational guidelines and implement minimum instream flow requirements for Alameda Creek downstream of the diversion dam from December through April to support resident trout spawning and egg incubation, would reduce this impact to a less-than-significant level. Measure 5.4.5-3a may be sufficient to fully mitigate WSIP effects on resident trout in Alameda Creek, including the effects of entrainment through the diversion tunnel. If, after monitoring of this measure and adaptive management of the minimum flow requirements, the monitoring indicates that WSIP effects are not fully mitigated, then the SFPUC also will implement Measure 5.4.5-3b: Alameda Diversion Dam Diversion Restrictions or Fish Screens, to either modify seasonal diversions schedules to minimize impacts on fish or screen its diversion facilities.

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Impact 5.4.5-4: Effects on fishery resources in San Antonio Reservoir.

Average storage volumes and reservoir elevations in San Antonio Reservoir under proposed operations would typically be slightly greater than under current conditions. Increased reservoir storage volume would increase the volume of habitat available for resident fish species inhabiting the reservoir, including both warmwater and coldwater fish species. The increased reservoir habitat may increase the abundance of non-native predators such as largemouth bass that prey on resident native species. The increase in storage elevations under the proposed program could also provide greater opportunities for connectivity and migration of fish between the reservoir and upstream tributary habitat. As a result of these factors, increased reservoir storage under proposed operations is considered a *beneficial impact* on fishery resources.

Impact 5.4.5-5: Effects on fishery resources along San Antonio Creek below San Antonio Reservoir.

Hydrologic modeling indicates a generally similar seasonal pattern in the magnitude of instream flow releases from San Antonio Reservoir to San Antonio Creek under existing conditions and with the WSIP. Proposed WSIP operations would result, on average, in slightly higher releases during the winter months (December–February) and a reduction in stream flow releases during the spring months (March–April) compared to existing conditions, while neither current nor projected future WSIP operations are anticipated to provide summer and fall base flows. The seasonal change in the timing of releases to San Antonio Creek is not expected to result in a significant impact to fishery resources. Since neither the WSIP nor current conditions provide summer and fall base flows within the creek, impacts to fishery resources are comparable under both existing and proposed operations. Therefore, impacts to fishery resources related to changes in releases from San Antonio Reservoir to San Antonio Creek would be *less than significant*, and no mitigation measures would be required.

Impact 5.4.5-6: Effects on fishery resources along Alameda Creek below confluence with San Antonio Creek.

Releases from San Antonio Reservoir to San Antonio Creek and subsequently into Alameda Creek have historically been rare under baseline conditions and would continue to be rare with the WSIP. Releases past the dam are modeled to occur in about 20 percent of the years under the existing condition and at approximately the same frequency with the WSIP, mostly in above-normal or wet years. The WSIP would have no effect on flow in San Antonio Creek in dry, below-normal, and normal years. WSIP operations would generally reduce flows in the winter and early spring of some wet years, and occasionally in the winter of some above-normal years. Occasionally, the WSIP could result in spills to San Antonio Creek that would not occur under existing conditions. These occasional spills would be the result of the reservoir being drawn less often due to the restoration of Calaveras Reservoir storage capacity and the recapture of the 1997

MOU-flows. Since there would be only minor changes in flows within San Antonio Creek, and the contribution of San Antonio Creek flows to fishery habitat downstream within Alameda Creek between current and future WSIP operations, potential impacts on fishery resources and their habitat along Alameda Creek downstream of the confluence with San Antonio Creek would be *less than significant,* and no mitigation measures would be required.

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5.4.6 Terrestrial Biological Resources

Operation of WSIP projects in the Alameda Creek watershed would alter the pattern of water levels in Calaveras and San Antonio Reservoirs as well as alter flows in Alameda and Calaveras Creeks. This section focuses on possible impacts on sensitive natural communities, key special-status species, and species of concern that could result from these changes. Although many terrestrial animal species may use riparian and aquatic systems intermittently for food, water, or cover, this discussion focuses on those species that depend on the riparian ecosystem for essential breeding and/or foraging habitat.

5.4.6.1 Setting

Overview

The Alameda Creek watershed provides habitat for a variety of wildlife. Grassland communities cover more than 50 percent of the watershed, and woodlands cover about 22 percent. Other habitats include freshwater marshes, where streams discharge into reservoirs, and brush, scrub, and chaparral communities in the flatter, drier, or steeper lands (SFPUC, 2007).

Ridgelands and open water make the area an attractive winter foraging and resting habitat for migrating and resident bird species, drawing birds of prey, waterfowl, and perching birds. In total, the watershed contains more than 17 types of wildlife habitat that support a range of animals, including tule elk, black-tailed deer, coyote, mountain lions, and bald eagles.

Alameda Creek Above the Alameda Creek Diversion Dam

The riparian resources along upper Alameda Creek are varied. Alameda Creek is usually a perennial stream above the diversion dam. It flows through relatively narrow alluvial valleys that support California sycamore (*Platanus racemosa*) alluvial woodland, and through narrower, more rocky areas that support bands of Central Coast arroyo willow (*Salix lasiolepis*) riparian forest and white alder (*Alnus rhombifolia*) riparian forest, bordered by coast live oak (*Quercus agrifolia*) woodland, mixed evergreen forest/oak woodland, and Diablan sage scrub.

Alameda Creek from the Diversion Dam to the Confluence with Calaveras Creek

Below the diversion dam, Alameda Creek passes through a steeply sloping, narrow bedrock channel section that supports a band of Central Coast arroyo willow riparian forest and white alder riparian forest. These forests are bordered by coast live oak woodland contained within a confined, rocky canyon. Near the confluence with Calaveras Creek, the canyon opens into a broader floodplain supporting an open California sycamore alluvial woodland and valley oak (*Quercus lobata*) savanna.

Calaveras Reservoir

Upland vegetation surrounding Calaveras Reservoir consists primarily of non-native annual grassland, coast live oak, and mixed evergreen forest and woodland, in addition to a small amount of Diablan sage scrub. An area of serpentine grassland, a sensitive natural community, is found

on the east side of Calaveras Reservoir between the dam and Arroyo Hondo. A number of perennial, ephemeral, and intermittent streams enter the reservoir, and many support narrow bands of central coast arroyo willow riparian forest. The largest tributary stream, Arroyo Hondo, is a perennial stream that supports one of the largest stands of white alder riparian forest in the Alameda watershed. Small areas of freshwater marsh and seep habitat often occur at the mouth of intermittent and perennial streams where the groundwater reaches the surface and meets the reservoir level. A small, apparently relict stand of willows persists at the mouth of Calaveras Creek, well above the currently maintained reservoir levels. A large area of seasonal wetland is present in the southern, shallow edge of Calaveras Reservoir. This area may have supported perennial freshwater marsh when the reservoir was maintained at higher levels. Between the currently maintained reservoir elevation and the historically maintained maximum reservoir elevation, wave erosion has left a strip of soil with coarse surface sediments. This area is relatively bare and mainly supports weedy annual plants.

Calaveras Creek

Calaveras Creek from the dam to the confluence with Alameda Creek is situated in a deep, shaded canyon with well-developed riparian vegetation. Although mapped as sycamore alluvial woodland (SFPUC, 2001), riparian vegetation along the creek also includes arroyo willow riparian forest and other species such as Fremont cottonwood (*Populus fremontii*) and valley oak.

Alameda Creek from Calaveras Creek to the Confluence with San Antonio Creek

From the confluence with Calaveras Creek to the confluence with San Antonio Creek, Alameda Creek begins as a broader watercourse with widely arcing bends and a continuous mixed-species riparian canopy composed of arroyo willow riparian forest and white alder riparian forest, with occasional Fremont cottonwoods (*Populus fremontii*), valley oaks, box elder (*Acer negundo* var. *californica*), and sycamores. Some large areas of valley oak savanna are associated with alluvial terraces along this section of the creek (SFPUC, 2001). During the summer months, surface water is present in pools, especially from the confluence with Calaveras Creek to the Sunol Valley WTP. From the Sunol Valley WTP to San Antonio Creek, Alameda Creek is situated in a quarter-mile-wide valley with a broad, cobbly floodplain that support sycamore alluvial woodland on the coarser soils, valley oak savanna on the finer soils, and narrow bands of arroyo willow scrub near the channel. Alameda Creek flows in this reach during the winter and spring rainy season, but dries up completely during the summer and fall due to high infiltration rates, especially in the lower portion of the reach. Portions of the former floodplain in the lower section of this reach have been developed as nurseries and aggregate quarries.

San Antonio Reservoir

Upland vegetation surrounding San Antonio Reservoir is primarily non-native annual grassland. North-facing slopes on the south side of San Antonio Reservoir support mixed evergreen and coast live oak woodland. Where minor tributaries enter San Antonio Reservoir, narrow bands of coast live oak riparian forest follow the watercourse and streambanks. On larger tributaries such as Indian Creek and San Antonio Creek, well-developed stands of sycamore alluvial woodland, valley oak savanna, and possibly white alder riparian forest line the channels. Some areas of

emergent vegetation are found at the mouths of the larger creeks. As is typical for reservoirs operated for water storage, a strip of unvegetated, wave-terraced soil is exposed when water levels fall below the usual maximum.

San Antonio Creek

San Antonio Creek below the dam supports native vegetation for a little over a mile (to Calaveras Road) before entering the highly disturbed gravel extraction area. The creek supports a diverse assemblage of central coast arroyo willow scrub in the upper section nearest the dam, and sycamore alluvial woodland in the section farther downstream. The creek flows little if at all, so the riparian vegetation is fed primarily by seepage. As with most sycamore alluvial woodland, the channel-forming processes needed for stand regeneration are no longer present, and all of the trees are large and mature with no evident recruitment.

Alameda Creek Below San Antonio Creek

Below the confluence with San Antonio Creek, Alameda Creek first passes through aggregate quarries. No vegetation and little flow occur in this area. Below the gravel quarries, Alameda Creek passes the Sunol Water Temple. In this area, the creek supports arroyo willow riparian forest, coast live oak riparian forest, and sycamore alluvial woodland before entering Niles Canyon—a broad, rocky canyon with an intermittent riparian canopy of mixed willows, cottonwoods, sycamores, and valley oaks. This section of Alameda Creek, below the confluence with Arroyo de la Laguna, flows year-round. The majority of dry-season flow below Sunol is derived from releases of South Bay Aqueduct water destined for groundwater recharge at the mouth of Niles Canyon.

Natural Communities, including Sensitive Natural Communities

Section 4.6, Biological Resources, presents a general discussion of wildlife habitats and sensitive natural communities. Figure 4.6-2b shows the distribution of habitat types in the Alameda watershed. Section 4.6 also provides additional detail specific to the Alameda watershed, including information on common or widespread natural communities. Roughly half of the Alameda watershed supports grassland, primarily non-native grassland. Diablan sage scrub is found on steep, rocky, exposed uplands with little soil development. Sheltered or drier sites with more soil development support forest and woodlands, while riparian forest and scrub are found along the major watercourses. The *Alameda Watershed Management Plan Environmental Impact Report* (San Francisco Planning Department, 2000) identified 18 natural community types within the watershed, six of which the California Natural Diversity Database (CNDDB) lists as sensitive (CDFG, 2006). Ten natural communities are found within the WSIP program area, of which six are considered sensitive. **Table 5.4.6-1** presents the name, status, and occurrence of natural communities within the program area in the Alameda watershed. These communities are briefly described in the paragraphs that follow.

- **Grasslands.** Serpentine grassland is specifically associated with soils derived from serpentine rock. These grasslands are characterized by a relatively high proportion of native species, many perennial grasses, and relatively low productivity. Typical perennial grasses

TABLE 5.4.6-1
POTENTIAL FOR OCCURRENCE OF NATURAL COMMUNITIES IN THE ALAMEDA WATERSHED WSIP PROGRAM AREA

Natural Community[a]	Alameda Creek above diversion dam	Calaveras Reservoir	Alameda Creek from diversion dam to confluence with Calaveras Creek	Calaveras Creek	Alameda Creek below confluence with Calaveras Creek	San Antonio Reservoir	San Antonio Creek	Alameda Creek below San Antonio Creek
Grasslands								
Serpentine grassland*		X						
Non-native grassland		X				X		
Chaparral and Scrub								
Diablan sage scrub	X	X						
Forest and Woodland								
Mixed evergreen forest/coast live oak woodland	X	X	X			X		
Valley oak woodland and savanna	X		X		X	X		
Central coast arroyo willow riparian forest*	X	X	X	X	X	X	X	X
Sycamore alluvial woodland*	X		X	X	X	X	X	X
White alder riparian forest*	X	X	X		X	X		
Central coast live oak riparian forest*						X		X
Marsh								
Coastal and valley freshwater marsh		X				X		

[a] An asterisk (*) indicates a sensitive natural community, as identified in the California Natural Diversity Database (CDFG, 2006).

include purple needlegrass (*Nassella pulchra*), pine bluegrass (*Poa secunda*), fescue (*Festuca* spp.), and junegrass (*Koeleria cristata*). Within the program area, serpentine grassland is found on the eastern shoreline of Calaveras Reservoir and on the ridge south of the reservoir west of Calaveras Creek. Non-native grassland is dominated by a variety of non-native annual grasses such as brome (*Bromus* spp.), oats (*Avena* spp.), and wild barley (*Hordeum* spp.) as well as herbs such as filaree (*Erodium* spp.), with less abundant native annual and perennial grasses and herbs.

Non-native grassland is the most common natural community on the watershed, bordering most of San Antonio Reservoir and much of the southern half of Calaveras Reservoir. It also adjoins riparian habitats along the creeks. Non-native grassland is dominated by a variety of non-native annual grasses and herbs, with less abundant native annual and perennial grasses and herbs. Small areas of valley needlegrass grassland may also be present in rocky areas, but were too small to map (Jones and Stokes, 2003).

- **Diablan sage scrub (or north coast scrub).** This shrub-dominated community is typically found on steep, rocky, exposed slopes. In the watershed, this community is dominated by coyote brush (*Baccharis pilularis*), poison-oak (*Toxicodendron diversilobum*), bush monkeyflower (*Mimulus aurantiacus*), and California sage (*Artemisia californica*) in

various proportions. Diablan sage scrub is found along the Arroyo Hondo arm on the eastern side of Calaveras Reservoir, and in small areas on the western side of the reservoir.

- **Forests and woodlands.** Mixed evergreen forest and coast live oak woodland are the most abundant forest communities on the watershed. These communities are typically found in less-exposed areas that have deeper soils than the scrub and grassland communities. Mixed evergreen forest is dominated by coast live oak, California bay (*Umbellularia californica*), and sometimes madrone (*Arbutus menziesii*), Douglas-fir (*Pseudotsuga menziesii*), and big-leaf maple (*Acer macrophyllum*). It tends to form a closed canopy with a shrubby or grassy understory. Coast live oak woodland is dominated by a single species, coast live oak. Coast live oak can form a nearly closed canopy forest in favorable sites with deep soils and ample soil moisture, or an open woodland with a grassy understory in drier areas. These communities are found in nearly all of the sheltered canyons and north-facing slopes in the watershed, including extensive areas along the shore of Calaveras Reservoir and smaller areas on the south side of San Antonio Reservoir.

  Valley oak woodland is limited primarily to the deep alluvial soils found along the floodplains of the major drainages such as Alameda Creek. It consists of an open canopy of a single tree species, valley oak, with an understory resembling non-native grassland.

- **Riparian forests.** Central coast arroyo willow riparian forest occurs in moist canyons, usually with perennial stream flow or seepage. It is a dense, broadleaved, winter-deciduous forest dominated by arroyo willow, which grows as a large, tree-like shrub. This is the most common riparian type on smaller streams in the Central Coast of California, and it is found in sections of Alameda Creek, Arroyo Hondo, and San Antonio Creek as well as various unnamed tributaries. It requires the least amount of groundwater and surface flow of any of the riparian communities discussed in this section.

  Sycamore alluvial woodland is an open woodland dominated by California sycamore. It is found along streams with very high peak flows and broad floodplains composed mainly of cobbles and other coarse material. Sycamore alluvial woodland in the Alameda watershed is best developed on the broad floodplain of Alameda Creek in the Sunol Valley, although examples also exist along San Antonio Creek.

  White alder riparian forest is a medium-tall, broadleaved, deciduous streamside forest; it is dominated by white alder and has a shrubby, deciduous understory. It is found along flowing perennial streams with coarse sediments such as Alameda Creek and Arroyo Hondo.

  Central coast live oak riparian forest is an evergreen riparian forest dominated by coast live oak. This community is present along the lower sections of Alameda Creek near the Sunol Water Temple and in Niles Canyon.

- **Marshes.** Coastal and valley freshwater marsh is a wetland community dominated by usually dense stands of perennial, emergent grass and grass-like plants up to 15 feet tall. Coastal and valley freshwater marsh is found in areas that are permanently flooded by fresh water. Small examples of this community are found around the perimeter of the reservoirs, where seepage from streams allows for this community to develop.

Seasonal wetland is not recognized by Holland (1986) as a natural community because it typically develops where managed hydrology creates an environment that is flooded or saturated for extended periods and then dries, but the inundation occurs for a shorter time, in a different season, or more irregularly than is required for development of freshwater marsh. The species found in seasonal wetland are variable, but non-native annuals in the grass, sunflower, and buckwheat families often dominate this vegetation type.

Key Special-Status Species and Other Species of Concern

Appendix D presents a list of key special-status plant and animal species and other species of concern considered in the preparation of the EIR for the *Alameda Watershed Management Plan* (San Francisco Planning Department, 2000). Although very inclusive, the plan concludes that most of the species are unlikely to occur in the watershed because of distributional range or habitat requirements. Section 4.6, Figure 4.6-2b shows the location of federally designated critical habitats in the Alameda watershed. The following key special-status plant and animal species and species of concern (see **Tables 5.4.6-2** and **5.4.6-3**) could be affected by WSIP operations due to their potential to occur in the watershed and their proximity, association, or dependence on reservoirs or streams:

- **Serpentine-associated plants.** Most beautiful jewel-flower (*Streptanthus albidus* ssp. *peramoenus*; California Native Plant Society [CNPS] List 1B) was observed by EDAW (in prep.) during 2006 botanical surveys for the Calaveras Dam project (SV-2). It was located in the serpentine grassland east of Calaveras Reservoir, but was not within the maximum water surface elevation. Suitable serpentine habitat is present in the Alameda watershed for the following species, but none were found during detailed botanical surveys for the Calaveras Dam project (May, 2006): Santa Clara red ribbons (*Clarkia concinna* ssp. *automixa*, CNPS List 1B), Presidio clarkia (*Clarkia franciscana*, federal endangered, California endangered, CNPS List 1B), Fragrant fritillary (*Fritillaria liliacea*, CNPS List 1B), Chaparral harebell (*Campanula exigua*, CNPS List 1B), Mt. Hamilton thistle (*Cirsium fontinale* var. *camplyon*, CNPS List 1B), and Santa Clara Valley dudleya (*Dudleya setchellii*, federal endangered, CNPS List 1B). No suitable habitat was found within the maximum elevation of Calaveras Reservoir or within the riparian habitats potentially affected by WSIP operations.

- **Grassland, scrub, and woodland plants.** Diablo helianthella (*Helianthella castanea*, CNPS List 1B) grows in openings in forest, chaparral, coastal scrub, riparian woodland, and sheltered grasslands. EDAW mapped four occurrences of this species in the Calaveras Reservoir (SV-2) construction area (May, 2006), but not within the area that would be affected by reservoir operations. Suitable habitat is present in the Alameda watershed for the following species, but none were found during detailed botanical surveys for the Calaveras Dam project (May, 2006), and no suitable habitat was present within the maximum elevation of Calaveras Reservoir or within the riparian habitats potentially affected by WSIP operations: bent-flowered fiddleneck (*Amsinckia lunaris*, CNPS List 1B), which occurs in woodland and grassland; big-scale balsamroot (*Balsamorhiza macrolepis* var. *macrolepis*, CNPS List 1B), which grows in chaparral, cismontane woodland, and grasslands, and sometimes in serpentine soils; robust spineflower (*Chorizanthe robusta* var. *robusta*, federal endangered, CNPS List 1B), which is found on sandy or gravelly substrates in woodland openings and coastal scrub; Mt. Hamilton coreopsis (*Coreopsis hamiltonii*, CNPS List 1B), which grows in rocky sites in woodlands (although the Alameda watershed is generally lower in elevation than the species' known range); Hospital Canyon larkspur (*Delphinium californicum* ssp. *interius*, CNPS List 1B), which

TABLE 5.4.6-2
POTENTIAL FOR OCCURRENCE OF KEY SPECIAL-STATUS PLANTS AND PLANT SPECIES OF CONCERN IN THE WSIP ALAMEDA WATERSHED PROGRAM AREA

Common Name *Scientific Name*	USFWS/CDFG/ CNPS Status[b]	Habitat	WSIP Program Area[a]			
			Calaveras and Alameda Creek below Diversion	Calaveras Reservoir	San Antonio Creek	San Antonio Reservoir
Bent-flowered fiddleneck *Amsinckia lunaris*	–/–/1B	Woodland and valley grassland		Potential nearby		Potential nearby
Big-scale balsamroot *Balsamorhiza macrolepis* var. *macrolepis*	–/–/1B	Chaparral, woodland, and grassland, sometimes in serpentinite		Potential nearby		Potential nearby
Chaparral harebell *Campanula exigua*	–/–/1B	Chaparral or rocky (usually serpentinite) areas		Potential nearby		
Robust spineflower *Chorizanthe robusta* var. *robusta*	FE–/1B*	Sandy or gravelly soil in woodland openings or scrub		Potential nearby		
Mt. Hamilton thistle *Cirsium fontinale* var. *campylon*	–/–/1B	Serpentine seeps		Potential nearby		
Presidio clarkia *Clarkia franciscana*	FE/CE/1B*	Serpentine grasslands		Potential nearby		
Mt. Hamilton coreopsis *Coreopsis hamiltonii*	–/–/1B	Rocky sites in woodland		Potential nearby		
Hospital Canyon larkspur *Delphinium californicum ssp. interius*	–/–/1B	Openings in chaparral habitat, woodland		Potential nearby		Potential nearby
Santa Clara Valley dudleya *Dudleya setchellii*	FE/–/1B*	Rocky serpentinite areas in woodland and grassland		Potential nearby		
Fragrant fritillary *Fritillaria liliacea*	–/–/1B	Clay soils, often on serpentine soils		Potential nearby		
Diablo helianthella *Helianthella castanea*	–/–/1B	Openings in woodland, chaparral, shady grassland		Potential nearby		Potential nearby
Hall's bush mallow *Malacothamnus hallii*	–/–/1B	Chaparral and coastal scrub		Potential nearby		Potential nearby
Maple-leaved checkerbloom *Sidalcea malvaeflora*	–/–/1B	Upland forest, coastal scrub, often in disturbed areas		Potential nearby		Potential nearby
Most beautiful jewel-flower *Streptanthus albidus var. peramoenus*	–/–/1B	Serpentine soils in chaparral, woodland, and grassland		Present nearby		

[a] The WSIP program area is the extent that could be affected by program operations, such as below maximum reservoir elevations, or within riparian areas where changes in flows could affect habitat.
[b] Federal (USFWS), state (CDFG), and CNPS protection status codes are as follows:

FC:	Federal candidate for listing	CE:	California endangered
FE:	Federal endangered	CT:	California threatened
FT:	Federal listed as threatened	1B:	CNPS List 1B, rare and endangered
FD:	Federal delisted	–	Indicates no federal or state protection

* Indicates key special-status plants, defined here to mean federal- or state-listed as endangered or threatened.

SOURCES: CDFG, 2006, 2007; USFWS, 2007; May, 2006.

TABLE 5.4.6-3
POTENTIAL FOR OCCURRENCE OF KEY SPECIAL-STATUS ANIMALS AND ANIMAL SPECIES OF CONCERN IN THE WSIP ALAMEDA WATERSHED PROGRAM AREA

Common Name *Scientific Name*	USFWS/CDFG Status[b]	Habitat	WSIP Program Area[a]			
			Calaveras and Alameda Creek below Diversion	Calaveras Reservoir	San Antonio Creek	San Antonio Reservoir
Invertebrates						
Bay checkerspot butterfly *Euphyhydras editha bayensis*	FT/–*	Serpentine bunchgrass and valley needlegrass grassland		Poor-quality habitat nearby		
Callippe silverspot butterfly *Speyeria callippe callippe*	FE/–*	Grasslands with *Viola pedunculata* and nearby adult nectar sources		Population with characteristics "near to" those of species present		
Reptiles and Amphibians						
California tiger salamander *Ambystoma californiense*	FT/CSC*	Ponds for breeding and grassland burrows for retreat	Present	Present	Potential	Potential
California red-legged frog *Rana aurora draytonii*	FT/CSC*	Slow-moving streams and ponds	Present	Present	Potential	Potential
Foothill yellow-legged frog *Rana boylii*	–/CSC*	Shallow, moving water with sunny banks	Present	Present, Arroyo Hondo		
Western pond turtle *Clemmys marmorata*	–/CSC	Permanent water, streams, ponds	Present	Present	Potential	Potential
Alameda whipsnake *Masticophis lateralis euryxanthus*	FT/CT*	Coastal scrub and chaparral	Nearby	Nearby	Nearby	Nearby
Birds						
Osprey *Pandion haliaetus* (nesting)	–/CSC	Open water, large trees and snags		Potential		Potential
White-tailed kite *Elanus leucurus* (nesting)	FP/–	Forages in open meadows, grasslands; nests in moderately tall trees				
Bald eagle *Haliaeetus leucocephalus* (nesting and wintering)	FD/CE, FP*	Forages in large bodies of water or rivers with adjacent snags or large, tall trees		Present		Potential
Northern harrier *Circus cyaneus* (nesting)	–/CSC	Forages and nests in marshes, moist grasslands, and meadows		Potential		Potential

TABLE 5.4.6-3 (Continued)
POTENTIAL FOR OCCURRENCE OF KEY SPECIAL-STATUS ANIMALS AND ANIMAL SPECIES OF CONCERN IN THE WSIP ALAMEDA WATERSHED PROGRAM AREA

Common Name *Scientific Name*	USFWS/CDFG Status[b]	Habitat	WSIP Program Area[a]			
			Calaveras and Alameda Creek below Diversion	Calaveras Reservoir	San Antonio Creek	San Antonio Reservoir
Birds (cont.)						
Sharp-shinned hawk *Accipiter striatus* (nesting)	–/CSC	Forages in woodlands; nests in coniferous or mixed forests	Potential	Potential	Potential	Potential
Cooper's hawk *Accipiter cooperii* (nesting)	–/CSC	Forages in many habitats; nests in forest and woodland	Potential	Potential	Potential	Potential
Ferruginous hawk *Buteo regalis* (wintering)	–/CSC	Forages in open grasslands	Potential nearby	Potential nearby	Potential nearby	Potential nearby
Golden eagle *Aquila chrysaetos* (nesting and wintering)	FP/CSC, FP	Forages in open grassland; nests in large trees, on cliffs or embankments	Potential nearby	Potential nearby	Potential nearby	Potential nearby
American peregrine falcon *Falco peregrinus anatum* (nesting)	FD/CE, FP*	Forages for birds in open areas; nests on cliffs		Potential		Potential
Prairie falcon *Falco mexicanus* (nesting)	–/CSC	Forages in open areas; nests on cliffs or ledges	Potential nearby	Potential nearby	Potential nearby	Potential nearby
Burrowing owl *Athene cunicularia* (burrowing sites)	–/CSC*	Open grasslands with available burrows	Potential nearby	Potential nearby	Potential nearby	Potential nearby
Long-eared owl *Asio otus* (nesting)	–/CSC	Dense riparian and oak woodlands	Potential	Potential	Potential	Potential
Loggerhead shrike *Lanius ludovicianus* (nesting)	–/CSC	Grasslands and open woodlands with scattered shrubs	Potential nearby	Potential nearby	Potential nearby	Potential nearby
California horned lark *Eremophila alpestris actia* (nesting)	–/CSC	Grasslands, especially sparsely vegetated or barren areas	Potential nearby	Potential nearby	Potential nearby	Potential nearby
Bell's sage sparrow *Amphispiza belli belli* (nesting)	–/CSC	Semi-open dry chaparral and coastal sage scrub	Potential nearby	Potential nearby	Potential nearby	Potential nearby

TABLE 5.4.6-3 (Continued)
POTENTIAL FOR OCCURRENCE OF KEY SPECIAL-STATUS ANIMALS AND ANIMAL SPECIES OF CONCERN IN THE WSIP ALAMEDA WATERSHED PROGRAM AREA

Common Name *Scientific Name*	USFWS/CDFG Status[b]	Habitat	WSIP Program Area[a]: Calaveras and Alameda Creek below Diversion	Calaveras Reservoir	San Antonio Creek	San Antonio Reservoir
Birds (cont.)						
Tricolored blackbird *Agelaius tricolor* (nesting)	–/CSC	Colonial nester in dense freshwater marsh or riparian vegetation with access to insect prey		Potential		Potential
Mammals						
Pallid bat *Antrozous pallidus*	–/CSC	Roosts in trees; forages over grassland	Potential nearby	Potential nearby	Potential nearby	Potential nearby
Pacific western big-eared bat *Corynorhinus (=Plecotus) townsendii*	–/CSC	Roosts in caves and buildings; forages in open country	Potential nearby	Potential nearby	Potential nearby	Potential nearby
Western mastiff bat *Eumops perotis californicus*	–/CSC	Requires cliff faces with high vertical drop; may roost in trees	Potential nearby	Potential nearby	Potential nearby	Potential nearby
American badger *Taxidea taxus*	–/CSC	Drier open grassland, shrub, and forest habitats with friable soils	Potential nearby	Potential nearby	Potential nearby	Potential nearby

[a] The WSIP program area is the extent that could be affected by program operations, such as below maximum reservoir elevations, or within riparian areas where changes in flows could affect habitat.
[b] Federal (USFWS) and state (CDFG) protection status codes are as follows:
FC: Federal candidate for listing
FE: Federal endangered
FT: Federal threatened
FD: Federal delisted
CE: California endangered
CT: California threatened
CSC: California species of special concern
FP: California fully protected
– Indicates no federal or state protection

* Indicates key special-status animals, defined here to mean federal- or state-listed as endangered or threatened.

SOURCES: San Francisco Planning Department, 2000; Leeman, 2006; Jennings and Hayes, 1994; CDFG, 2006.

grows in openings in chaparral habitat and cismontane woodland; Hall's bush mallow (*Malacothamnus hallii*, CNPS List 1B), which grows in chaparral and coastal scrub; and maple-leaved checkerbloom (*Sidalcea malvaeflora*, CNPS List 1B), which grows in upland forest and coastal scrub, often in disturbed sites. All of these species have a low to moderate potential to occur at the perimeter of San Antonio Reservoir, but no suitable habitat is present within the maximum water surface elevation of the reservoir.

- **Perennial grassland invertebrates.** Callippe silverspot butterfly (*Speyeria callippe callippe*, federal endangered) requires grasslands supporting the larval foodplant Johnny-jump-up (*Viola pedunculata*) and adult nectar sources such as California buckeye (*Aesculus californica*) nearby. Entomological Consulting Services (2004) found a population of Callippe silverspots on the watershed that is intermediate in appearance between the listed subspecies and a related, non-endangered subspecies. The author concluded that these populations should be protected, but should be considered "near to" the Callippe silverspot. Bay checkerspot butterfly (*Euphydryas editha editha*, federal endangered) occurs on serpentine grasslands supporting native plantain (*Plantago erecta*) and annual owl's-clover (*Castilleja* spp.). Entomological Consulting Services (2005) carried out intensive surveys for Bay checkerspot butterfly in 2004 and 2005. The species was not found, and the author concluded that habitat quality on the watershed for this species was poor.

- **Reptiles and amphibians.** California tiger salamander (*Ambystoma californiense*, federal threatened, California species of special concern) and California red-legged frog (*Rana aurora draytonii*, federal threatened, California species of special concern) are known to occur in several locations in the Alameda watershed. California tiger salamander breeds in vernal pools and permanent ponds or lakes and estivate in burrows in adjacent uplands. The species is known to breed around the perimeter of Calaveras Reservoir and in Calaveras Creek below the dam (Leeman, 2006). Suitable habitat is also present in stock ponds and possibly San Antonio Reservoir and Alameda and San Antonio Creeks. California red-legged frog breeds in still or slow-moving water such as the edges of reservoirs, often with emergent vegetation. This species has been documented in Alameda Creek below Calaveras Creek and in stock ponds in several locations in the Alameda watershed. Suitable habitat is also present at San Antonio Creek and San Antonio Reservoir.

  Foothill yellow-legged frog (*Rana boylii*, California species of special concern) breeds in shallow, flowing streams with cobbles, sunny banks, and some riffles. The species is known to breed in Alameda Creek between the diversion tunnel and the gravel mines at the lower end of the Sunol Valley, as well in Arroyo Hondo (Leeman, 2006). The Alameda watershed may support one of the largest areas of suitable habitat for this species in the Bay Area.

  Western pond turtle (*Actinemys = Clemmys marmorata*, California species of special concern) breeds in Alameda Creek below the confluence with Calaveras Creek where water is present year-round, in Arroyo Hondo, in side channels of Alameda Creek below the Sunol Water Temple, and in at least one other pond within the watershed.

  Alameda whipsnake (*Masticophis lateralis euryxanthus*, federal threatened, California threatened) is known to be present in many localities within the Alameda watershed. It inhabits coastal scrub and nearby grassland and woodland habitats. Suitable habitat is present on the perimeter of Calaveras and San Antonio Reservoirs, but not within the maximum water surface elevation.

- **Riparian-associated birds.** Several bird species of concern are closely associated with the riparian and wetland habitats in the Alameda watershed. Riparian trees have a moderate potential to support nesting and foraging Cooper's hawk (*Accipiter cooperi*, California species of special concern) and sharp-shinned hawk (*A. striatus*, California species of special concern). Long-eared owl (*Asio otus*, California species of special concern) nests in dense riparian and oak woodlands. Suitable habitat is present throughout the program area in the Alameda watershed.

- **Marsh- and lake-dependent birds.** Tricolored blackbird (*Agelaius tricolor*, California species of special concern) nests in freshwater emergent vegetation. Although no colonies are known to occur in the Alameda watershed, suitable habitat may be present on the margins of Calaveras and San Antonio Reservoirs. Northern harrier (*Circus cyaneus*, California species of special concern) nests and forages in wet meadows and pastures; a limited amount of habitat is present within the watershed, primarily in the vicinity of San Antonio and Calaveras Reservoirs. Bald eagle (*Haliaeetus leucocephalus*, federal endangered – delisted and California endangered) and osprey (*Pandion haliaetus*, California species of special concern) forage in lakes and reservoirs and nest in large trees nearby. A pair of nesting bald eagles was recently reported in the Alameda watershed, and the species could breed or winter near San Antonio and Calaveras Reservoirs. Peregrine falcon (*Falco peregrinus anatum*, federal delisted, California endangered) nests in cliffs and outcrops and forages near wetlands and open water. Loggerhead shrike (*Lanius ludovicianus*, California species of special concern) nests in riparian and other woodlands and forages over open country. It may be present throughout the Alameda watershed in suitable habitat.

- **Upland birds.** Burrowing owl (*Speotyto = Athene cunicularia*, California species of special concern) lives in mammal burrows in open, sloping grasslands. The range of this species includes the Alameda watershed. Ferruginous hawk (*Buteo regalis*, California species of special concern) winters in the Bay Area, where it forages in open grasslands and agricultural fields. Suitable habitat may be present in the extensive watershed grasslands, including those near the reservoirs. Golden eagle (*Aquila chrysaetos*, California species of special concern) forages in open grasslands and agricultural areas, and nests in large trees. It has been known to breed in the Alameda watershed and may forage near San Antonio and Calaveras Reservoirs. Foraging habitat may be present throughout the Alameda watershed. Prairie falcon (*Falco mexicanus*, California species of special concern) nests in cliffs or ledges and forages over grasslands. Suitable habitat is present within the Alameda watershed, including near San Antonio and Calaveras Reservoirs and within the Sunol Valley. California horned lark (*Eremophilus alpestris actia*, California species of special concern) nests in sparse grasslands and barren areas. Suitable habitat may be present in the grasslands near the reservoirs and in the Sunol Valley. Bell's sage sparrow (*Amphispiza belli belli*, California species of special concern) nests in chaparral and coastal scrub. Suitable habitat may be present near the reservoirs.

- **Mammal species.** Pallid bat (*Antrozous pallidus*, California species of special concern) roosts in trees and forages over open grassland and could occur throughout the watershed. Pacific western (Townsend's) big-eared bat (*Corynorhinus townsendii*) roosts in caves and buildings and forages in open country. Suitable habitat is present near both Calaveras and San Andreas Reservoirs and the open areas of the Sunol Valley. Western mastiff bat (*Eumops perotis californicus*, California species of special concern) roosts on cliffs and forages in open country. Its primary foraging area in the vicinity of the program area would be near Calaveras and San Antonio Reservoirs.

5.4.6.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to terrestrial biological resources, but generally considers that implementation of the proposed program would have a significant biological impact if it were to:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFG or USFWS
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the CDFG or USFWS
- Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including but not limited to marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites
- Have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, or substantially reduce the number or restrict the range of an endangered, rare or threatened species
- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance
- Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan

Approach to Analysis

The assessment of WSIP operational impacts on terrestrial biological resources focuses primarily on the extent to which proposed operations would change the existing habitat near reservoirs and creeks. Operational changes consist of increased diversions from Alameda Creek during late fall, winter, and early spring; increased releases to Calaveras Creek to maintain minimum flows; and changes in the elevation, annual range, and seasonal timing of reservoir levels. An overview of the general types of effects of stream diversions on riparian ecological resources is provided in Section 5.3.7. An assessment of the changes in hydrology in the Alameda Creek watershed under the WSIP is presented in Section 5.4.1.

This section discusses impacts on riparian and wetland habitats, key special-status species, other species of concern, and common habitats and species. The discussion of riparian and wetland habitats addresses the second and third significance criteria listed above. “Key special-status species” include species that are formally listed as endangered or threatened under the state or

federal endangered species acts, as well as a few other species (such as burrowing owl and foothill yellow-legged frog) that are afforded some degree of legal protection and have a high risk of local population decline or extirpation. The key special-status species discussion addresses the first significance criterion. "Other species of concern" and "common habitats and species" are more general categories relevant to the fourth and fifth significance criteria.

As discussed in Section 5.1, the existing conditions baseline setting used in the PEIR for impact analysis reflects the current flow conditions in Alameda Creek since DSOD imposed storage restrictions on Calaveras Reservoir in December 2001, which substantially reduced SFPUC's typical diversions from the creek to the reservoir. Section 5.4.1, above, further describes current flow conditions in Alameda Creek and how they changed in 2002 from the previous 70 years of SFPUC diversion. Riparian stand structure, especially when dominated by long-lived trees, responds slowly to changes in stream flow. Riparian structure today is the result of physical responses that have prevailed over the lifetime of the plants. In general, plants are most vulnerable during germination and establishment; if conditions become less favorable afterward, individuals may continue to persist but without successful recruitment. Therefore, the condition, distribution, and abundance of short-lived or young plants reflect existing stream flow conditions; those of moderately aged trees and shrubs reflect a combination of both older (pre-2002) and existing flow conditions; and those of old trees, such as mature California sycamores and valley oaks, reflect a combination of pre-Calaveras Reservoir, pre-2002 (prior to DSOD restrictions on Calaveras Reservoir storage), and existing operations. The impact analysis uses the existing conditions (2005) baseline but the history of flows in Alameda Creek is discussed in the impact analysis where appropriate because of the role of historic flows in shaping existing resources such as the riparian vegetation.

Impact Summary

Table 5.4.6-4 presents a summary of the impacts on terrestrial biological resources in the Alameda Creek watershed that could result from implementation of the proposed water supply and system operations.

Impact Discussion

Impact 5.4.6-1: Effects on riparian habitat and related biological resources in Calaveras Reservoir.

Sensitive Habitats

Impact of Higher Storage Levels. Calaveras Reservoir is surrounded by wetland and upland habitats that formed since December 2001, when the reservoir storage levels were lowered. These habitats, in turn, are surrounded by well-established riparian, grassland, woodland, and scrub habitats growing above the high-water elevation. Under the WSIP, restoring the original storage capacity of Calaveras Reservoir would result in the inundation and permanent loss of the seasonal wetlands, seeps, perennial freshwater marsh, and riparian habitat that have formed since 2002. Prior to 2002, these areas were regularly inundated, sometimes for several months at a time.

TABLE 5.4.6-4
SUMMARY OF IMPACTS –
TERRESTRIAL BIOLOGICAL RESOURCES IN THE ALAMEDA CREEK WATERSHED

Impacts	Sensitive Habitats	Key Special-Status Species	Other Species of Concern	Common Habitats and Species
Impact 5.4.6-1: Effects on riparian habitat and related biological resources in Calaveras Reservoir	PSM	PSM	LS	LS
Impact 5.4.6-2: Effects on riparian habitat and related biological resources along Alameda Creek, from below the diversion dam to the confluence with Calaveras Creek	LS	PSM	LS	N/A
Impact 5.4.6-3: Effects on riparian habitat and related biological resources along Calaveras Creek, from Calaveras Reservoir to the confluence with Alameda Creek	LS	PSM	LS	LS
Impact 5.4.6-4: Effects on riparian habitat and related biological resources along Alameda Creek, from the confluence with Calaveras Creek to the confluence with San Antonio Creek	LS	PSM	LS	LS
Impact 5.4.6-5: Effects on riparian habitat and related biological resources in San Antonio Reservoir	LS	LS	LS	LS
Impact 5.4.6-6: Effects on riparian habitat and related biological resources along San Antonio Creek between Turner Dam and the confluence with Alameda Creek	LS	LS	LS	N/A
Impact 5.4.6-7: Effects on riparian habitat and related biological resources along Alameda Creek below the confluence with San Antonio Creek	LS	LS	LS	N/A
Impact 5.4.6-8: Conflicts with the provisions of adopted conservation plans or other approved biological resource plans	LS			

LS = Less than Significant impact, no mitigation required
PSM= Potentially Significant impact, can be mitigated to less than significant
N/A = Not Applicable

The Calaveras Dam project (SV-2) would not raise the maximum reservoir levels any higher than historical levels. Therefore, no sensitive upland habitats or riparian habitats higher than the spillway elevation would be inundated. Areas of well-developed riparian forest along Calaveras Creek and Arroyo Hondo above Calaveras Reservoir would therefore not be affected by the proposed WSIP operations. However, because seasonal wetlands, seeps, and other wetland features below the current maximum reservoir elevation would be inundated, the impact on sensitive habitats of restoring reservoir levels at Calaveras Reservoir is *potentially significant*. Although the impact of fluctuating reservoir elevation is discussed for other reservoirs, this impact is not applicable to Calaveras Reservoir because wetlands within the existing operational range would be inundated and lost.

Impacts of Periodic Drawdowns. Under the WSIP, the reservoir would be lowered by up to 20 feet for an extended period during systemwide maintenance (every five years), which could affect riparian and freshwater marsh habitats that depend on sustained moist soil or standing water. However, the existing riparian and wetland habitats above the spillway elevation have tolerated an extended drawdown since December 2001 and can be expected to tolerate periodic drawdowns of shorter duration, such as those proposed under the WSIP. Some studies have suggested that occasional, appropriately timed dewatering can enhance wetland diversity by providing unusual opportunities for germination and establishment (e.g., Schneider, 1994); however, lowering the reservoir level would not necessarily benefit freshwater marsh or riparian vegetation. These potentially beneficial and adverse impacts are relatively minor; the impact of reservoir operations would be less than significant.

Key Special-Status Species

Key special-status species potentially affected by Calaveras Reservoir operations under the WSIP include California red-legged frog, foothill yellow-legged frog, California tiger salamander, and bald eagle. Suitable upland habitat is not present within the operational area of Calaveras Reservoir for other key special-status species discussed in this section, such as Callippe silverspot butterfly, Alameda whipsnake, burrowing owl, and peregrine falcon.

In a study of water level fluctuations for a similar reservoir project in Washington State (but applicable here), Devine Tarbell & Associates (2006) examined the effect of modest daily fluctuations on the two most vulnerable impact receptors: amphibians and waterbirds. First, the study authors note that littoral wetlands (those on or near the shore) are well suited to handling changes in soil moisture and water content that are of short duration. The study evaluated seven species of common amphibians and made several observations. Amphibian eggs are generally laid in shallow water or are attached to vegetation high in the water column. As such, water level fluctuations of even a few inches can expose developing eggs to desiccation, freezing, or increased predation. However, the authors conclude that minor fluctuations are likely less important than other factors governing habitat suitability in habitats connected to the reservoir, such as the presence of predatory fish, wave action, scant vegetative cover, and water temperature. Put another way, lakeside species are adapted to varying water levels, which occur in natural water bodies as well as managed ones.

Restoring the operational capacity of Calaveras Reservoir under the WSIP would result in the inundation and loss of poor-quality upland habitat for California tiger salamander and California red-legged frog. Habitat below the pre-2002 maximum reservoir level was not considered part of the designated critical habitat for California tiger salamander; no critical habitat for California red-legged frog is present in this area. Due to the low quality of upland habitat that would be inundated by restoring Calaveras Reservoir to its former levels, this impact would be less than significant.

Higher reservoir levels under the WSIP would reduce the duration of flowing water in Arroyo Hondo and Calaveras Creek. Arroyo Hondo is a perennial stream and has high-quality habitat for foothill yellow-legged frogs in the well-developed riparian sections above the maximum spillway

elevation. Arroyo Hondo has about 10,000 linear feet of stream channel habitat between the DSOD-mandated maximum reservoir elevation and the spillway elevation. Actual reservoir elevations have varied considerably since December 2001, and have sometimes been held 20 to 30 feet higher than the DSOD-mandated level, occasionally reducing this habitat to about a mile. Although Arroyo Hondo is a perennial stream above the former maximum reservoir elevation, the CDFG observed in August 2004 that the section below this elevation was dry (CDFG, 2005), indicating it was not perennial in this section (CDFG, 2005). Yellow-legged frogs have been observed in this section of Arroyo Hondo (between the DSOD maximum and the pre-2002 maximum) since 2002. Although the habitat is of limited quality and apparently intermittent as well, it is occupied by foothill yellow-legged frogs and is of considerable length. Therefore, this impact would be *potentially significant.*

Bald eagle would not be affected by reservoir operations, except that eagle foraging can be enhanced by the shallower water and concentration of fish that occurs during drawdowns.

Other Species of Concern

No plant species of concern would be inundated as a result of Calaveras Reservoir operations under the WSIP. Wildlife species of concern in and near Calaveras Reservoir include western pond turtle, several raptor species that forage in grasslands, songbirds that nest and forage in riparian or marsh habitat, and bat species that roost in riparian habitat or forage over water. Because potential changes to grassland, riparian, and marsh habitats are minor, this impact would be *less than significant,* and no mitigation measures would be required.

Common Habitats and Species

Operation of Calaveras Dam and Reservoir under the WSIP would inundate low-diversity, weedy upland vegetation with little habitat value for wildlife. It would not interfere substantially with the movement of any native wildlife species or wildlife nursery sites, nor would it cause a plant or wildlife population to drop below self-sustaining levels. Impacts related to this loss of low-quality habitat would be *less than significant,* and no mitigation measures would be required.

Impact Conclusions

Overall, implementation of the proposed WSIP water supply and system operations would result in *potentially significant* impacts on sensitive habitats and key special-status species, especially foothill yellow-legged frog. Implementation of Measure 5.4.6-1, Compensation for Impacts on Terrestrial Biological Resources, which involves the creation, preservation, and enhancement of wetland habitat elsewhere within the Alameda watershed, including riparian habitat, would reduce this impact to a less-than-significant level.

Impact 5.4.6-2: Effects on riparian habitat and related biological resources along Alameda Creek, from below the diversion dam to the confluence with Calaveras Creek.

Sensitive Habitats

Sensitive habitats in this reach of Alameda Creek include several riparian forest communities, including Central Coast arroyo willow riparian forest, white alder riparian forest, and sycamore alluvial woodland. Most of this reach is a steeply sloping, confined bedrock channel, and the hydrograph is flashy. Most of the structure and species composition of the riparian habitat is the result of conditions that prevailed prior to 2002.

Flow Impacts. After the new Calaveras Dam is fully operational and the Alameda Creek Diversion Dam can be operated to maximum capacity, flows in Alameda Creek below the diversion dam would be reduced in frequency, duration, and magnitude compared with existing conditions. Peak flows would be diminished when the diversion tunnel is open, which would be most of the winter rainfall season. Under the WSIP, sediment would continue to be cleared annually from the diversion dam and transported downstream, much as under existing conditions. Because flow in Alameda Creek is rainfall-based, the receding flows decline rapidly, and the hydrograph pattern is not as important to riparian vegetation as with snowmelt-based systems. Compared with existing conditions, the pattern and duration of minimum flows in Alameda Creek would be about the same.

For the most part, the composition and structure of the existing riparian communities are a function of the flow conditions that prevailed before the DSOD imposed operational restrictions on the reservoir. The existing sycamore alluvial woodland and valley oak woodland formed under unimpaired flow conditions prior to construction of Calaveras Dam in 1925, and the willow and alder riparian forests formed under pre-2002 Calaveras Dam operations. Therefore, it is more useful to assess the impact of the WSIP by comparing future conditions with the conditions under which these riparian communities formed. Under pre-2002 conditions, as much flow as possible was diverted from Alameda Creek into the diversion tunnel, and, under the WSIP, as much flow as possible would again be diverted. The pattern and quantity of flows in Alameda Creek would be nearly the same as under pre-2002 conditions. The slight increase in late-winter flows under some hydrologic year types would not have a detectable effect on riparian habitat. Neither existing nor future conditions appear to be suitable for stand regeneration of sycamore alluvial woodland or valley oak woodland. A return to the pre-2002 pattern of diversions from Alameda Creek would return flow conditions to those under which the riparian forest and scrub formed; therefore, the impact of the WSIP on the extent, structure, composition, and sustainability of these habitats would be *less than significant*, and no mitigation measures would be required.

Key Special-Status Species

California red-legged frog and foothill yellow-legged frog currently occupy this section of Alameda Creek. Under the WSIP, there would be a substantial reduction in total winter flows compared with existing conditions. Reductions in the highest peak flows could reduce the extent of scouring that removes egg masses and tadpoles, which would be beneficial. However, the general reduction in flow would reduce the total available aquatic breeding habitat for these

species and would also reduce the area suitable for producing their food sources, such as benthic macroinvertebrates. Although there could be both beneficial and adverse impacts on habitat for California red-legged frog and foothill yellow-legged frog, the reduction in aquatic breeding habitat would be a *potentially significant* impact.

Other Species of Concern

No plant species of concern would be affected by WSIP operations in this section of Alameda Creek. A number of raptor, songbird, and mammal species of concern could be affected in this section of Alameda Creek. Although the WSIP would reduce flows compared to the existing condition, prevailing habitat conditions are not expected to change because they are more a result of the slightly lower pre-2002 flows. This impact would be *less than significant*, and no mitigation measures would be required.

Common Habitats and Species

The more common upland habitats and species would not be affected by WSIP operational changes in this area. In this reach, the WSIP would not interfere substantially with the movement of any native wildlife species or wildlife nursery sites, nor would it cause a plant or wildlife population to drop below self-sustaining levels. Therefore, this impact would *not apply* to common habitats and species.

Impact Conclusions

Overall, implementation of the proposed WSIP water supply and system operations would result in *potentially significant* impacts on terrestrial biological resources due to a potential reduction in aquatic breeding habitat for key special-status species. Measure 5.4.1-2, Diversion Tunnel Operation, calls for operation of the diversion tunnel in a manner that ensures that flows not required to maintain storage in Calaveras Reservoir are passed down Alameda Creek at the diversion dam. Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek, calls for minimum flows below the diversion dam from December through April. Implementation of these measures would ensure that minimum flows in Alameda Creek are allowed to pass by the diversion dam. Taken together, these measures would reduce adverse impacts on key special-status species to a less-than-significant level.

Impact 5.4.6-3: Effects on riparian habitat and related biological resources along Calaveras Creek, from Calaveras Reservoir to the confluence with Alameda Creek.

Sensitive Habitats

Sensitive habitats in Calaveras Creek below Calaveras Dam consist of riparian habitats such as Central Coast arroyo willow riparian forest and sycamore alluvial woodland. For the most part, Calaveras Creek is situated in a confined canyon with a bedrock channel. In addition to groundwater contributions to flow and input from lateral tributaries, releases from Calaveras under existing conditions consist of several weeks of releases averaging 300 to 400 cfs.

Impacts from Winter Flows. Compared with the existing condition, high-flow winter releases into Calaveras Creek under the WSIP would decrease, especially during normal, above-normal, and wet years. Since 2002, no spills have occurred, but cone valve releases of 325 to 375 cfs have occurred during certain high rainfall periods. The confined bedrock channel already limits channel-forming processes and opportunities for riparian regeneration. The reduction of flows in Calaveras Creek would incrementally reduce suitable habitat for riparian vegetation, but the change would be so small as to be impossible to quantify. As a result, the impact would be less than significant.

Similar to Alameda Creek below the diversion dam, most of the existing riparian habitat is the result of flow conditions that prevailed before December 2001, so pre-2002 flow conditions are considered in this impact analysis. Under the WSIP, spills are projected to occur slightly more frequently, but might be smaller in magnitude relative to pre-2002 operations. Under pre-2002 conditions and under the proposed program, the SFPUC would operate Calaveras Reservoir to retain as much water as operationally feasible, minimizing releases and spills to Calaveras Creek. Although there could be some slight changes in the pattern of releases and spills in Calaveras Creek under the WSIP, the overall pattern and quantity of high winter releases and spills would remain very similar to pre-2002 conditions, and the impact on riparian habitats would be less than significant.

Flows in Calaveras Creek below Calaveras Dam would be altered in two ways during the two- to five-year period when the reservoir is being refilled. First, there would be no cone valve releases into Calaveras Creek below the dam. Second, the SFPUC would initiate required minimum instream flow releases (see Table 5.4.1-9) when construction of the new Calaveras Dam is completed. When flows at the confluence of Alameda and Calaveras Creeks fall below the minimum required flow, generally during protracted dry periods, releases would be made from Calaveras Dam. These releases would ensure that existing riparian habitat would be sustained; therefore, impacts on riparian habitats related to filling the reservoir would be *less than significant*, and no mitigation measures would be required.

Impacts from Minimum Flows. Under the WSIP, minimum flows would be maintained year-round, an increase over both existing conditions and pre-2002 conditions. Sustained minimum flows during the dry season could slightly increase groundwater recharge. It could also facilitate the conversion from riparian habitats that require only seasonally flowing water to those that require permanent flowing water, such as alder riparian forest. This potential replacement of one sensitive riparian habitat with another one (with no change in the total extent of riparian habitat) would be *less than significant*.

Impacts from Changes to Pattern of High-Flow Releases. The proposed new Calaveras Dam would be equipped with several means by which to release large volumes of water into Calaveras Creek, allowing for greater control over released flow levels than at present. Peak releases into Calaveras Creek could be greater than under existing conditions because the improved outlet works would be fully operational, which could enhance channel-forming processes. However, the narrow canyon, confined riparian zone, and bedrock channel are limiting factors. There might be

slight changes in the pattern of high-flow releases due to the operational goal of maintaining Calaveras Reservoir as full as feasible. However, these changes would be relatively small and would not substantially alter the dynamics of the riparian habitats in Calaveras Creek. Therefore, impacts on sensitive habitats related to changes in the pattern of high-flow releases would be *less than significant*, and no mitigation measures would be required.

Key Special-Status Species

Impact of Changed Minimum and High Flows. Potentially affected key special-status species are California red-legged frog and foothill yellow-legged frog, which could breed in Calaveras Creek. No critical habitat is present in Calaveras Creek below Calaveras Dam. Average winter flows under the WSIP would be lower than under existing conditions, especially during wet and above-normal rainfall years, thus reducing the available breeding and foraging habitat. The WSIP would maintain minimum flows year-round, which would be beneficial in providing more sustained aquatic habitat for breeding and foraging. The peak flows might not be greatly reduced and therefore might not reduce entrainment and scouring.

Impact of Changed Pattern of Releases. A description of operational releases has not been developed at the program level. The rate at which flows are increased during releases and the magnitude of recurring controlled releases are important to breeding amphibians; gradual increases in flows allow adults and juveniles to seek sheltered sites, while rapid increases in flow can wash them downstream. The highest flows can cause significant scouring, resulting in losses of egg masses and tadpoles. At the program level, these impacts are conservatively considered *potentially significant*, because the outlet works at Calaveras Dam would have the capacity for greater releases with more rapid ramping up. Depending on the timing and volume of these releases, they could increase the risk of washing away adults, eggs, or tadpoles.

Other Species of Concern

No plant species of concern would be affected by WSIP operations in the vicinity of Calaveras Creek below the reservoir. Potential changes in riparian habitat could result in a minor change in breeding habitat for riparian-nesting birds such as raptors, egrets, and songbird species of concern. Although there could be some change in the structure and species composition of the riparian habitats, the overall extent would not change. Therefore, this impact would be *less than significant*, and no mitigation measures would be required.

Common Habitats and Species

The WSIP would not interfere substantially with the movement of any native wildlife species or wildlife nursery sites, nor would it cause a plant wildlife population to drop below self-sustaining levels. Impacts on common habitats and species would be *less than significant*, and no mitigation measures would be required.

Impact Conclusions

Overall, implementation of the proposed WSIP water supply and system operations would result in *potentially significant* impacts on terrestrial biological resources in Calaveras Creek, but only

with respect to high flows and the resulting loss of frog eggs or egg masses. Measure 5.4.6-3, Operational Procedures for Calaveras Dam Releases, requires the development of procedures to manage releases from Calaveras Dam so as to minimize habitat impacts and maximize benefits by mimicking the natural regime to the extent possible. The measure would include procedures for increasing and decreasing the rate of releases. With implementation this measure, impacts on terrestrial biological resources in this reach of Calaveras Creek would be reduced to a less-than-significant level.

Impact 5.4.6-4: Effects on riparian habitat and related biological resources along Alameda Creek, from the confluence with Calaveras Creek to the confluence with San Antonio Creek.

Sensitive Habitats

Sensitive riparian communities in this section of Alameda Creek include sycamore alluvial woodland, Central Coast arroyo willow riparian forest, valley oak woodland, and white alder riparian forest. The WSIP would substantially reduce winter flows compared to those under existing conditions (they would be similar to, but slightly muted from, flows in the reach directly below the diversion dam). The change in flows would have no effect on the woodland communities; for stand regeneration, sycamore woodland requires flows similar to unimpaired flows. The slight potential reduction in flows (as it relates to stand regeneration for willow and alder riparian forest) would be offset by increased summer flows under the 1997 MOU. Sustained winter and summer minimum flows could facilitate the conversion of existing riparian habitats, such as sycamore alluvial woodland and valley oak woodland, to alder- and willow-dominated habitats, but the extent of this potential impact would be small. Channel incision is not expected to be an important factor because of the large cobble content of the substrate. Overall, these impacts would offset one another; as a result, the impact on sensitive habitats would be *less than significant*, and no mitigation measures would be required.

Key Special-Status Species

This section of Alameda Creek supports California red-legged frog and foothill yellow-legged frog. Flow in this section of Alameda Creek would be lower than under existing conditions but higher than under pre-2002 conditions. Impacts on these species could be both beneficial and adverse, depending on annual rainfall and localized site conditions along the creek. Compared with existing conditions, lower winter flows could improve breeding conditions in the short term but reduce the total available breeding habitat and habitat for macroinvertebrate food resources. Compared with pre-2002 conditions, higher winter flows could cause some breeding losses, but would improve long-term habitat conditions because of greater aquatic habitat complexity. Sustained minimum flows would generally provide more consistent breeding habitat. In general, impacts on key special-status species would be both beneficial and adverse and would likely depend on year-to-year conditions and site-to-site conditions within this reach of the creek. Because of the uncertainty, the potential impact of releases on breeding amphibians is considered

potentially significant. Alameda whipsnake would not be affected by WSIP operations along Alameda Creek.

Other Species of Concern

No plant species of concern would be affected by WSIP operations in this section of Alameda Creek. A less-than-significant change in the structure and diversity of riparian habitat would not substantially alter the extent or quality of breeding habitat for songbirds, raptors, and mammals. The overall impact on habitat would be less than significant, so the impact on species of concern would be *less than significant.* No mitigation measures would be required.

Common Habitats and Species

Common upland habitats would not be affected by changes in stream flows resulting from WSIP operations. Since the overall extent of riparian habitat is expected to be about the same (even if the structure and composition changes), impacts on common species would be *less than significant*. No mitigation measures would be required.

Impact Conclusions

Overall, implementation of the proposed WSIP water supply and system operations would result in *potentially significant* impacts on key special-status species. Measure 5.4.6-3, Operational Procedures for Calaveras Dam Releases, would require the development of procedures to manage releases from Calaveras Dam so as to minimize amphibian breeding habitat impacts and maximize benefits by mimicking the natural regime to the extent possible. Implementation of this measure would reduce impacts on key special-status species on this reach of Alameda Creek. Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek, would ensure adequate flows in Alameda Creek below the diversion dam during December through April. Taken together, these measures would reduce impacts on key special-status species in this portion of Alameda Creek to a less-than-significant level.

Impact 5.4.6-5: Effects on riparian habitat and related biological resources in San Antonio Reservoir.

Sensitive Habitats

Sensitive habitats that could be affected by operations of San Antonio Reservoir include small areas of freshwater marsh and riparian scrub on gently sloping reservoir margins. The average reservoir levels would be higher with the WSIP than under existing conditions, but the maximum reservoir levels would not change. No upland habitats would be affected. The average range of reservoir elevations under the WSIP would be slightly less than under existing conditions. Little perennial freshwater marsh or riparian scrub would be inundated to the extent that it would be permanently lost. Any loss of such habitat would be balanced by development of similar habitat at higher elevations. Thus, WSIP impacts on riparian and freshwater marsh habitat along the

margins of San Antonio Reservoir would be *less than significant*, and no mitigation measures would be required.

Drawdown once every five years during late fall or early winter would have a less-than-significant impact on habitat, since reservoir levels would be restored within a few months after system maintenance is completed.

Key Special-Status Species

WSIP operations at San Antonio Reservoir would not result in impacts on upland habitats, and therefore no impacts on Alameda whipsnake would occur. Key special-status species that could be affected by WSIP operations at San Antonio Reservoir include California red-legged frog and California tiger salamander. However, impacts related to the negligible changes in the extent of riparian scrub and freshwater marsh habitat would be *less than significant*, and no mitigation measures would be required.

Other Species of Concern

San Antonio Reservoir would be kept near maximum levels for longer periods, the maximum water surface elevation would not change, and only minor fluctuations in water level would occur (apart from maintenance drawdown). As noted in the discussion of Calaveras Reservoir, studies of amphibians and breeding birds at a similar reservoir project in Washington State found little change in habitat suitability with relatively minor fluctuations in reservoir elevation. As a result, WSIP-related impacts on other species of concern in San Antonio Reservoir would be *less than significant*, and no mitigation measures would be required.

Finally, waterfowl and other littoral species could be temporarily displaced from preferred habitat during drawdowns; however, the availability of numerous alternative food resources and the minor change in reservoir operations support a determination of a negligible effect.

Common Habitats and Species

No impacts on upland habitats would occur. There could be a slight reduction in the extent of weedy habitat around the periphery of the reservoir below the maximum reservoir elevation. This impact would be *less than significant*, and no mitigation measures would be required.

Impact Conclusions

Overall, impacts on terrestrial biological resources in the San Antonio Reservoir area due to implementation of the proposed WSIP operations would be *less than significant*, and no mitigation measures would be required.

Impact 5.4.6-6: Effects on riparian habitat and related biological resources along San Antonio Creek between Turner Dam and the confluence with Alameda Creek.

Sensitive Habitats

Sensitive habitats along San Antonio Creek include sycamore alluvial woodland and willow scrub and mixed riparian habitats. Releases into San Antonio Creek would be rare, similar to existing conditions. As a result, no change in conditions for riparian and wetland habitats would occur; the impact of the WSIP would be *less than significant,* and no mitigation measures would be required.

Key Special-Status Species

Any impacts on habitat for key special-status species (e.g., California red-legged frog) would be minimal, and the effect on breeding habitat would be *less than significant*. No mitigation measures would be required.

Other Species of Concern

Due to the lack of change from existing conditions, impacts on common species at risk would be *less than significant*, and no mitigation measures would be required.

Common Habitats and Species

No impacts on common habitats would occur as a result of WSIP changes in the operation of Turner Dam. The operational changes in this reach would not interfere substantially with the movement of any native wildlife species or wildlife nursery sites, nor would it cause a plant or wildlife population to drop below self-sustaining levels. Therefore, this impact would *not apply* to common habitats and species.

Impact Conclusions

Overall, impacts on terrestrial biological resources in San Antonio Creek due to implementation of the proposed WSIP water supply and system operations would be *less than significant,* and no mitigation measures would be required.

Impact 5.4.6-7: Effects on riparian habitat and related biological resources along Alameda Creek below the confluence with San Antonio Creek.

Sensitive Habitats

Flow in Alameda Creek between San Antonio Creek and Arroyo de la Laguna would be reduced during the winter months, especially during normal and wetter rainfall years. However, changes in flow would be buffered by other stream inputs from this point downstream. Judged against the baseline of current conditions, impacts on riparian and wetland habitats in this reach of Alameda Creek would be *less than significant,* and no mitigation measures would be required.

Key Special-Status Species

There would be little alteration in habitat for identified key special-status species due to WSIP-related operational changes. As a result, impacts on key special-status species would be *less than significant*, and no mitigation measures would be required.

Other Species of Concern

Potential impacts of WSIP operations on species of concern would be *less than significant*, for the same reasons described above for riparian and wetland habitats. No mitigation measures would be required.

Common Habitats and Species

Because flow changes in this reach of Alameda Creek would be minimal during normal to wet years, there would be limited impacts on terrestrial ecological resources. Thus, common habitats and species would not be affected, and this impact would *not apply*.

Impact Conclusions

Overall, impacts on terrestrial biological resources in Alameda Creek below San Antonio Creek due to implementation of the proposed WSIP water supply and system operations would be *less than significant*, and no mitigation measures would be required.

Impact 5.4.6-8: Conflicts with the provisions of adopted conservation plans or other approved biological resources plans.

The only plan relevant to proposed WSIP operations is the *Alameda Watershed Management Plan*. The WSIP program as a whole would be consistent with the provisions of this plan, which places priority on resource protection while ensuring that the objective of delivering adequate, high-quality water is met. The SFPUC is currently preparing a habitat conservation plan for the Alameda watershed; however, WSIP operations are not considered in this plan, which covers only existing operations. Therefore, impacts related to conflicts with adopted plans would be *less than significant*.

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5.4.7 Recreational and Visual Resources

Chapter 4, Section 4.12, Recreational Resources, provided a general overview of the park and recreational facilities and resources in the WSIP study area and near proposed facility projects. This section discusses specific recreational resources and activities within the Alameda Creek watershed that could be affected by the proposed water supply and system operations. Thus, the analysis deals primarily with water-related recreation, including fishing, swimming, boating, rafting, or activities such as scenic viewing, walking, hiking, or camping adjacent to water bodies.

5.4.7.1 Setting

The three main water features within the Alameda Creek watershed are San Antonio Reservoir, Calaveras Reservoir, and Alameda Creek. The natural drainage basin for Calaveras Reservoir includes Arroyo Hondo and Calaveras Creek from the southeast and local drainage areas along the west shore of the reservoir. The natural drainage basin for San Antonio Reservoir, which is the same as the watershed for San Antonio Creek, includes the tributary sub-drainage basins for Indian Creek, La Costa Creek, and Williams Gulch. Alameda Creek also receives limited surface flows from Calaveras Creek, Arroyo Hondo, and San Antonio Creek, as well as flows and runoff from tributary drainages in the Diablo Range and Livermore Valley. Farther downstream, Alameda Creek receives additional flows from Arroyo de la Laguna and Vallecitos Creek. The two reservoirs, as well as much of the rest of the Alameda Creek watershed, are located within the SFPUC Alameda watershed. This watershed is described below under Alameda Creek. The visual quality, recreational uses, and facilities associated with each water feature, including both SFPUC-managed and other uses and facilities, are described below (SFPUC, 2001).

Alameda Creek Recreation and Visual Quality

Alameda Creek runs through several parks and municipalities, including Sunol Regional Wilderness, Alameda County, and the cities of Fremont and Union City. The recreational uses of the creek are described below.

SFPUC Alameda Watershed

The CCSF owns about 30 percent of Alameda Creek's natural watershed (see Figure 5.4.1-1 in Section 5.4.1). The CCSF-owned portion of the Alameda Creek watershed encompasses approximately 36,000 acres of land, with 23,000 acres in Alameda County and 13,000 acres in Santa Clara County (see Figure 5.4.1-2 in Section 5.4.1). Visually, these areas range from steeply sloped, heavily vegetated semi-wilderness areas to industrialized and gravel mining areas in developed valleys. The CCSF leases some of its upper watershed land to the East Bay Regional Park District (EBRPD) for public recreational use, as described below. Public access to interior parts of the CCSF-owned watershed lands, including stretches of Alameda Creek, is prohibited because of the risk of fire and potential degradation of water quality and natural resources. The creek within these watershed lands is therefore not used for boating, fishing, swimming, or other water-related recreation. However, the SFPUC, which manages the watershed lands, does allow access to some internal fire roads and trails by permit for research or educational purposes to groups accompanied by volunteer leaders (SFPUC, 2001; 2007).

Sunol Water Temple. The Sunol Water Temple, a pavilion and temple situated over a convergence of the infiltration galleries and the downstream end of the defunct Pleasanton-Sunol pipeline, is located within the SFPUC Alameda watershed and adjacent to Alameda Creek. The temple is a destination for picnickers and tourists as a scenic and historic landmark and is open to the public at specified hours. It is also available for public events by SFPUC permit (SFPUC, 2001).

Sunol Regional Wilderness

The 6,858-acre Sunol Regional Wilderness, part of the Sunol-Ohlone Regional Park managed by the EBRPD, lies between San Antonio Reservoir and Calaveras Reservoir, with Alameda Creek running along its eastern edge (see Figure 4.12-1, in Section 4.12). A portion of the Sunol Regional Wilderness is located on SFPUC Alameda watershed lands leased by the EBRPD. Aesthetically, this parkland is comprised of undeveloped canyon, streamside, and ridgeline areas; some of the ridges offer expansive views of the surrounding areas.

The Sunol Regional Wilderness includes more than 26 miles of hiking, equestrian, and biking trails, including the Ohlone Wilderness Regional Trail (see below). Facilities and programs include picnic areas, barbeque pits, group and backpack camps, a visitor's center, naturalist-led activities, and equestrian facilities. At least one camping area is situated next to Alameda Creek. Little Yosemite, a scenic gorge on Alameda Creek, is located within the Sunol Regional Wilderness. Swimming is permitted within the wilderness area, except in Little Yosemite. Other water sports, including boating, rafting, and canoeing, are generally not feasible in this portion of Alameda Creek due to the creek's water level, and fishing is not allowed in creek (EBRPD, 2007a).

Ohlone Wilderness Regional Trail

The Ohlone Wilderness Regional Trail, managed by the EBRPD, is a 28-mile trail for hikers and equestrians (no bicycles or motor vehicles are permitted) that stretches across and connects four regional parks and wilderness areas, including Ohlone Regional Wilderness, Mission Peak Regional Preserve, Sunol Regional Wilderness, and Del Valle Regional Park. It also passes through two watershed areas leased from the CCSF. The trail crosses Alameda Creek within the Sunol Regional Wilderness. This trail affords both secluded canyon views and expansive ridge-top vistas.

Alameda Creek Regional Trail

The Alameda Creek Regional Trail follows the banks of Alameda Creek in southern Alameda County from the mouth of Niles Canyon (in the Niles District of Fremont) westward to San Francisco Bay for a distance of 12 miles. The trail runs on both sides of the creek; on the north side of the creek, it is an unpaved trail for pedestrians, equestrians, and cyclists, and on the south side is a paved trail for pedestrians and cyclists only. Motor vehicles are not allowed on the trail. This trail includes views of both semi-natural and urban landscapes.

The trail is accessible from several thoroughfares in the Fremont, Union City, and Newark areas. It provides access to Coyote Hills Regional Park (from the south side of the creek only) and

Quarry Lakes Regional Recreation Area (from both sides of the creek). The Alameda Creek Stables Staging Area, Beard Staging Area, Isherwood Staging Area, and Niles Staging Area are stationed along the trail, providing facilities such as restrooms, picnic areas, and drinking fountains (EBRPD, 2007b).

Quarry Lakes Regional Recreation Area

Quarry Lakes Regional Recreation Area, managed by the EBRPD, borders the north side of Alameda Creek for approximately 1.8 miles in the city of Fremont. The Alameda Creek Trail is accessible from several points in the recreation area. The recreation area has several lakes; public access is provided to these lakes for fishing, swimming, and boating (EBRPD, 2007c). The lakes afford open-space and water-feature views for park users.

Coyote Hills Regional Park

Coyote Hills Regional Park, managed by the EBRPD, borders the south side of Alameda Creek for approximately 1.1 miles in the city of Fremont (see Figure 4.12-1 in Section 4.12). The Alameda Creek Trail is accessible from several points in the park. The park provides naturalist programs, a visitor center, group campgrounds, several miles of trails, cultural artifact displays, and a boardwalk through marshlands. Nature viewing and hiking are encouraged within the park (EBRPD, 2007d).

Don Edwards San Francisco Bay National Wildlife Refuge

The Don Edwards San Francisco Bay National Wildlife Refuge borders Alameda Creek as it approaches San Francisco Bay (see Figure 4.12-1 in Section 4.12). The wildlife refuge, managed by the USFWS, includes trails and nature viewing. One of the refuge's stated goals is to provide opportunities for wildlife-oriented recreation and nature study (USFWS, 2007). The wildlife refuge provides views of the bay and associated wetland areas as well as of the nearby salt ponds.

Other Access to Alameda Creek

Other recreational facilities in Fremont and Union City that either abut or provide access to Alameda Creek and the Alameda Creek Trail include Shinn Pond, Niles Community Park, Kaiser Pond, the Model Mariners boat club, Rancho Arroyo Park, William Cann Park, and David Jones Park (EBRPD, 2007b).

San Antonio and Calaveras Reservoirs

San Antonio and Calaveras Reservoirs are located entirely within the SFPUC Alameda watershed. As mentioned above, public access to interior parts of the Alameda watershed lands is prohibited, and the reservoirs are not available for water-related recreation; however, the SFPUC does allow access to some internal fire roads and trails by permit for research or educational purposes to groups accompanied by volunteer leaders (SFPUC, 2001). Both reservoirs appear as visually prominent water features in views from surrounding ridges.

Regulatory Considerations

As discussed in Chapter 4, Section 4.2, Plans and Policies, the *Alameda Watershed Management Plan* includes the following policy related to visual quality:

- *Policy WA 9*: If new facilities require additional new locations, require that view shed studies be conducted to minimize, eliminate or conceal the violation of scenic values.

However, the WSIP water supply and system operations analyzed in this section would not require any new facilities, other than those already discussed and analyzed in Section 4.3, Land Use and Visual Quality. Therefore, this policy is not addressed further in this section.

5.4.7.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to recreational or visual resources, but generally considers that implementation of the proposed program would have a significant impact on these resources if it were to:

Recreation

- Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated (Secondary impacts of growth are evaluated in Chapter 7, Growth-Inducement Potential and Indirect Effects of Growth)

- Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment (Secondary impacts of growth are evaluated in Chapter 7)

- Physically degrade existing recreational resources

The physical degradation of existing resources could occur if the WSIP were to: (1) remove or damage existing recreational resources; (2) cause environmental impacts (such as air quality or noise effects) that would indirectly cause a deterioration in the quality of the recreational experience; or (3) disrupt access to existing recreational facilities (which would divide a community from some of the established amenities used by its members).

Visual Quality

- Have a substantial adverse effect on a scenic vista
- Substantially damage scenic resources, including but not limited to trees, rock outcroppings, and other features of the built or natural environment that contribute to a scenic public setting
- Substantially degrade the existing visual character or quality of the site and its surroundings

Approach to Analysis

The WSIP would change water levels in reservoirs and alter flow in streams in the Alameda watershed. WSIP-induced changes in reservoir water levels and stream flow in the Alameda Creek watershed were estimated using the HH/LSM (see Appendix H). WSIP-induced changes in reservoir water levels and stream flow were estimate semi-quantitatively. A specialist in recreational and visual resources assessed the impacts of the WSIP on these environmental elements based on the estimated WSIP-induced changes in reservoir water levels and stream flow (see Section 5.4.1).

Impact Summary

Table 5.4.7-1 presents a summary of the impacts on recreational and visual resources in the Alameda Creek watershed that could result from implementation of the proposed water supply and system operations.

TABLE 5.4.7-1
SUMMARY OF IMPACTS –
RECREATIONAL AND VISUAL RESOURCES IN THE ALAMEDA CREEK WATERSHED

Impact	Significance Determination
Impact 5.4.7-1: Effects on recreational facilities and/or activities	PSM
Impact 5.4.7-2: Visual effects on scenic resources or the visual character of water bodies	PSM

PSM = Potentially Significant impact, can be mitigated to less than significant

Impact Discussion

Impact 5.4.7-1: Effects on recreational facilities and/or activities.

The WSIP would not affect water-related recreational facilities or activities in the Alameda Creek watershed. As described above in Section 5.4.7.1, Setting, water recreation is not allowed on the SFPUC reservoirs; because there would be no change to this policy under the WSIP, impacts on recreation would not occur as a result of water level changes in the reservoir. With respect to recreation in and along the creeks in the watershed, for most portions of the watershed, there is either: (1) no or only very limited water recreation occurring at present, and/or (2) the WSIP-related flow changes described in Section 5.4.1 would not change creek flows to an extent that existing recreational use would be affected. However, the proposed program would substantially reduce flows along Alameda Creek in the Sunol Regional Wilderness in the winter and early spring months. The reduced flows would somewhat degrade the recreational experience for hikers on the trails near (or with views of) Alameda Creek, resulting in a *potentially significant* impact. Implementation of Measure 5.4.1-2, Diversion Tunnel Operation, and Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek, would reduce this impact to a less-than-significant level.

Impact 5.4.7-2: Visual effects on scenic resources or the visual character of water bodies.

As described in Section 5.4.1, changes in stream flow and reservoir water levels under the WSIP are not beyond the range of flow and water level variation that occurs now. The reductions in peak flows in average, above-average, and wet years under the proposed program would not be visually apparent to most recreational users and others viewing the creeks and reservoirs. The main exception would be the substantial reductions in flows in Alameda Creek in the Sunol Regional Wilderness, including the scenic Little Yosemite area, during winter and spring months. Reduced flows in Alameda Creek in the Little Yosemite area would result in a *potentially significant* impact on scenic resources. Implementation of Measure 5.4.1-2, Diversion Tunnel Operation, and Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek, would reduce potential impacts on scenic resources along Alameda Creek in the Sunol Regional Wilderness to a less-than-significant level.

Proposed releases to support fisheries would increase flows in Calaveras Creek and downstream in Alameda Creek and would have a beneficial visual effect, because the releases would enhance the creek's appearance in the summer months when recreational use is highest. Therefore, no significant adverse visual impacts would occur, and no mitigation is required.

References – Recreational and Visual Resources

East Bay Regional Parks District (EBRPD), Fishing in the Regional Parks, available online at http://www.ebparks.org/fish.htm, accessed June 12, 2007a.

East Bay Regional Parks District (EBRPD), Alameda Creek Trail, available online at http://www.ebparks.org/parks/alameda.htm, accessed June 12, 2007b.

East Bay Regional Parks District (EBRPD), Quarry Lakes, available online at http://www.ebparks.org/parks/quarry.htm, accessed June 12, 2007c.

East Bay Regional Parks District (EBRPD), Coyote Hills, available online at http://www.ebparks.org/parks/coyote.htm, accessed June 12, 2007d.

San Francisco Public Utilities Commission (SFPUC), *Final Alameda Watershed Management Plan*, April 2001.

San Francisco Public Utilities Commission (SFPUC), Alameda Watershed, available online at http://sfwater.org/msc_main.cfm/MC_ID/20/MSC_ID/188, accessed on June 12, 2007.

U.S. Fish and Wildlife Service (USFWS), Don Edwards San Francisco Bay National Wildlife Refuge, available online at http://www.fws.gov/desfbay/, accessed June 12, 2007.

5.5 San Francisco Peninsula Streams and Reservoirs

Section 5.5 Subsections	
5.5.1	Stream Flow and Reservoir Water Levels
5.5.2	Geomorphology
5.5.3	Surface Water Quality
5.5.4	Groundwater
5.5.5	Fisheries
5.5.6	Terrestrial Biological Resources
5.5.7	Recreational and Visual Resources
(References included under each section)	

5.5.1 Stream Flow and Reservoir Water Levels

The following setting section describes the streams and reservoirs on the San Francisco Peninsula that could be affected by the WSIP. The impact section (Section 5.5.1.2) provides a description of the changes in stream flow and reservoir water levels that would result from implementation of the WSIP.

5.5.1.1 Setting

The SFPUC operates four water supply reservoirs on the San Francisco Peninsula: Pilarcitos, Upper and Lower Crystal Springs, and San Andreas Reservoirs. The Spring Valley Water Company built the reservoirs between 1864 and 1890. The four reservoirs and two streams (San Mateo Creek and Pilarcitos Creek) on the Peninsula could be affected by the WSIP. San Mateo Creek, and its tributary San Andreas Creek, flow southward in the rift valley formed by the San Andreas fault and then turn east, flowing to San Francisco Bay. Pilarcitos Creek also flows southward, but it turns to the west and flows to the Pacific Ocean. **Figure 5.5.1-1** shows the boundaries of the drainage areas of the four Peninsula reservoirs, and **Figure 5.5.1-2** shows the SFPUC regional facilities associated with these reservoirs. The SFPUC's water supply facilities on the San Francisco Peninsula lie within two watersheds, the San Mateo Creek and Pilarcitos Creek watersheds, which are referred to collectively as the Peninsula watershed.

San Mateo Creek

General Description

San Mateo Creek, and its major tributary San Andreas Creek, rises in the Coast Range mountains west of the city of Millbrae. San Mateo and San Andreas Creeks are fed by rainfall, which varies with altitude and is in the range of 25 to 40 inches annually. Almost all of the rainfall occurs between October and April.

SOURCE: ESA + Orion; USGS 1978

Figure 5.5.1-1
Peninsula Watersheds and Drainages

SOURCE: ESA + Orion; USGS 1978

SFPUC Water System Improvement Program . 203287

Figure 5.5.1-2

Peninsula Watershed Facilites and Flow Locations Analyzed

The upper reaches of San Mateo Creek and all reaches of San Andreas Creek are in undeveloped land, most of which is owned by the City and County of San Francisco (CCSF). The lower reaches of San Mateo Creek below Lower Crystal Springs Dam flow through a densely developed urban area to San Francisco Bay, about 1.6 miles north of the Hayward–San Mateo Bridge. The main tributary of San Mateo Creek downstream of Lower Crystal Springs Dam is Polhemus Creek.

Stream Flow and Water System Operations

Flow in San Mateo and San Andreas Creeks was first affected by water system operations in 1870 when San Andreas Dam was built in the upper reaches of San Andreas Creek. The dam impounds San Andreas Reservoir. Upper Crystal Springs Dam was built just upstream of the confluence of San Andreas Creek and San Mateo Creek in 1877 and formed Upper Crystal Springs Reservoir. In 1890, Lower Crystal Springs Dam was built on San Mateo Creek downstream of Upper Crystal Springs Reservoir, forming Lower Crystal Springs Reservoir. In 1924, culverts were built through Upper Crystal Springs Dam to hydraulically link Upper and Lower Crystal Springs Reservoirs. The current maximum capacities of San Andreas, Upper Crystal Springs, and Lower Crystal Springs Reservoirs are 19,000, 23,360, and 35,040 acre-feet, respectively. (The California Department of Water Resources, Division of Safety of Dams, currently restricts Crystal Springs Reservoir storage). **Figures 5.5.1-3** and **5.5.1-4** show historical water surface elevations in San Andreas and Crystal Springs Reservoirs between 1998 and 2006.

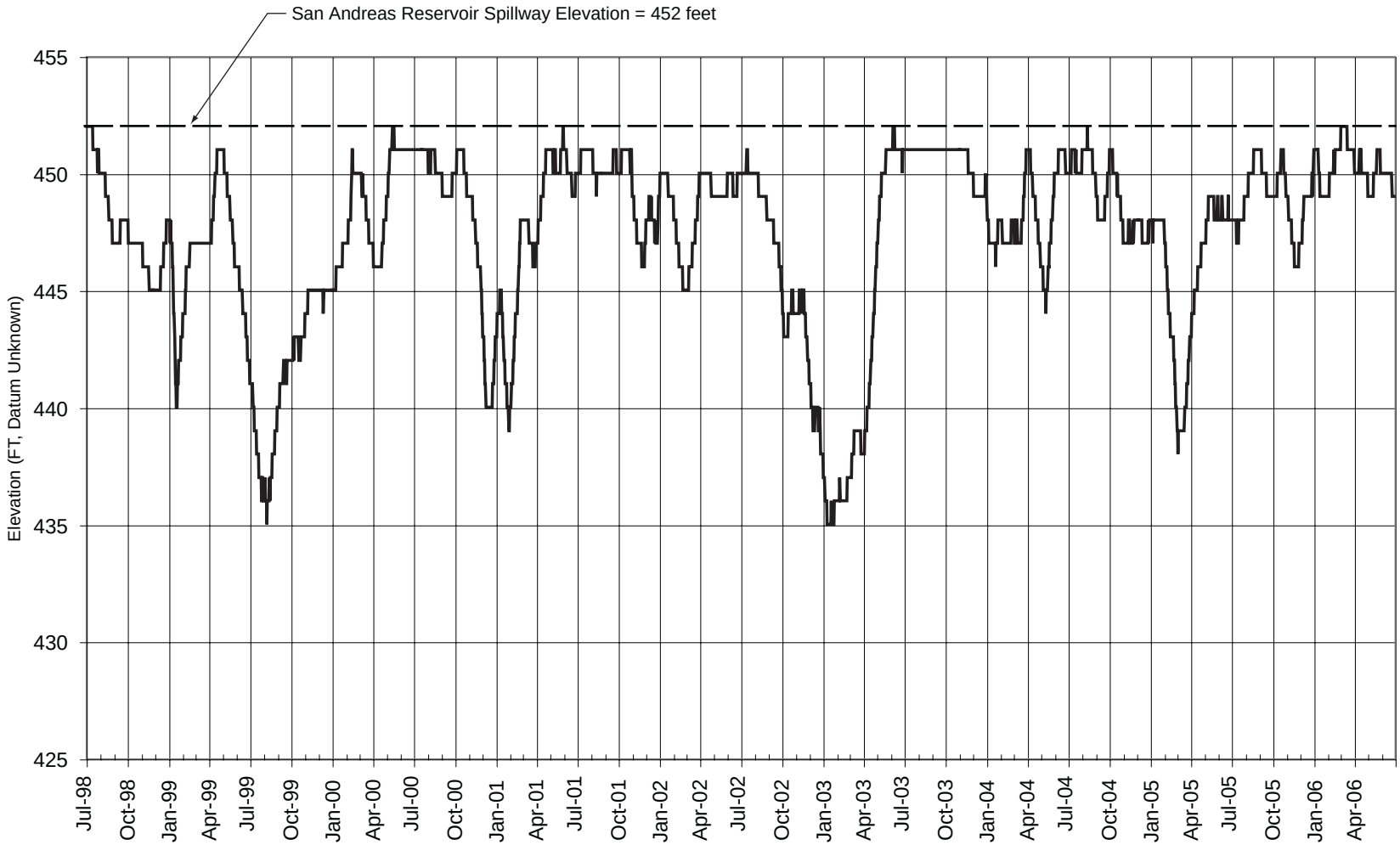
San Andreas and Crystal Springs Reservoirs serve as terminal reservoirs for the SFPUC water system. They not only capture local runoff but also store water conveyed from the Tuolumne River, the Alameda Creek watershed, and Pilarcitos Creek; consequently, the reservoirs are larger than would be necessary if their sole purpose were to capture runoff from local watersheds. The reservoirs on San Andreas and San Mateo Creeks eliminate flow in the creeks immediately below the dams, except for occasional spills or releases from the reservoirs and seepage through the dams. The creeks gain flow in a downstream direction as a result of tributary flow from surface and groundwater sources. No measurements of flow in either creek are available.

Although flood reduction was not one of the original purposes of the CCSF's reservoirs in the San Mateo Creek watershed, Crystal Springs Reservoir reduces peak flow in the creek most of the time. Space for floodwaters is provided in the reservoir when major storms are expected. Once the space allocated for flood storage is filled, uncontrolled flow over the spillway at Lower Crystal Springs Dam can occur, or controlled releases can be made from outlets equipped with valves. Before the valves are opened, the SFPUC considers potential downstream effects. The dam is operated so that peak flows do not increase above the peak flows that would have existed had the reservoirs not been constructed.

Pilarcitos Creek/Pilarcitos Reservoir

General Description

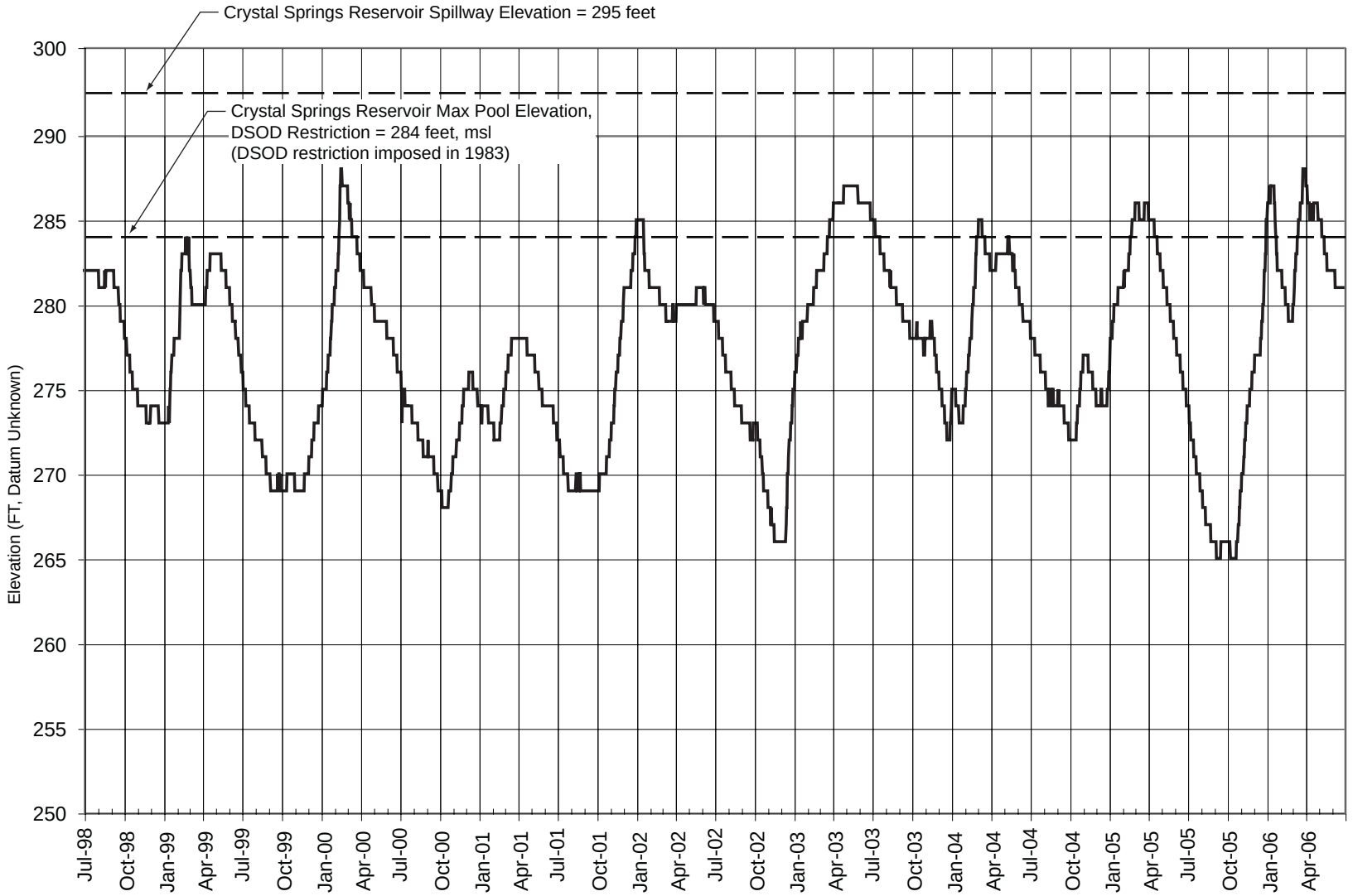
Pilarcitos Creek rises on the eastern flanks of Montara Mountain in the Coast Ranges. The creek flows southward through the mountains before turning westward and discharging to the Pacific Ocean at Half Moon Bay, as shown in **Figure 5.5.1-5**. Rainfall in the Pilarcitos Creek watershed



SOURCE: SFPUC, HH/LSM (see Appendix H)

Figure 5.5.1-3

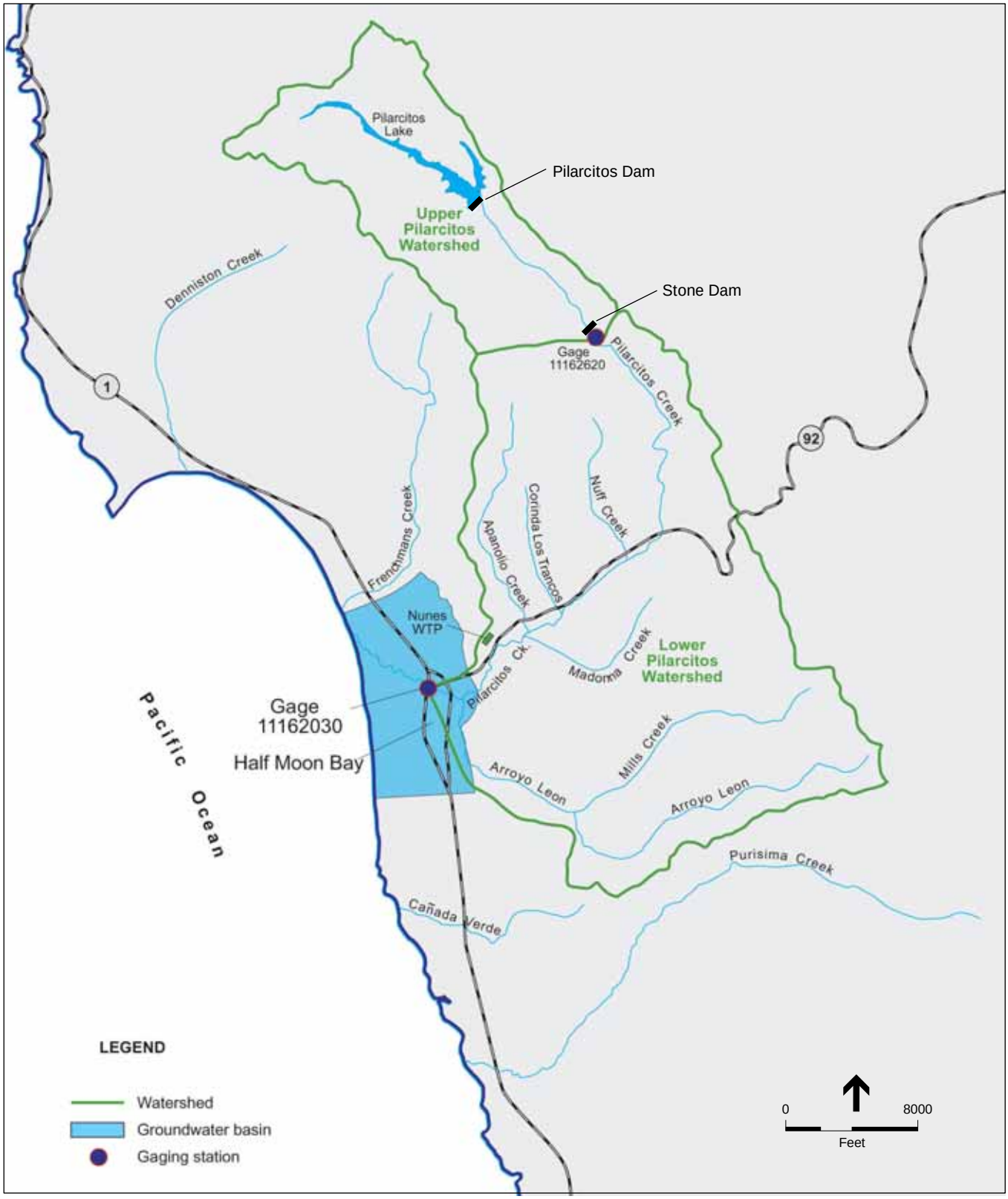
San Andreas Reservoir, Historical Water Levels, 1998 to 2006



SOURCE: SFPUC, HH/LSM (see Appendix H)

Figure 5.5.1-4

Crystal Springs Reservoir, Historical Water Levels, 1998 to 2006



SOURCE: Todd Engineers

SFPUC Water System Improvement Program . 203287

Figure 5.5.1-5
Pilarcitos Creek Watershed

is variable, ranging from 26 inches annually at the coast to 42 inches near Pilarcitos Reservoir. The approximately 27-square-mile Pilarcitos Creek watershed consists primarily of relatively rugged uplands, characterized by shrubs and grasslands. The CCSF owns substantial portions of the upper watershed, and the Peninsula Open Space Trust protects large areas of the lower watershed above Arroyo Leon. Developed lands within the watershed are primarily agricultural and are located along the lower reaches of the stream corridors. Residential land uses are also present in the watershed, generally along roadways. Other land uses include a cemetery on Highway 92 at Skyline Boulevard, a sanitary landfill in upper Corrida Los Trancos Canyon, and a quarry in Nuff Creek Canyon.

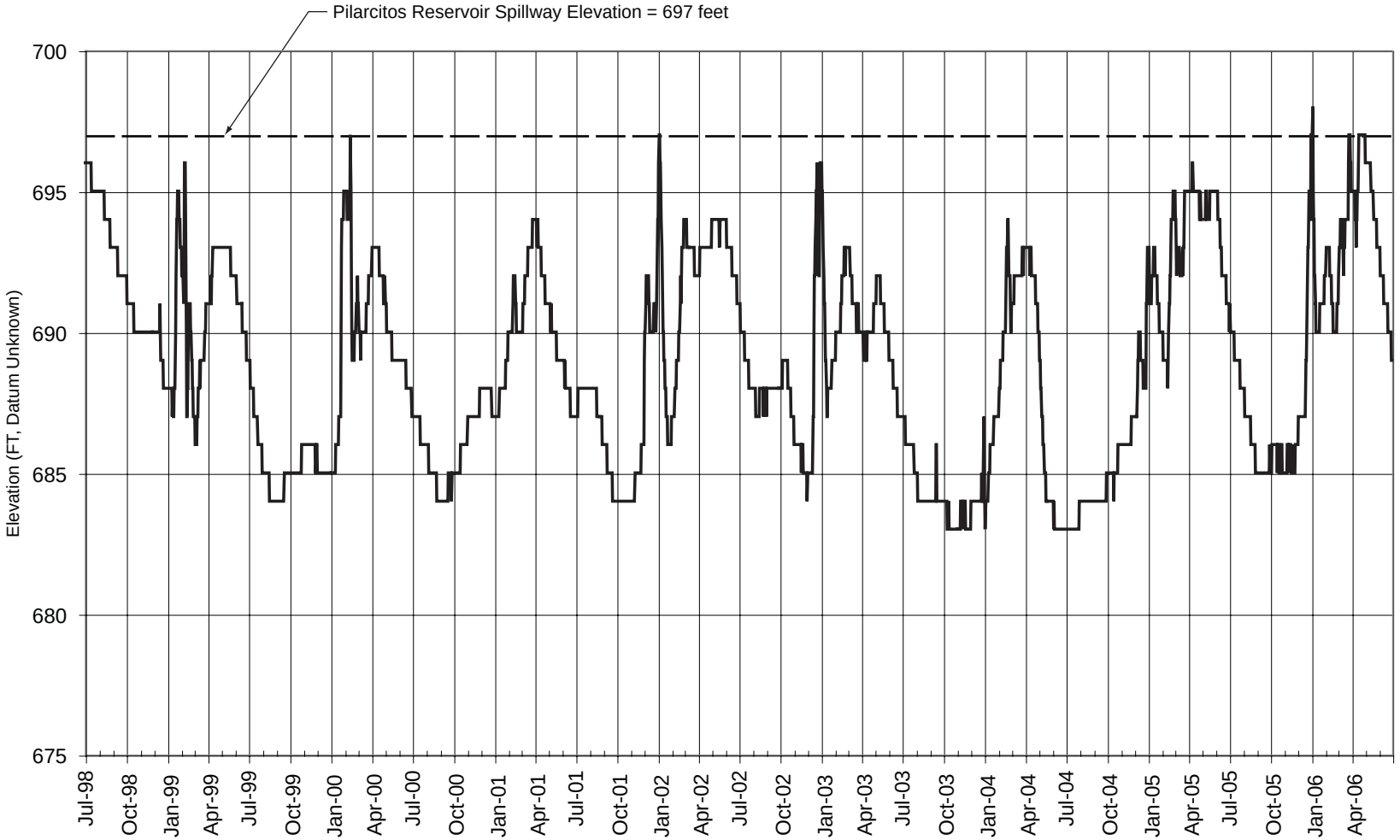
Stream Flow and Water System Operations

Flow in Pilarcitos Creek was first affected by water system operations in 1864 when Pilarcitos Dam was built, and again in 1871 when Stone Dam was built. Pilarcitos Dam impounds Pilarcitos Reservoir, which has a maximum capacity of 3,100 acre-feet of water. Stone Dam, which is about two miles downstream of Pilarcitos Reservoir, is essentially a diversion dam; it impounds about 15 acre-feet of water.

Local runoff from an approximately six-square-mile watershed is Pilarcitos Reservoir's only source of water. Inflow to the reservoir occurs predominantly from rainfall during December through April. Annual runoff to Pilarcitos Reservoir is quite variable and has ranged from almost nothing to more than 15,000 acre-feet. Average annual runoff is estimated to be approximately 4,000 acre-feet per year. Tributaries that join Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam contribute an average annual of about 1,850 acre-feet per year.

The SFPUC uses Pilarcitos Reservoir to store water for use by the Coastside County Water District (Coastside CWD) and to store and divert water for its own use. During the winter months, the SFPUC typically diverts most of the runoff into Pilarcitos Reservoir from the Pilarcitos Creek watershed to its reservoirs in the San Mateo Creek watershed, primarily to San Andreas Reservoir, but also to Crystal Springs Reservoirs. At the end of the rainy season, diversions from Pilarcitos Creek to San Andreas Reservoir are curtailed, with the goal of filling Pilarcitos Reservoir by the late spring. As indicated in **Figure 5.5.1-6**, which shows historical water surface elevations in Pilarcitos Reservoir from 1998 to 2006, the reservoir refills or almost refills in the winter or spring of most years. After the reservoir has filled, the only water SFPUC releases from Pilarcitos Reservoir is that amount requested by Coastside CWD to meet its water needs.

The SFPUC releases water from Pilarcitos Reservoir to Pilarcitos Creek during the summer for use by Coastside CWD and during the winter diverts water from Pilarcitos Reservoir to San Andreas Reservoir through Pilarcitos Tunnels No. 1 and 2. It can also divert water from Pilarcitos Reservoir to Crystal Springs Reservoir through Pilarcitos Tunnel No. 1 and from Stone Dam to Crystal Springs Reservoir through Stone Dam Tunnel No. 1; this is less desirable than transfers to San Andreas Reservoir, however, because San Andreas Reservoir is at a higher elevation than Crystal Springs Reservoir. Any water diverted from Pilarcitos Creek to Crystal Springs Reservoir must ultimately be pumped to San Andreas Reservoir before it is treated and delivered to retail customers. Consequently, the SFPUC only diverts water from the Pilarcitos Creek watershed to



SOURCE: SFPUC, 2007

Figure 5.5.1-6

Pilarcitos Reservoir, Historical Water Levels, 1998 to 2006

Crystal Springs Reservoir when the available water at Pilarcitos Reservoir exceeds the conveyance capacity of Pilarcitos Tunnels No. 1 and 2, or when water is available as result of tributary flow between Pilarcitos Reservoir and Stone Dam.

Water released from Pilarcitos Reservoir flows down Pilarcitos Creek to Stone Dam. Water is diverted at Stone Dam into a tunnel and pipeline that leads to Stone Dam Tunnel No. 1. Coastside CWD has a turnout from the pipeline just upstream of Stone Dam Tunnel No. 1. Coastside CWD's own pipeline, which has a maximum capacity of about 2 million gallons per day (mgd), conveys water from this turnout to the Nunes Water Treatment Plant and on to its service area.

Coastside CWD supplies water to the city of Half Moon Bay and several unincorporated communities, including El Granada, Miramar, and Princeton-by-the Sea. Its water sources are surface water from Denniston Creek, two groundwater wellfields, and the SFPUC. Coastside CWD's total water demand currently averages 2.5 mgd, but varies seasonally. Demand in December, January, and February is about 1.6 mgd, and in July and August is about 3.2 mgd. Coastside CWD meets its customers' water demand from its own water sources to the degree it can, and then supplements its own supplies with water from the SFPUC.

Because Coastside CWD's own water sources produce only a modest amount of water, Coastside CWD supplements its own water supplies with water from the SFPUC year-round. In the winter months, when demand in the Coastside CWD service area is at its seasonal minimum, Coastside CWD obtains 0.5 to 1 mgd from the SFPUC. In the summer when demand is at its seasonal maximum, Coastside CWD obtains 1.5 to 3 mgd from the SFPUC.

When Coastside CWD needs water from the SFPUC, it requests that the SFPUC release water from Pilarcitos Dam for diversion by Coastside CWD at Stone Dam. During the summer months, Coastside CWD is unable to receive enough water from the Pilarcitos Creek watershed to meet its need for supplemental water supplies. This may be because (1) Pilarcitos Reservoir is drawn down and the SFPUC is unable to release enough water down Pilarcitos Creek to meet Coastside CWD's needs or (2) the capacity of the upper portion of the pipeline from Stone Dam to the Nunes Water Treatment Plant is insufficient to convey the needed volume of water to the Coastside CWD, even when sufficient water is available from the Pilarcitos Creek watershed. Under these circumstances, Coastside CWD activates a pump to lift water out of Crystal Springs Reservoir to a ridge-top storage tank; from there, the water is conveyed to the Nunes Water Treatment Plant.

Currently, and in a normal year, about half the water from the upper Pilarcitos Creek watershed is diverted to San Andreas and Crystal Springs Reservoirs; the other half is released down Pilarcitos Creek and diverted for use by Coastside CWD at Stone Dam. Currently, approximately three-quarters of Coastside CWD's water supply is provided by the SFPUC, either from Pilarcitos Creek or Crystal Springs Reservoir.

Flow in Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam consists of tributary flow from surface and groundwater sources, releases from the reservoir to supply Coastside CWD, and occasional spills from Pilarcitos Reservoir in wet periods. During the dry season, and until

recently, no intentional releases were made from Stone Dam to Pilarcitos Creek, and flow in the creek immediately below the dam consisted only of leakage through the spillway boards and seepage through the dam. Currently, experimental releases of a few cubic feet per second (cfs) are being made as part of a study of aquatic resources. In the wet months of wet years, spills over Stone Dam to Pilarcitos Creek are frequent. A tributary adds water to Pilarcitos Creek about one-tenth of a mile below Stone Dam in all but a few months of the driest years.

Flow in Pilarcitos Creek is measured at two gages—one just below Stone Dam, and the other near the creek mouth at Half Moon Bay. Flow measured at the gage in Half Moon Bay varies seasonally, with average monthly flow reaching a seasonal maximum of 53 cfs in February and a seasonal minimum of less than 1 cfs in August and September. Flow varies greatly from year to year. In 1976 and 1977, two very dry years, average monthly flow in the creek did not exceed 2.5 cfs. In 1998, a very wet year, a monthly average flow of 329 cfs was recorded.

Minimum Instream Flow Requirements

No releases are required from Crystal Springs, San Andreas, and Pilarcitos Reservoirs to maintain minimum stream flows in San Mateo, San Andreas, and Pilarcitos Creeks.

5.5.1.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to stream flow and reservoir levels, but generally considers that implementation of the proposed program would have a significant impact if it were to:

- Substantially alter stream flows such that they are outside of the range of pre-WSIP conditions and result in adverse hydrologic effects

The stream flow significance threshold is based on the fact that natural stream flows have varied substantially in the past 50 years, and that such variations are a part of the existing baseline. Therefore, variations substantially outside of these past levels due to implementation of the proposed program that would result in adverse hydrologic effects (such as flooding, dewatering, erosion, or drainage alteration, among others) would be considered a significant direct impact.

In addition to direct impacts resulting from changes in stream flows and reservoir levels, this PEIR also considers indirect impacts. However, for organizational purposes, the indirect impacts are not described in this section of the document, but rather in the sections describing the resources that would be indirectly affected by changes in steam flows and reservoir levels. These include geomorphology, surface water quality, groundwater, fisheries, terrestrial biological resources, recreation, and visual resources. It should be noted that there might be cases in which significant indirect impacts could result from less-than-significant direct impacts.

Approach to Analysis

Changes in reservoir storage and water levels attributable to the WSIP in the San Mateo Creek watershed were estimated using the Hetch Hetchy/Local Simulation Model (HH/LSM). An overview of the model is presented in Section 5.1. Detailed information on the model and the assumptions that underlie it is provided in Appendix H. Stream flows in San Mateo Creek and stream flows and changes in reservoir storage and water levels for the Pilarcitos Creek watershed were estimated semi-quantitatively based on results from the model in addition to interviews with individuals knowledgeable about historical, current, and expected future (with-WSIP) water system operations. Information on the limitations of the HH/LSM and reasons for using supplemental information are provided in Section 5.1. Information on current and expected future operations in the Pilarcitos Creek watershed is provided in Appendix H.

Total water demand in the Coastside CWD service area is expected to increase from an annual average of 2.7 mgd in 2005 to an annual average of about 3.2 mgd in 2030. Coastside CWD intends to meet future demand by increasing its purchase request from the SFPUC. The SFPUC and Coastside CWD are currently discussing how the SFPUC might meet the increased purchase request, but no decision on a course of action has yet been made. However, in order to perform a conservative assessment of potential environmental impacts, a course of action was assumed that would have greater environmental consequences for Pilarcitos Reservoir and Pilarcitos Creek than other possible courses of action. Under the assumed scenario, the SFPUC would supply water to Coastside CWD from both Pilarcitos Creek and Crystal Springs Reservoir, as it does currently, but it would take more water from both sources. Most of the additional water would come from Crystal Springs Reservoir.[1] The SFPUC already takes all of the water from the Pilarcitos Creek watershed upstream of Stone Dam in normal, below-normal, and dry years, so any further use of Pilarcitos Creek water would come at the expense of spills from Stone Dam in the wet months of wet years.

Meeting Coastside CWD's future purchase requests might require the construction of new facilities. The environmental impacts of the new facilities are not analyzed in this PEIR, but would be addressed during subsequent, project-level CEQA review. The project-level review would occur after the SFPUC determines how it will meet Coastside CWD's 2030 purchase request, but before the facilities are constructed. However, it is expected that any construction impacts could be reduced to a less-than-significant level by conventional and project-specific construction mitigation measures.

Impact Summary

Table 5.5.1-1 presents a summary of the impacts on stream flow in Peninsula watershed water bodies that could result from implementation of the proposed water supply and system operations.

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1 Increased diversions of water from Crystal Springs Reservoir could in turn increase diversions of water from the Tuolumne River. Chapter 8 provides an analysis of the environmental effects of several variants of the proposed program. The environmental analysis of Variant 1, which would involve meeting all of the additional purchase requests from the Tuolumne River, provides an indication of the likely effects of increased diversions from the Tuolumne River, as would occur (but on a much smaller scale) under this scenario.

TABLE 5.5.1-1
SUMMARY OF IMPACTS – STREAM FLOW
IN SAN FRANCISCO PENINSULA STREAMS

Impact	Significance Determination
Impact 5.5.1-1: Effects on flow along San Mateo Creek	LS
Impact 5.5.1-2: Effects on flow along Pilarcitos Creek	LS

LS = Less than Significant impact, no mitigation required

Impact Discussion

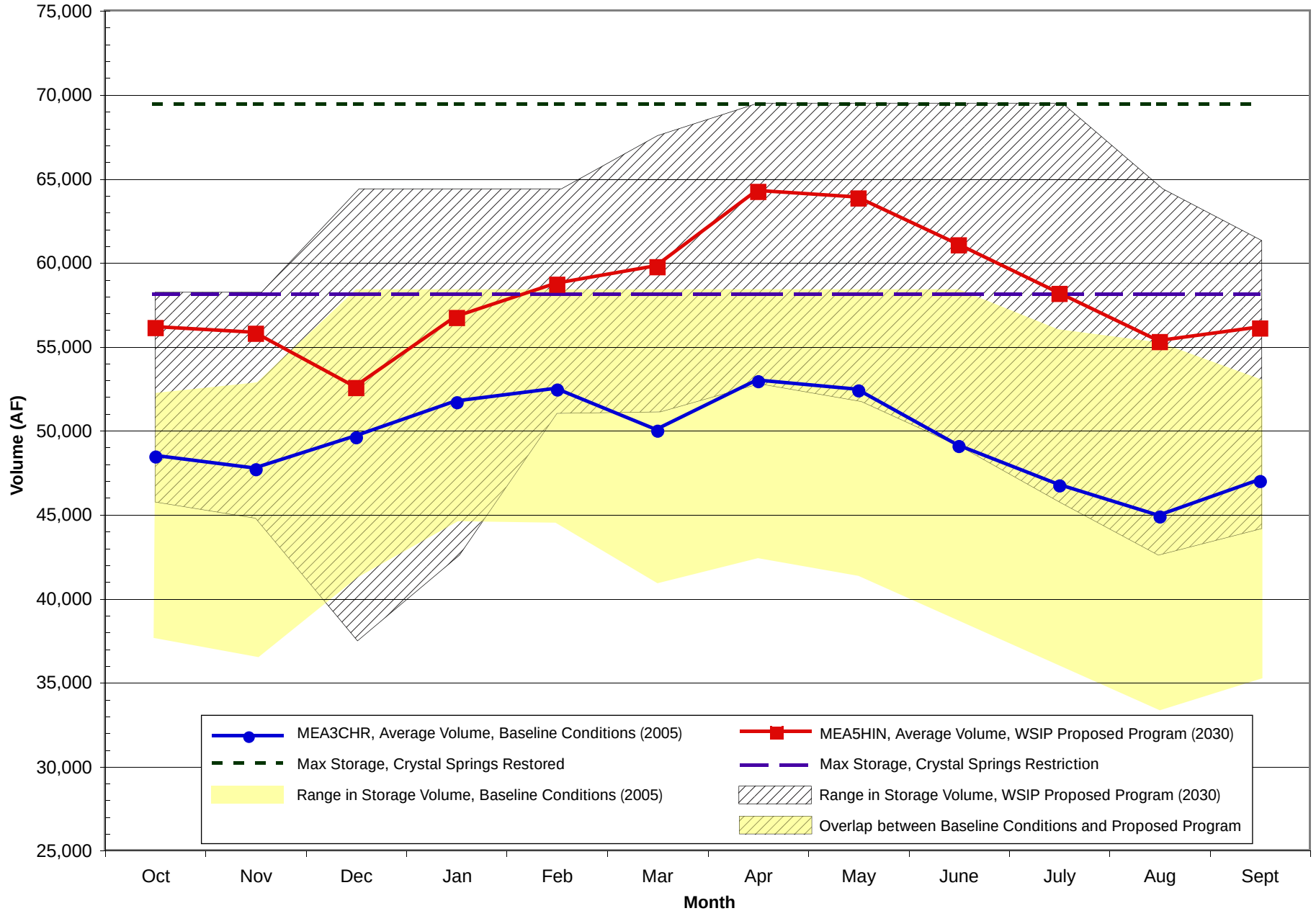
Impact 5.5.1-1: Effects on flow along San Mateo Creek.

Reservoir Operations

Crystal Springs and San Andreas Reservoirs store water from their local watersheds and water imported from the Tuolumne River and Pilarcitos Creek. The reservoirs are filled during the rainy season in the Bay Area and the snowmelt season in the Sierra Nevada. During the summer, when local demand exceeds the supply of water that can be delivered from the Tuolumne River, water is drawn from Crystal Springs and San Andreas Reservoirs to meet part of the demand. Storage in the reservoirs is replenished in the following winter, spring, and early summer. The reservoirs are operated to minimize spills from Crystal Springs Reservoir to San Mateo Creek. The WSIP would not change the SFPUC's operational goals for Crystal Springs and San Andreas Reservoirs, but it would affect water levels in the reservoirs and could affect the volume of spills from Crystal Springs Reservoir to San Mateo Creek.

Water Storage and Water Levels in Crystal Springs and San Andreas Reservoirs

The proposed program would increase average monthly storage in Crystal Springs Reservoir year-round compared to the existing condition. **Figure 5.5.1-7** shows average monthly storage in the reservoir. The increase in average monthly storage would mostly be attributable to the Lower Crystal Springs Dam project (PN-4), but also to improvements to the SFPUC regional water system as a whole. The improvements to Crystal Springs Dam are part of the WSIP and would allow the reservoir to be operated at its full capacity of 69,300 acre-feet, or 22.6 billion gallons. The Division of Safety of Dams currently limits the maximum storage capacity in Crystal Springs Reservoir to 58,400 acre-feet (19 billion gallons) due to concerns regarding the ability of the dam spillway to safely pass the largest floods that could occur in the watershed. The other system improvements, also a part of the WSIP, would increase the SFPUC's ability to convey Tuolumne River water across the San Joaquin Valley and thus improve its ability to maintain storage in Crystal Springs Reservoir. With the WSIP, storage in the reservoir would typically fluctuate during the year between full and 58,000 acre-feet (19 billion gallons), except during maintenance of the conveyance components of the Hetch Hetchy system (primarily



SOURCE: SFPUC, HH/LSM (see Appendix H)

Figure 5.5.1-7
Average Monthly Storage Volume,
Crystal Springs Reservoir

Mountain Tunnel and the San Joaquin Valley Pipeline) and during years of little local inflow or curtailed imports from the Tuolumne River.

Because the WSIP would restore Crystal Springs Reservoir storage, average monthly water levels would rise by 2 to 8 feet compared to the existing condition, with an average increase of 5 feet. The average monthly water levels with the WSIP would fluctuate more than under the existing condition. Currently, the difference between the annual average monthly maximum and minimum water levels is 7 feet; with the WSIP it would be 9 feet. The increased fluctuation would be due in part to periodic drawdown of storage in Crystal Springs Reservoir during maintenance of the conveyance components of the Hetch Hetchy system, as described below.

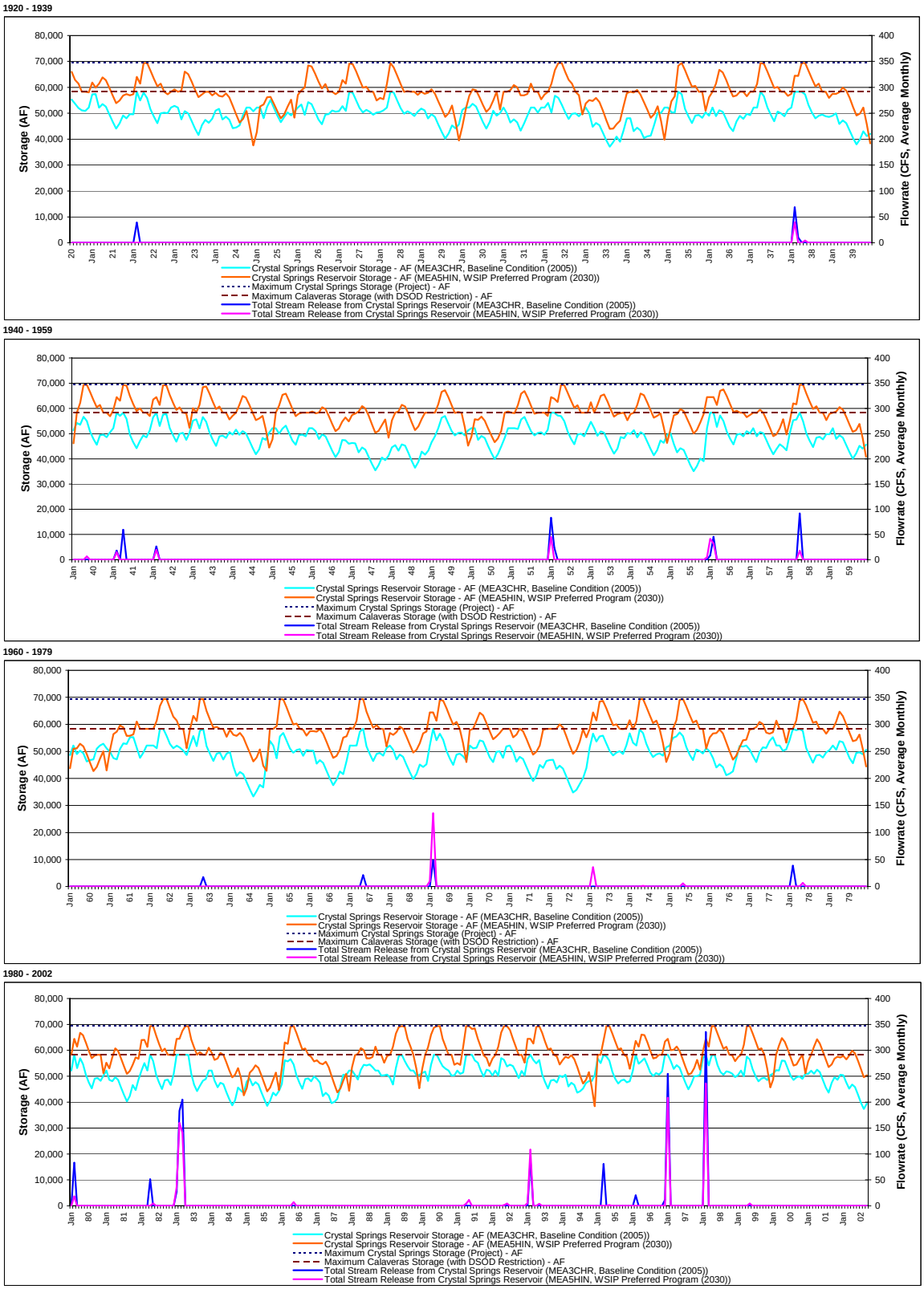
Figure 5.5.1-8 shows chronological modeled storage in Crystal Springs Reservoir using hydrology data from the period 1920 to 2002. The figure compares the WSIP to the existing condition and shows that Crystal Springs Reservoir storage with the WSIP would be greater in most years. The exception occurs every fifth year, as maintenance of the conveyance components of the Hetch Hetchy system would reduce the importation of water and require that water be withdrawn from local storage to meet water deliveries. Although maintenance is predicted to occur every five years, flexibility in the schedule could shift the years in which maintenance occurs. Maintenance would occur during the months of October, November, and December, when the demand for water is at its seasonal minimum. During these months, water levels in Crystal Springs Reservoir would fall by as much as 16 feet, and then recover when maintenance is completed.

Average monthly storage in San Andreas Reservoir is shown in **Figure 5.5.1-9** with the WSIP and under the existing condition. Under both scenarios, storage in the reservoir would typically fluctuate during the year between the full capacity of 19,000 acre-feet (6.2 billion gallons) and 17,200 acre-feet (5.6 billion gallons). Average monthly water levels with the WSIP and under existing conditions would be within a foot or two of each other, except during maintenance activities, as described below.

With implementation of the WSIP, storage in San Andreas Reservoir would be drawn down in every fifth year for planned maintenance of the conveyance components of the Hetch Hetchy system. When maintenance occurs, it would be in the months of October, November, and December. During these months, water levels in San Andreas Reservoir would fall by as much as 14 feet, and then recover when maintenance is completed.

Flow in San Mateo Creek

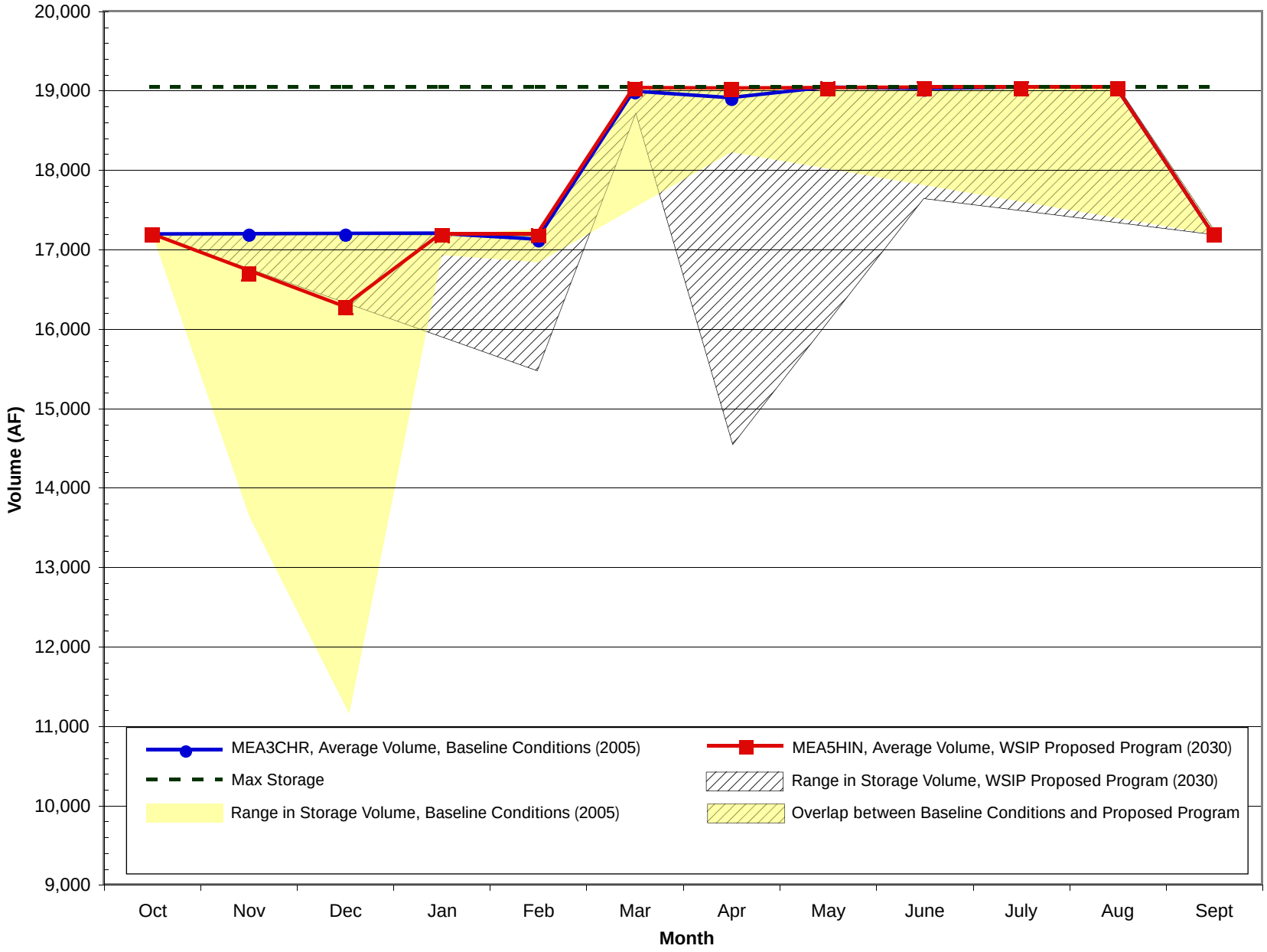
The SFPUC attempts to capture as much runoff as possible from the upper San Mateo Creek watershed in San Andreas and Crystal Springs Reservoirs. Most of the time, the SFPUC captures all of the runoff from the upper watershed, and no water is released to San Mateo Creek below Crystal Springs Dam. During the rainy season, the operators of the reservoir obtain frequent weather forecasts and manage the reservoir to capture as much runoff as possible from the sequence of winter storms that cross the watershed. The operators' decisions with respect to reservoir management are made on a day-to-day, sometimes hour-to-hour basis. In some



SFPUC Water System Improvement Program ▪ 203287

SOURCE: SFPUC, HH/LSM (see Appendix H).

Figure 5.5.1-8
Crystal Springs Storage and Releases to San Mateo Creek



SOURCE: SFPUC, HH/LSM (see Appendix H)

Figure 5.5.1-9
Average Monthly Storage Volume,
San Andreas Reservoir

circumstances, the operators are unable to capture all of the runoff due to the unpredictability of the weather. Releases to the creek only occur when runoff cannot be contained in the reservoirs or conveyed to customers after treatment at the Harry Tracy Water Treatment Plant.

As a consequence of the reservoir operations described above, no releases are usually made from Crystal Springs Reservoir in dry, below-normal, and normal hydrologic years, and flow in San Mateo Creek immediately below Lower Crystal Springs Dam typically occurs only as a result of groundwater infiltration and seepage around the dam. Occasionally in wet months of wet and above-normal years, the SFPUC releases water from the reservoir, thus increasing flow in San Mateo Creek. As the creek flows toward San Francisco Bay, it gains flow from tributaries, groundwater infiltration, and discharges of urban stormwater. There is no stream gage on San Mateo Creek, so actual flows are not known. When the infrequent releases from Crystal Springs Reservoir occur, they probably represent a substantial proportion of flow in the creek. In the dry season, flow in the nontidal reach of the creek is minimal, consisting primarily of groundwater infiltration and urban stormwater associated with car washing and over-irrigation of landscaping.

With the WSIP in place, the SFPUC would operate the reservoirs in the San Mateo Creek watershed as they are currently operated. Releases to San Mateo Creek would occur infrequently, as they do under the existing condition, and would be of a similar magnitude.

Impact Conclusions

The WSIP would not alter the character of San Mateo Creek immediately below Lower Crystal Springs Dam—it is an intermittent stream under the existing condition and would remain so with the WSIP. Releases to the creek are infrequent under the existing condition and would remain so with the WSIP. The total volume of releases might be somewhat higher or lower than under the existing condition depending on circumstances, but the range of flows with the WSIP would be similar to those under the existing condition. Adverse impacts on flow along San Mateo Creek would be *less than significant*, and no mitigation measures would be required.

Impact 5.5.1-2: Effects on flow along Pilarcitos Creek.

Reservoir Operations

Pilarcitos Reservoir fills with runoff from the upper Pilarcitos Creek watershed. It receives only local runoff and cannot be filled with imported water. Water from the upper Pilarcitos Creek watershed is diverted to Crystal Springs and San Andreas Reservoirs for use by the SFPUC and is used to supply water to the Coastside CWD. Coastside CWD diverts water from Pilarcitos Creek at Stone Dam, about two miles below Pilarcitos Reservoir. During the rainy season, flow in Pilarcitos Creek at Stone Dam is sufficient to meet the Coastside CWD's needs. During the drier months, when creek flow below Pilarcitos Reservoir subsides, the SFPUC releases water from the reservoir for diversion by Coastside CWD. Pilarcitos Reservoir is drawn down in the drier months and then refilled in the rainy season. Pilarcitos Reservoir and Stone Dam are typically operated to minimize spills from Stone Dam to Pilarcitos Creek, although small experimental

releases are currently being made as part of a study of aquatic resources. The WSIP would not change the SFPUC's operational goals for Pilarcitos Reservoir and Stone Dam, but, assuming implementation of the scenario described earlier, the program would affect water levels in the reservoir and flow in Pilarcitos Creek, both between Pilarcitos Reservoir and Stone Dam and below Stone Dam.

Water Storage and Water Levels in Pilarcitos Reservoir

Seasonal changes in storage and water surface elevation in Pilarcitos Reservoir under the existing condition are shown in Figure 5.5.1-6. With the WSIP, storage in the reservoir would follow a similar seasonal pattern as under the existing condition, but would be drawn down more rapidly in the late spring and summer. The increased rate of drawdown is primarily attributable to increased water demand in the Coastside CWD service area, which is served by releases from the reservoir. As water demand increases in the Coastside CWD service area, additional water would be drawn from Pilarcitos Reservoir.

Storage in Pilarcitos Reservoir with the WSIP would be reduced much of the time, except when the reservoir is full and spilling, or at its minimum elevation and no further diversions can be made. Under existing conditions and in dry periods, storage in the reservoir becomes depleted by the late summer, and the only releases made to Pilarcitos Creek are the consequence of inflow to the reservoir from groundwater and tributary streams. Depletion of the reservoir in dry periods would occur earlier in the year with the WSIP.

Flow in Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam

Under the existing condition, releases are typically made from Pilarcitos Reservoir to the creek to provide water to Coastside CWD, with the releases rising to the capacity of Coastside CWD's delivery pipeline in the summer when water demand is at its seasonal maximum. No releases are made if the runoff from tributary streams between Pilarcitos Reservoir and Stone Dam is sufficient to meet demand in the Coastside CWD service area, although spills from the reservoir may occur if it is full. With the WSIP, releases would follow the same seasonal pattern of water demand as under the existing condition, but the releases would be at the capacity of Coastside CWD's delivery pipeline more of the time in order to meet increased water demand in the Coastside CWD service area.

Under the existing condition during normal, below-normal, and dry years, storage in Pilarcitos Reservoir is routinely drawn down so far by late summer that the releases do not meet Coastside CWD's needs. During these times, Coastside CWD activates a pump and draws water from Crystal Springs Reservoir. This would occur more frequently in the future with the WSIP, given the expected increase in Coastside CWD's water demand.

Most runoff into Pilarcitos Reservoir occurs between November and April. In normal, above-normal, and wet years when the reservoir is full and runoff exceeds the capacity of the diversion tunnels to San Andreas and Crystal Springs Reservoirs, the reservoir spills to Pilarcitos Creek. Because Pilarcitos Reservoir is drawn down to its minimum elevation in late summer in all but

the wettest of years, the WSIP would have a negligible effect on wintertime spills to Pilarcitos Creek in most years. Some reduction in spills could occur in wet years.

The WSIP would increase flow in Pilarcitos Creek immediately below Pilarcitos Reservoir in some late spring and summer months of most hydrologic year types as a result of increased releases from the reservoir to meet Coastside CWD's needs. In the summer months of dry years, Pilarcitos Reservoir would became depleted earlier in the year with the WSIP than it does under the existing condition. Coastside CWD would activate its pumps and draw water from Crystal Springs Reservoir earlier in the year than it does under the existing condition. At such times, there would be no releases from Pilarcitos Reservoir to the creek except for dry season inflow to the reservoir. Flow in the creek below the reservoir would be the same as under the existing condition, consisting of inflow releases, seepage from the dam, infiltration from groundwater, and tributary flow. The period of minimal flow below Pilarcitos Reservoir would be extended with the WSIP, because the reservoir would be drawn down to its minimum elevation earlier in the year.

Flow in Pilarcitos Creek Below Stone Dam

Under the existing condition, water occasionally spills over Stone Dam to Pilarcitos Creek. There is little flow in Pilarcitos Creek immediately below Stone Dam most of the time, and no flow in dry periods. Spills over Stone Dam occur when releases from Pilarcitos Reservoir and runoff into Pilarcitos Creek between the reservoir and Stone Dam exceed the capacity of the diversion at Stone Dam. Occasional spills over Stone Dam would continue under the WSIP. The volume of spills would be reduced by the additional amount of Pilarcitos Creek water that the SFPUC supplies to Coastside CWD.

In most months in wet years, spills over Stone Dam with the WSIP and under the existing condition would be the same. In some winter and early spring months, spills with the WSIP would probably be less than under the existing condition. Spills at Stone Dam typically occur in wet years when Pilarcitos Reservoir is full, Coastside CWD's demand is met, and the SFPUC cannot transfer water to the San Mateo Creek watershed, either because available water in the Pilarcitos Creek watershed exceeds the capacity of the SFPUC's tunnels to San Andreas and Crystal Springs Reservoir or those reservoirs are already full.

Because most flow from the upper watershed of Pilarcitos Creek is diverted for municipal water supply, most of the flow in the creek below Stone Dam is supplied by runoff from the lower watershed. For example, in the four-month period between January and April of 1998 (a wet year), total measured flow in Pilarcitos Creek at Half Moon Bay, near the mouth of the creek, was about 32,300 acre-feet (equivalent to a continuous flow of 136 cfs). At a gage that records both spills at Stone Dam and flow in a Pilarcitos Creek tributary downstream of the dam, flow was measured at 10,500 acre-feet (equivalent to a continuous flow of 44.2 cfs) for the same period. Thus, spills in 1998 over Stone Dam represented less than one-third of total flow in Pilarcitos Creek.

Impact Conclusions

The WSIP would not alter the character of Pilarcitos Creek immediately below Stone Dam. Flow in the creek immediately below the dam is intermittent under the existing condition and would continue to be intermittent with the WSIP, so no adverse hydrologic effects would occur. With the WSIP, total spills to the creek immediately below Stone Dam would be reduced, but the magnitude of the flows in the lower reaches of the creek would be similar to those under existing conditions. Therefore, adverse impacts on water levels in Pilarcitos Reservoir and on flow along Pilarcitos Creek below Stone Dam would be *less than significant*, and no mitigation measures would be required.

Flow in Pilarcitos Creek immediately below Pilarcitos Reservoir would be the same or greater with the WSIP than under the existing condition most of the time. In dry periods and in the summer, releases to the creek from Pilarcitos Reservoir would be reduced to dry-season reservoir inflow at an earlier date than under the existing condition. The creek's character in the reach immediately below Pilarcitos Reservoir would not be altered from its existing condition. The creek experiences minimal flow in most summers under the existing condition and would continue to do so with the WSIP. Therefore, this impact would be *less than significant*, and no mitigation measures would be required.

References – Stream Flow and Reservoir Water Levels

Todd Engineers, *Lower Pilarcitos Creek Groundwater Basin Study*, 2003.

5.5.2 Geomorphology

The following setting section describes the geomorphology of the streams on the San Francisco Peninsula that could be affected by the WSIP. The impact section (Section 5.5.2.2) provides a description of the changes in stream channel form and erosion and siltation rates that would result from WSIP-induced changes in stream flow, as described in Section 5.5.1.

5.5.2.1 Setting

Geomorphology

The geomorphology of the SFPUC Peninsula watershed is defined by the San Andreas fault and its associated steep terrain, northwest-trending ridges and valleys, and ongoing uplifting and erosional processes. Fifield and Cahill Ridges divide the two principal watersheds, San Mateo Creek to the east and Pilarcitos Creek to the west. The San Mateo Creek watershed above Crystal Springs Dam is 22.5 square miles in size, in addition to the 4.4-square-mile watershed above San Andreas Reservoir. The Pilarcitos Creek watershed above Pilarcitos Reservoir is 3.8 square miles.

San Mateo Creek below Crystal Springs Dam initially flows eastward through a steep canyon for about 1.5 miles, then enters the broad, gently sloping lands surrounding San Francisco Bay. The canyon itself is rather narrow, but contains several alluvial terraces for most of its length. In the canyon, San Mateo Creek has a 1 percent slope. It passes through Franciscan Complex sandstone and some serpentine, then through the Colma Formation, a Pleistocene formation of marine and nonmarine sands and clays, and the recent Temescal Formation, which is composed primarily of fine-textured sand. The channel in San Mateo Creek canyon is primarily riffle and pool. The creek channel is comparatively deep and broad for the current flow due to the high historical unimpaired flows. The channel bed is composed primarily of sand and silt, with some gravel deposits. Below the canyon, San Mateo Creek is a meandering channel with a slope of about 0.25 percent. This reach of the creek has been highly modified and constrained by urbanization. The creek flows through several culverts before discharging to San Francisco Bay.

Above Crystal Springs Dam, San Andreas Creek empties into San Andreas Reservoir. Its natural course below the dam follows a straight, narrow valley along the San Andreas fault southeasterly into Lower Crystal Springs Reservoir. San Mateo Creek itself originates to the southwest, in the steep country between Fifield and Sawyer Ridges. It follows a relatively straight course for nearly eight miles before emptying into Lower Crystal Springs Reservoir. The creek's slope varies from about 1 percent in the upper reaches and about 2 percent in the narrow canyon before it enters the reservoir. From the southeast, Laguna Creek is the principal tributary to Upper Crystal Springs Reservoir, which is connected via culverts with Lower Crystal Springs Reservoir. Rainfall within the watershed ranges from about 30 to 40 inches per year (USDA, 1961).

The northern portion of the upper San Mateo Creek watershed is steep and rugged. Like the Pilarcitos Creek watershed, average hillslope gradients range from 3:1 to 1:1 (horizontal to vertical ratio), while the southern portion of the watershed has average gradients ranging from

5:1 to 3:1 (San Francisco Planning Department, 2001). The San Andreas Creek and San Mateo Creek watersheds are composed of Franciscan Complex sedimentary and metamorphic rocks. Sandstone, shale, chert, and conglomerate marine deposits are predominant to the southwest of the San Andreas fault, while metamorphosed Franciscan rock, such as serpentine, is widespread on the northeastern side of the fault. The watershed surrounding Upper Crystal Springs Reservoir is composed of Butano Formation, Eocene marine sedimentary rocks such as fine-textured sandstones and shale (Jennings and Burnett, 1961).

Sediment transport thresholds and rates have not been monitored or evaluated in these reaches. No sediment transport data have been quantified for these watersheds. However, the steep slopes are inherently highly erodible, and natural landslides are an important landscape-forming influence. This watershed has been unaffected by livestock grazing and wildfire for many decades. The SFPUC has constructed and maintains a system of sediment catchment basins around the reservoirs to capture the incoming sediment.

Pilarcitos Creek originates in between Fifield Ridge and the western Coast Ranges. It follows the Pilarcitos fault, parallel to and west of the San Andreas fault. Three unnamed tributaries flow into Pilarcitos Reservoir through relatively low-gradient valleys consisting of Farallone coarse sandy loam. Below the reservoir, Pilarcitos Creek flows in a southeasterly direction past Stone Dam, eventually emptying into the Pacific Ocean near Half Moon Bay. The upper reaches above Pilarcitos Reservoir are composed of Franciscan Complex volcanic, metavolcanic (metamorphosed volcanic rock), and sedimentary Cretaceous rock. Below the dam, Mesozoic granite underlies the western side of the creek, and Franciscan Complex bedrock underlies the eastern side (Jennings and Burnett, 1961). The corresponding soils are Hugo and Josephine loam and Sheridan coarse sandy loam.

Slopes in the Pilarcitos Creek watershed have average gradients ranging from 3:1 to 1:1 (San Francisco Planning Department, 2001). The slopes in the canyon below Pilarcitos Dam are extremely steep. For about a mile downstream from Pilarcitos Dam, Pilarcitos Creek has a slope of about 1 percent. Soils are mapped as a gravelly substrate with no further classification (USDA, 1961). There is very little terracing in the narrow valley, and bedrock is frequently exposed. Average annual rainfall is 45 inches at Pilarcitos Reservoir, and the typical five-year storm brings 3.6 inches of rainfall in 24 hours (USDA, 1961).

5.5.2.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to geomorphology, but generally considers that implementation of the proposed program would have a significant impact if it were to:

- Substantially change the topography such that ecological, hydrologic, or aesthetic functions are adversely affected, or substantially change any unique geologic or physical features of the site or area

- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of the stream or river, in a manner that would result in substantial erosion or siltation or adversely affect the ecological, hydrologic, or aesthetic functions of the site or area

Although the "substantial change in topography" criterion is typically applied to upland areas, it is considered applicable to stream channel/bank topography in this instance because of the sensitivity of the resources that depend on the topography of these features (i.e., riparian vegetation and fisheries). For a stream channel, the relevant aspect of topography to be evaluated are those associated with channel form and the related movement and distribution of sediment.

Approach to Analysis

This impact section presents a discussion of projected changes in sediment transport and geomorphology based on changes in stream flow, reservoir storage, and related reservoir water levels that would result from WSIP implementation, as described in Section 5.5.1. A qualitative assessment of potential effects was conducted based on generalized channel bed/bank characteristics and consideration of proposed changes in stream flow that would result from implementation of the WSIP.

Impact Summary

Table 5.5.2-1 presents a summary of the impacts on sediment transport and geomorphology in the Peninsula watershed that could result from implementation of the proposed water supply and system operations.

TABLE 5.5.2-1
SUMMARY OF IMPACTS – GEOMORPHOLOGY
OF SAN FRANCISCO PENINSULA STREAMS AND RESERVOIRS

Impact	Significance Determination
Impact 5.5.2-1: Changes in sediment transport and channel morphology in the Peninsula watershed	LS

LS = Less than Significant impact, no mitigation required

Impact Discussion

Impact 5.5.2-1: Changes in sediment transport and channel morphology in the Peninsula watershed.

Changes in storage and water levels in reservoirs in the San Mateo Creek watershed attributable to the WSIP were estimated using the HH/LSM. An overview of the model is presented in Section 5.1. Detailed information on the model and the assumptions that underlie it is provided in Appendix H. Changes in stream flow and reservoir storage and water levels in the Pilarcitos

Creek watershed attributable to the WSIP were estimated semi-quantitatively by reviewing historical data and consulting with individuals knowledgeable about past and expected future reservoir operations.

Releases to San Mateo Creek downstream of Lower Crystal Springs Dam are expected to be approximately the same with the WSIP as they are under the existing condition. Thus, the WSIP would have no effect on channel-forming events and sediment transport in this already highly impaired creek.

Implementation of the WSIP would also result in higher average reservoir levels in Upper and Lower Crystal Springs Reservoirs, which in turn would cause tributary streams to deposit their sediment at correspondingly higher elevations. The amount of incoming sediment would not be affected. The reservoir level at San Andreas Reservoir is projected to change very little, so no impact on sediment transport and channel morphology would occur, even at the mouths of tributary streams.

Increased releases from Pilarcitos Reservoir into Pilarcitos Creek in most spring and early summer months would increase sediment transport and channel-forming processes in the creek compared to the existing condition. The projected lower flows in the summer months of dry years would reduce sediment transport and channel-forming processes compared to the existing condition. Both the increases and decreases in sediment transport would be small and relatively inconsequential, because channel form is largely a function of the magnitude and frequency of occasional large winter flows, which would not be affected by the WSIP.

Under the WSIP, spills over Stone Dam in the wet months of above-normal and wet years would be reduced in frequency and magnitude. This could in turn reduce sediment movement and channel-forming processes in the reach of Pilarcitos Creek immediately below the dam, but with decreasing effect in a downstream direction as tributaries add flow to the creek.

WSIP-induced changes in flow in San Mateo and Pilarcitos Creeks and the changes in reservoir level in Pilarcitos, San Andreas, and Upper and Lower Crystal Springs Reservoirs would result in small incremental reductions or no change in sediment transport and channel-forming processes.

The projected changes in flow would result in insignificant changes in topography, drainage patterns, erosion, and siltation in and away from the creeks and reservoirs in the Peninsula watershed. Therefore, impacts on fluvial geomorphologic characteristics in the Peninsula watershed would be *less than significant*, and no mitigation is required.

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References – Geomorphology

Jennings, Charles W. and John Burnett, *Geologic Map of California, San Francisco Sheet*, California Department of Natural Resources, Sacramento, 1961.

San Francisco Planning Department, *Peninsula Watershed Management Plan EIR*, prepared by Environmental Science Associates for the San Francisco Planning Department, 2001.

U.S. Department of Agriculture (USDA), *Soil Survey, San Mateo Area*, 1961.

5.5.3 Surface Water Quality

The following setting section describes surface water quality in streams and reservoirs on the San Francisco Peninsula that could be affected by the WSIP. The impact section (Section 5.5.3.2) provides a description of the changes in water quality in streams and reservoirs that would result from WSIP-induced changes in stream flow and reservoir water levels.

5.5.3.1 Setting

The SFPUC operates four reservoirs on the Peninsula: the Pilarcitos, Upper and Lower Crystal Springs, and San Andreas Reservoirs. The Upper and Lower Crystal Springs Reservoirs function as a single water body. The WSIP could affect water quality in the reservoirs. Water quality in two streams on the San Francisco Peninsula could also be affected by the WSIP. They are San Mateo Creek and Pilarcitos Creek, both of which rise in the Coast Range mountains. San Mateo Creek, and its tributary San Andreas Creek, flow southward in the rift valley formed by the San Andreas fault and then turn east, flowing to San Francisco Bay. Pilarcitos Creek also flows southward, but it turns to the west and flows to the Pacific Ocean.

Crystal Springs Reservoir, San Andreas Reservoir, and San Mateo Creek

Water quality in San Andreas and Crystals Springs Reservoirs reflects that of its sources—local runoff, Alameda Creek, Pilarcitos Creek, and the Tuolumne River. Because the Tuolumne River is the source of most of the water, it is the predominant influence on water quality in the reservoirs. Water quality is generally very good, exhibiting low concentrations of total dissolved solids and plant nutrients (nitrates and phosphates).

Crystal Springs Reservoir stratifies in the summer months; that is, the upper part of the reservoir (the “epilimnion”) warms, while water in the lower part of the reservoir (the “hypolimnion”) remains cool. The dividing line between the two zones is called the thermocline and is typically 25 to 50 feet below the surface of the reservoir. The two zones do not mix, and water in the hypolimnion becomes depleted of oxygen. As air temperatures drop in the fall and water in the epilimnion cools, the reservoir “turns over.” The reservoir then destratifies and water in the two zones mixes.

Although nutrient concentrations in the reservoirs are low, they are sufficient to support the growth of algae in the summer months. Algae in a water source can make water treatment more difficult and cause taste and odor problems with finished water. In 2005, the SFPUC changed the method it uses to disinfect water in order to comply with drinking water standards. Formerly, the SFPUC disinfected water with chlorine; now it uses chloramine, a chemical compound that contains both chlorine and ammonia. Ammonia is a form of nitrogen that rapidly decomposes in natural waters to another form of nitrogen called nitrate. Past studies have shown that the growth of algae in Crystal Springs Reservoir is limited by a lack of nitrogen and phosphorous, both of which are plant nutrients; therefore, an increase in the concentration of either could increase the growth of algae. To avoid the discharge of nitrogen and the possible consequent increase in algae concentration in Crystal Springs Reservoir, the SFPUC constructed dechloramination facilities at

the same time it constructed chloramination facilities. The dechloramination facilities completely remove the chlorine and remove most of the ammonia from water before it is discharged to Crystal Springs Reservoir. The use of chloramine as a disinfectant has resulted in a small increase in the concentration of nitrate in Crystal Springs Reservoir (SFPUC, 2006).

When Lower Crystal Springs Reservoir spills, water quality in San Mateo Creek is very similar to reservoir water quality. However, most of the time, when creek flow immediately below Lower Crystal Springs Dam consists of seepage from the dam and inflow from the ground, the quality of water in the creek is lower than that in the reservoir. **Table 5.5.3-1** shows water quality at three locations along San Mateo Creek below Lower Crystal Springs Dam as measured between May 2003 and February 2004. Water quality at the Polhemus sampling station 0.7 mile below Lower Crystal Springs Dam was generally good, with a total dissolved solids concentration in the range 124 to 211 milligrams per liter (mg/L) and dissolved oxygen concentrations at or near saturation. Water quality deteriorated as San Mateo Creek flowed through the urban areas to San Francisco Bay. Total dissolved solids concentrations at the Gateway Park station, 5.1 miles downstream of Crystal Springs Dam, were in the range of 332 to 427 mg/L, except on one occasion when sampling results were affected by the tide. Late-summer and fall dissolved oxygen concentrations were at about 50 percent saturation.

Pilarcitos Reservoir and Pilarcitos Creek

Water quality in Pilarcitos Reservoir is good because the Pilarcitos Creek watershed above the reservoir is largely undeveloped. Plant nutrient concentrations in Pilarcitos Reservoir water are low, but 50 to 100 percent greater than in the water stored in the San Andreas and Crystal Springs Reservoirs. Summertime algae concentrations in Pilarcitos Reservoir are also greater than those in Crystal Springs and San Andreas Reservoirs.

Like Crystal Springs Reservoir, Pilarcitos Reservoir stratifies in the summer months. Water in the bottom part of the reservoir becomes depleted of oxygen.

Beneficial Uses and Water Quality Objectives

Pursuant to the federal Clean Water Act and the Porter-Cologne Water Quality Control Act, the San Francisco Bay Regional Water Quality Control Board has designated beneficial uses that Crystal Springs, San Andreas, and Pilarcitos Reservoirs and San Mateo and Pilarcitos Creeks must support. Designated existing beneficial uses for Crystal Springs, San Andreas, and Pilarcitos Reservoirs are municipal and domestic water supply (MUN), non-water-contact recreation (REC-2), cold freshwater habitat (COLD), warm freshwater habitat (WARM), fish spawning (SPWN), wildlife habitat (WILD), and rare and endangered species (RARE). Pilarcitos Reservoir is listed as having water-contact recreation as a limited beneficial use.

Existing designated beneficial uses for San Mateo Creek are freshwater replenishment (FRSH), SPWN, and RARE. Potential beneficial uses of San Mateo Creek are water contact recreation (REC-1), REC-2, and COLD. Current designated beneficial uses of Pilarcitos Creek are agricultural water supply (AGR), MUN, COLD, WARM, SPWN, RARE, WILD, and migration of aquatic organisms (MGR). Potential designated uses of Pilarcitos Creek are REC-1 and REC-2.

TABLE 5.5.3-1
WATER QUALITY IN SAN MATEO CREEK BELOW CRYSTAL SPRINGS RESERVOIR

Water Quality Parameter (Median Values)	Monitoring Station		
	Polhemus	Arroyo Court Park	Gateway Park
Distance downstream of Crystal Spring Dam, miles	0.7	4.2	5.1
Median Electrical Conductivity, µS/cm (total dissolved solids, mg/L)			
May 2003	230 (133)	514 (298)	607 (352)
Aug 2003	214 (124)	551 (320)	737 (427)
Oct 2003	183 (106)	493 (286)	27,600 (16,000)[a]
Feb 2004	364 (211)	681 (395)	572 (332)
Dissolved Oxygen, mg/L (% of saturation)			
May 2003	10.8 (101%)	5.5 (52%)	9.5 (91%)
Aug 2003	7.9 (85%)	7.2 (76%)	3.8 (43%)
Oct 2003	8.2 (83%)	9.4 (92%)	4.3 (46%)
Feb 2004	10.4 (91%)	11.8 (102%)	10.8 (93%)
Temperature, °C			
May 2003	13	13	13
Aug 2003	19	18	19
Oct 2003	16	15	16
Feb 2004	9	9	9

[a] This measurement was influenced by the tidal incursion of saline water.
°C = degrees Celsius
mg/L = milligrams per liter
µS/cm = microsiemens per centimeter

SOURCE: SFPUC, 2004.

Prior to being discharged into Upper Crystal Springs Reservoir, Hetch Hetchy system water that has been disinfected with chloramine is treated to remove chlorine and ammonia and to adjust its pH. Chloramine contains chlorine and ammonia, both of which are toxic to aquatic organisms. The Regional Water Quality Control Board has established a discharge limit of 0.0 mg/L for chlorine residual, which includes both free chlorine[1] and chloramine. In order to meet this limit, the SFPUC neutralizes the chloramine residual in Hetch Hetchy water before it is discharged to the two reservoirs, thus eliminating toxicity to aquatic life. However, some residual ammonia remains after neutralization (SFPUC, 2006).

1 Free chlorine consists of a compound, hypochlorous acid, and the hypochlorite ion, both of which form when chlorine gas is added to water.

Unlike chlorine, ammonia is regulated as a water quality objective for receiving waters. Ammonia exists in two forms in water: un-ionized and ionized forms. Un-ionized ammonia is toxic, whereas its ionized form is relatively harmless. The water quality objective for ammonia is specified as un-ionized ammonia (the toxic form), and the water quality objective of 0.40 mg/L of un-ionized ammonia as nitrogen applies. The relative concentration of the two forms of ammonia depends on the pH and temperature of the water. The un-ionized (toxic) form increases as the temperature and pH increase. In the temperature and pH range of natural waters, the nontoxic form of ammonia predominates; in most instances, ammonia in discharges is diluted or degraded to a nontoxic form fairly rapidly. In the SFPUC water supply, the maximum total ammonia concentration before dechloramination is about 0.5 mg/L. When added to Crystal Springs Reservoir under typical receiving-water conditions (pH = 8.5, and water temperature = 24 °C), the maximum resulting concentration of un-ionized ammonia would be about 0.07 mg/L, which is well below the objective of 0.40 mg/L. However, because water is dechloraminated prior to discharge into the reservoir, the actual concentrations of un-ionized ammonia would be close to zero.

5.5.3.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to surface water quality, but generally considers that implementation of the proposed program would have a significant surface water quality impact if it were to:

- Substantially impair a water body's ability to support beneficial uses designated by the State Water Resources Control Board or Regional Water Quality Control Board
- Otherwise substantially degrade water quality

Approach to Analysis

Changes in reservoir storage and water levels in the San Mateo Creek watershed attributable to the WSIP were estimated using the HH/LSM. An overview of the model is presented in Section 5.1. Detailed information on the model and the assumptions that underlie it is provided in Appendix H. Changes in stream flow in both the San Mateo and Pilaracitos watersheds and changes in reservoir storage and water levels in the Pilarcitos watershed attributable to the WSIP were estimated semi-quantitatively in consultation with individuals knowledgeable about the historical, current, and expected future (with-WSIP) water system operations.

Impact Summary

Table 5.5.3-2 presents a summary of the impacts on the water quality of Peninsula watershed streams and reservoirs that could result from implementation of the proposed water supply and system operations.

TABLE 5.5.3-2
SUMMARY OF IMPACTS – WATER QUALITY
OF SAN FRANCISCO PENINSULA STREAMS AND RESERVOIRS

Impact	Significance Determination
Impact 5.5.3-1: Effects on water quality in Crystal Springs Reservoir, San Andreas Reservoir, and San Mateo Creek	LS
Impact 5.5.3-2: Effects on water quality in Pilarcitos Reservoir and along Pilarcitos Creek	PSM

LS = Less than Significant impact, no mitigation required
PSM = Potentially Significant impact, can be mitigated to less than significant

Impact Discussion

Impact 5.5.3-1: Effects on water quality in Crystal Springs Reservoir, San Andreas Reservoir, and San Mateo Creek.

Crystal Springs and San Andreas Reservoirs

The proposed program would affect water quality in Crystal Springs and San Andreas Reservoirs. Average monthly storage would increase in Crystal Springs Reservoir by 5 to 10 percent. The reservoir would capture more local runoff and hold more water from the Hetch Hetchy system. However, the proportions of local runoff and Hetch Hetchy water in the reservoir with the WSIP would remain about the same most of the time compared to existing conditions.

It is possible, however, that with the WSIP the proportion of Hetch Hetchy water in Crystal Springs Reservoir could increase at times relative to existing conditions, particularly in the winter. An increase in the proportion of Hetch Hetchy water, which is disinfected with chloramine, would increase the concentration of nitrogen to the reservoir. Although the SFPUC removes chlorine and ammonia, the constituents of chloramine, from Hetch Hetchy water before it is discharged into Crystal Springs Reservoir, the removal of ammonia is not complete, and so some nitrogen is added to the reservoir. As noted earlier, the nitrate concentration has risen in Crystal Springs Reservoir waters since chloramine disinfection was initiated. If the proportion of Hetch Hetchy water placed in Crystal Springs Reservoir increased as a result of the WSIP, then the rate of discharge of nitrogen into the reservoir would also increase. The increase in nitrogen concentration in the reservoir would have the potential to increase the growth of algae.

The increase in storage and water level in Upper Crystal Springs Reservoir could increase the stability of thermal stratification. The increase in storage would be a result of restored capacity in Crystal Springs Reservoir and improvements to the conveyance components of the Hetch Hetchy system that would enable the SFPUC to refill local reservoirs with Tuolumne River water more reliably than under the existing condition. More stable thermal stratification combined with the input of oxygen-demanding substances associated with chloramination and dechloramination could deplete oxygen levels below the thermocline to a greater degree than under existing conditions. Under oxygen-depleted conditions, nutrients are released from the sediments at the

bottom of the reservoir. If the proposed program increased the volume of oxygen-depleted water at the bottom of the reservoir, it could increase the release of phosphorous. Increased release of phosphorous and increased phosphorous concentrations in reservoir water would have the potential to increase the growth of algae.

Studies completed over the last several years indicate that the growth of algae in Crystal Springs Reservoir has historically been limited by both nitrogen and phosphorous concentrations. After the SFPUC began disinfecting Hetch Hetchy water with chloramine, the nitrogen concentration in the reservoir increased, and the concentration of phosphorous in reservoir water became the factor limiting the growth of algae. Thus, the addition of more nitrogen as a result of a WSIP-induced increase in the proportion of Hetch Hetchy water in Crystal Springs Reservoir would not alone increase the growth of algae. Increased phosphorous concentrations in the reservoir as a result of the more stable thermal stratification induced by the WSIP would increase the growth of algae.

The WSIP would have very little effect on average monthly storage in San Andreas Reservoir. The proportion of local runoff and Hetch Hetchy water is expected to remain the same as under existing conditions.

The WSIP could have a minor effect on water quality in Crystal Springs Reservoir and a negligible effect on water quality in San Andreas Reservoir. Any water quality changes would be too small to affect beneficial uses. If water quality changes in Upper Crystal Springs Reservoir resulted in increased growth of algae, water treatment could become more difficult and expensive. Adverse impacts of the WSIP on water quality in Crystal Springs and San Andreas Reservoirs would be less than significant, and no mitigation is required.

San Mateo Creek

Most of the time, flow in San Mateo Creek immediately below Lower Crystal Springs Dam is very low and consists of seepage through and around the dam. Occasionally, in wet months of wet and above-normal years, the SFPUC releases water to the creek from the dam. The creek then gains water from tributaries, groundwater, and urban runoff as it flows to San Francisco Bay. Water quality is good immediately below the dam and deteriorates in a downstream direction.

Under current conditions, the releases from Crystal Springs Reservoir in the winter and spring months of wet and above-normal years probably affect water quality in San Mateo Creek in two ways. The releases have a direct and beneficial effect on water quality during the releases themselves because a higher proportion of stream flow consists of high-quality Crystal Springs Reservoir water. The second effect of the releases is to contribute to periodic large “flushing flows” that serve to wash debris and accumulated organic matter out of the stream and into San Francisco Bay. In California’s Mediterranean climate, leaves, lawn clippings, and the detritus of urban life tend to accumulate in the beds of urban streams during the dry summer months. The accumulated organic matter has an adverse effect on water quality, depleting the dissolved oxygen content of stream water and producing plant nutrients. Wintertime flushing flows remove some of the organic matter, reducing its ability to adversely affect water quality.

Under current conditions, releases of high-quality Crystal Springs Reservoir water occur about 10 percent of the time, with beneficial effects on creek water quality. With the WSIP, releases would also occur about 10 percent of the time and at about the same magnitude. Water quality in the creek would be improved by the releases, as it is under the current condition.

Impact Summary

Overall, impacts of the WSIP on water quality in Crystal Springs and San Andreas Reservoirs and in San Mateo Creek would be *less than significant*, and no mitigation is required.

Impact 5.5.3-2: Effects on water quality in Pilarcitos Reservoir and along Pilarcitos Creek.

Pilarcitos Reservoir

Figure 5.5.1-6 shows recent past storage levels in Pilarcitos Reservoir from 1998 to 2006. Under the existing condition, the reservoir is drawn down through the summer, reaching minimum storage in October and November just before the rainy season begins. With the WSIP, drawdown would occur more rapidly in many years. The increased drawdown attributable to the proposed program could cause the reservoir to destratify earlier than under existing conditions. This would not adversely affect water quality; in fact, mechanical destratification in the fall has been recommended to the SFPUC as a means of improving water quality (SFPUC, 2002).

One of the beneficial uses of Pilarcitos Reservoir is cold freshwater habitat (COLD). Because water is released from Pilarcitos Reservoir near the surface, a pool of cool water is retained through the summer near the bottom of the reservoir and below the lowest release point. Under the WSIP, the volume of the pool of cool water below the thermocline would be reduced compared to the existing condition, but would never be exhausted (for the reason noted above). However, the ability of Pilarcitos Reservoir to support the COLD beneficial use under the WSIP could be reduced. This impact would be potentially significant.

Pilarcitos Creek Between Pilarcitos Reservoir and Stone Dam

The WSIP could affect water quality in Pilarcitos Creek between Pilacitos Reservoir and Stone Dam in two ways—by altering the quality of water released from Pilarcitos Reservoir to the creek and by altering flow in the creek. As discussed above, with the WSIP in place, the volume of the pool of cool water in Pilarcitos Reservoir below the thermocline would be reduced compared to the existing condition, but the quality of water released to Pilarcitos Creek from the reservoir would change little.

The WSIP would increase flow in this reach of the creek in most spring and summer months compared to the existing condition because larger volumes of water would be released from Pilarcitos Reservoir to meet the Coastside CWD's water demand. This increased flow would generally have a beneficial effect on water quality, because water temperature in the spring and summer months would not rise as rapidly in the stream as it flows from the foot of Pilarcitos Dam to Stone Dam as it does under the existing condition. On the other hand, during dry years the

WSIP would extend the period in which no releases are made from Pilarcitos Reservoir to Pilarcitos Creek compared to the existing condition. This is because increased releases to meet Coastside's demand would deplete storage in Pilarcitos Reservoir earlier than under the existing condition. Water quality in the reach of Pilacitos Creek between Pilarcitos Reservoir and Stone Dam could deteriorate as a result. Creek flow would consist only of seepage from Pilarcitos Reservoir, groundwater infiltration, and tributary flow, none of which would be expected to contribute much water to the stream during the summer of a dry year for a longer period with the WSIP than under the existing condition. Water in the creek immediately below Pilarcitos Reservoir at such times could be reduced to isolated pools. Water temperature in the pools could rise, although the extensive vegetative cover in this reach of the creek would likely limit the potential for any such increase.

The proposed program would also reduce flow in Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam in wet months of wet years. It is not expected that the wet-year flow reductions would have an adverse effect on water quality in the stream because, during the winter, water in the creek would be cool and well oxygenated.

Two of the beneficial uses of Pilarcitos Creek are cold freshwater habitat (COLD) and migration of aquatic organisms (MGR). The MGR beneficial use cannot currently be supported in Pilarcitos Creek above Stone Dam because the dam prevents fish passage. The WSIP would extend the period in which releases from Pilarcitos Reservoir would be eliminated in the summer of dry years, which would degrade water quality in the creek between the reservoir and Stone Dam and reduce the creek's ability to support the COLD beneficial use. This impact would be potentially significant.

Pilarcitos Creek Below Stone Dam

The proposed program would have no effect on flow in Pilarcitos Creek below Stone Dam in dry and below-normal years, and consequently would have no effect on water quality in those hydrologic year types. There is no flow in the creek immediately below Stone Dam in dry and below-normal years under existing conditions, and there would be no flow with the proposed program.

With the WSIP, less water would pass over Stone Dam in wet winters than it does under the existing condition. It is unlikely that the reductions in spill over Stone Dam would have much effect on water quality in Pilarcitos Creek below Stone Dam. The reductions in spill would occur in wet years when runoff from the Pilarcitos Creek watershed below Stone Dam would be high. For this reason, the effect of the reductions on water quality in the creek below Stone Dam would be minor.

Two of the beneficial uses of Pilarcitos Creek are cold freshwater habitat (COLD) and migration of aquatic organisms (MGR). Because the proposed program would have little effect on water quality in Pilarcitos Creek below Stone Dam, impacts on water quality in Pilarcitos Creek below Stone Dam would be less than significant.

Impact Summary

Overall, adverse impacts of the WSIP on water quality in Pilarcitos Reservoir and along Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam would be *potentially significant*; however implementation of Measure 5.5.3-2, Revised Operations Plan for Pilarcitos Watershed Facilities, would maintain the current storage levels in the reservoir and reduce this impact to a less than significant level.

References – Surface Water Quality

San Francisco Public Utilities Commission (SFPUC), *Reservoir Water Quality Management Plans*, prepared for the SPFUC by Merritt Smith Consulting in cooperation with Malcom Pirnie, Olivia Chen Consultants, Water Resources Engineering, Inc., and Alex Horne Associates, March 2002.

San Francisco Public Utilities Commission (SFPUC), unpublished, Water Quality Monitoring Data for San Mateo Creek Watershed, 2004.

San Francisco Public Utilities Commission (SFPUC), *Water Quality Investigation and Assessment: Impacts of Chloramination and Associated Water Quality Implications at Crystal Springs,* prepared by Merritt Smith Consulting, 2006.

5.5.4 Groundwater

The following setting section identifies groundwater bodies in the Peninsula watershed that could be affected by the WSIP. The impact section (Section 5.5.4.2) provides a description of the changes in groundwater levels and quality that would result from WSIP-induced changes in stream flow.

5.5.4.1 Setting

The upper reaches of the San Mateo and Pilarcitos Creek watersheds are composed primarily of non-water-bearing igneous, metamorphic, and sedimentary rocks, together with recent alluvium and colluvium.[1] The main groundwater-bearing units associated with San Mateo and Pilarcitos Creeks are in their lower watersheds. Groundwaters in the lower San Mateo Creek watershed are not used for municipal water supply. Groundwaters in the lower Pilarcitos Creek provide a portion of Coastside CWD's municipal supply (Coastside CWD, 2005).

Within the lower Pilarcitos Creek watershed, the main water-bearing units are the marine terrace deposits, which are sand and gravel deposits ranging from 30 to 60 feet thick. The aquifer is bounded on the east by bedrock and on the west by the Pacific Ocean, and is underlain by the relatively impermeable Purisima Formation. Within this groundwater basin, flow is from east to west, discharging to the ocean. Total aquifer storage is estimated at 10,600 acre-feet (Todd Engineers, 2003). Percolation of Pilarcitos Creek flow is an important part of overall local aquifer recharge.

Groundwater quality is of concern in the lower Pilarcitos Creek groundwater basin, especially with respect to iron and manganese; in addition, the water is hard. Seawater intrusion is not considered a problem in the basin, but slightly elevated salt contents were probably incorporated into the aquifer during its formation. A summary of local groundwater quality is presented in **Table 5.5.4-1**; the table provides an average from a sampling program of five wells in the lower Pilarcitos Creek groundwater basin.

5.5.4.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to groundwater, but generally considers that implementation of the proposed program would have a significant groundwater impact if it were to:

- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of preexisting nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted)

[1] Alluvium consists of unconsolidated mixtures of gravel, sand, clay, and silt and is typically deposited by streams. Colluvium is a loose deposit of rock debris accumulated through the action of gravity at the base of a cliff or slope.

TABLE 5.5.4-1
SUMMARY OF GROUNDWATER QUALITY PARAMETERS, LOWER PILARCITOS CREEK BASIN

Parameter	Average Value (mg/L, unless otherwise noted)
Total Hardness	228
Alkalinity	184
pH Units	6.9
Total Dissolved Solids	426
Calcium	43
Sodium	60
Bicarbonate	188
Sulfate	50
Chloride	93
Iron	7.5
Manganese	0.61
Nitrate	8.7
Boron	0.166
Arsenic	0.0030

SOURCE: Todd Engineers, 2003.

- Substantially impair a water body's ability to support beneficial uses designated by the State Water Resources Control Board or Regional Water Quality Control Board
- Otherwise substantially degrade water quality

Approach to Analysis

Information on potentially affected groundwater bodies was obtained from published sources related to hydrogeology and groundwater management in the potentially affected area. Impact assessments were performed by reviewing WSIP-induced changes in stream flow and examining their potential to affect groundwater levels or quality.

Impact Summary

Table 5.5.4-2 presents a summary of the impacts on groundwater bodies in the Peninsula watershed that could result from implementation of the proposed water supply and system operations.

TABLE 5.5.4-2
SUMMARY OF IMPACTS – GROUNDWATER BODIES IN PENINSULA WATERSHED

Impact	Significance Determination
Impact 5.5.4-1: Alteration of stream flows along Pilarcitos Creek, which could affect groundwater levels and water quality	LS

LS = Less than Significant impact, no mitigation required

Impact Discussion

Impact 5.5.4-1: Alteration of stream flow along Pilarcitos Creek, which could affect groundwater levels and water quality.

As discussed in Impact 5.5.1-2, the proposed program would have very little effect on flow in Pilarcitos Creek below Stone Dam. There would be some reduction in wintertime spills over the dam in wet and above-normal years as a result of the WSIP, but the reduction would be too small to have an appreciable effect on groundwater recharge in the lower Pilarcitos Creek watershed. Under the existing condition and with the proposed program, the upper Pilarcitos Creek watershed contributes very little flow to the lower watershed. Most wintertime flow in the stream originates below Stone Dam, and this stream flow is the primary source of groundwater recharge. Overall, the effects of the WSIP on groundwater levels and groundwater quality would be *less than significant*, and no mitigation measures would be required.

References – Groundwater

Coastside County Water District (Coastside CWD), *2005 Urban Water Management Plan*, 2005.

Todd Engineers, *Lower Pilarcitos Creek Groundwater Basin Study*, 2003.

5.5.5 Fisheries

The following setting section describes the fishery resources within the streams and reservoirs of the San Francisco Peninsula that could be affected by the WSIP. The impact section (Section 5.5.5.2) provides a description of the effects of WSIP-induced changes in stream flow and reservoir levels on fishery resources.

5.5.5.1 Setting

Water Development

The Crystal Springs, San Andreas, and Pilarcitos Reservoirs are located in the Peninsula watershed at the base of San Mateo, Pilarcitos, and San Andreas Creeks, which are fed by coastal mountain drainage headwaters. Crystal Springs and Pilarcitos Reservoirs are stratified and become slightly anoxic during the late summer and fall, while San Andreas Reservoir remains well mixed. Water flow in San Mateo Creek below Crystal Springs Reservoir is dependent on stormwater runoff from the watershed below Lower Crystal Springs Dam, seepage from the dam, and groundwater infiltration. Water flow in Pilarcitos Creek below Stone Dam is similarly dependent on stormwater runoff from the watershed below Stone Dam and groundwater infiltration. Releases from Crystal Springs Reservoir and Stone Dam historically have occurred only in wet months of wet years. The SFPUC permits only limited recreational activity on its lands and reservoirs within the Peninsula watershed; water-contact activities, fishing, and boating on the reservoirs are not allowed.

Aquatic Habitat

San Mateo Creek

San Mateo Creek and its tributary watersheds, including San Andreas Creek, are tributary to the southern portion of San Francisco Bay. San Mateo Creek enters South San Francisco Bay approximately 1.6 miles south of the Hayward–San Mateo Bridge. Stream flows and associated fishery habitat within the San Mateo Creek watershed are affected by seasonal patterns in local rainfall and runoff as well as by San Andreas Dam (constructed in 1870), Upper Crystal Springs Reservoir (constructed in 1877), and Lower Crystal Springs Dam (constructed in 1890). Crystal Springs Reservoir is a barrier to upstream migration by Central California Coast anadromous steelhead. Central California Coast steelhead, which inhabit tributaries to South San Francisco Bay as well as coastal watersheds, have been listed by the National Marine Fisheries Service (NMFS) as a threatened species under the Federal Endangered Species Act. The common species inhabiting the watershed include steelhead/rainbow trout and threespine stickleback (Leidy *et al.* 2005); other species present include suckers, tule perch, and sculpin (RWQCB, 2002). Other fish species recently documented in San Mateo Creek include sculpin, which are found to inhabit the upper part of the watershed, and suckers, carp, and stickleback, which are found within the lower reaches of the creek (Taylor, 2002; Leidy, 2002).

The San Mateo Creek watershed originates in undeveloped lands flowing downstream through urbanized areas adjacent to South San Francisco Bay. The creek corridor within this downstream

urban region has been highly modified. The upstream impoundments, in combination with channel modifications within the downstream reaches, are intended in part to provide flood control protection for urban areas. Changes in channel structure and function as a result of both reservoir impoundments and channel modifications have affected instream habitat for steelhead and other fish species.

In 1860, prior to construction San Andreas and Upper and Lower Crystal Springs Reservoirs, steelhead/rainbow trout were collected from San Mateo Creek (Leidy *et al.*, 2005). Leidy (1984) and Smith (1991) collected rainbow trout within San Mateo Creek both upstream and downstream of Lower Crystal Springs Reservoir. Leidy *et al.* (2005) concluded that San Mateo Creek historically supported resident rainbow trout populations, and that small numbers of anadromous steelhead may have utilized the creek downstream of Crystal Springs Reservoir as spawning and juvenile rearing habitat. For purposes of management under the Federal Endangered Species Act, the NMFS defines "steelhead" to include resident rainbow trout inhabiting streams and rivers downstream of impassable reservoirs (including Crystal Springs Dam) and other barriers to migration. Therefore, trout inhabiting the stream upstream of the dam are considered to be resident rainbow trout, while trout downstream of the dam (which could potentially migrate successfully to the ocean) are considered to be steelhead. Fishery studies conducted within other watersheds tributary to South San Francisco Bay have also reported small populations of both spawning and rearing adult steelhead (and in some tributaries, fall-run Chinook salmon). Modification of many of these tributaries, including the lower reaches of San Mateo Creek, present impediments or barriers to upstream access by migrating salmonids and have therefore affected the ability of many of the tributary streams to successfully support populations of anadromous steelhead. Streambank erosion into the creek within the lower reaches may also be contributing to compromised steelhead habitat quality. Potentially compromised water quality in this reach of the creek may have decreased substrate quality, increased temperatures, and reduced dissolved oxygen levels, which can reduce habitat for both salmonids, resident fish populations, and other benthic macroinvertebrate species (RWQCB, 2002). Local watershed groups and state and federal resource agencies are currently developing habitat enhancement measures for San Mateo Creek and other South San Francisco Bay tributaries to enhance access to suitable spawning and juvenile rearing habitat and to improve overall fishery habitat conditions within these small streams.

Pilarcitos Creek

Pilarcitos Creek, a small coastal stream approximately 12 miles long, flows into the Pacific Ocean near Half Moon Bay. Two impoundments regulate flow within Pilarcitos Creek: Pilarcitos Dam and Reservoir, located 10.8 miles upstream (constructed in 1866), and Stone Dam, located 8.5 miles upstream (constructed in 1874). Pilarcitos Creek and Spring Valley Creek provide water supplies to Pilarcitos Reservoir, which can convey water through a tunnel into San Andreas Reservoir and Lower Crystal Springs Reservoir. A total of six small tributaries—four of which enter Pilarcitos Creek in the reach between Pilarcitos Dam and Stone Dam, and two located downstream of Stone Dam—provide additional inflow to Pilarcitos Creek. Water can be diverted from Stone Dam to Lower Crystal Springs Reservoir, and also to the Coastside County Water District. Flow within Pilarcitos Creek downstream of Stone Dam, which has no outlet structure other than a flashboard weir and spillway, primarily originates as tributary inflow.

Stone Dam has been identified as a barrier that prohibits access by anadromous steelhead to upstream habitat. Therefore, Pilarcitos Creek has been characterized as having two separate fishery habitat reaches: the anadromous salmonid reach located downstream of Stone Dam and a resident trout reach located upstream of Stone Dam. The NMSF has expressed interest in developing fish passage opportunities at Stone Dam that would allow anadromous steelhead access to upstream habitat for spawning and juvenile rearing. Alternatives identified for providing upstream access at Stone Dam include complete dam removal, partial dam removal, or construction and operation of a fish ladder.

Information on seasonal stream flows within Pilarcitos Creek downstream of Stone Dam is available from the U.S. Geological Survey Gaging Station No. 11162620. Flow at the gaging station reflects the effects of the upstream impoundments and water diversions on Pilarcitos Creek. Flow within the creek downstream of Stone Dam shows a typical seasonal pattern within coastal watersheds, with consistently low flows during the spring, summer, and early fall (April–November) and higher stream flows during the winter months (December–March) in response to rainfall and runoff. The highest average monthly flows and peak daily flows have occurred during January and February. Peak daily flows during January and February have exceeded 90–100 cfs, with corresponding average monthly flows of approximately 7 cfs in January and 15 cfs in February. Average monthly flows during the spring, summer, and fall within Pilarcitos Creek downstream of Stone Dam typically range from approximately 0.1 to 0.5 cfs. The increased flows during January and February within the tributaries and watershed generally correspond with the seasonal life history of Central California Coast anadromous steelhead, with adult upstream migration and juvenile downstream migration during the winter.

Pilarcitos Creek is characterized by a moderately steep stream gradient downstream of Stone Dam. The substrate within the creek is predominantly fine sediment, sand, and small gravel. Although present, boulders and bedrock outcroppings are rare. Upstream and downstream of Stone Dam, reaches of the creek are characterized predominantly by run habitat and, to a lesser extent, pools and riffles. During the summer months, pool habitat is typically shallow (generally less than 1.5 feet deep). Pilarcitos Creek to the Highway 92 crossing has an adequate riparian corridor, with instream cover provided by overhead vegetation, undercut banks, and other structures. From that point downstream, the creek traverses agricultural and residential areas, and riparian habitat in these areas is limited.

Several barriers or impediments to fish movement have been identified within Pilarcitos Creek, including culverts that would prevent or impede migration under low-flow conditions but would potentially be passable at higher flows. As noted above, Stone Dam is a complete barrier to anadromous steelhead migration at all flow levels within Pilarcitos Creek. Pilarcitos Dam is also a barrier to fish movement within the creek. Several additional passage impediments, such as low-flow riffles, limit fish movement within the creek under low-flow conditions, but are expected to be passable at higher stream flows such as those occurring during the winter.

Another possible factor in reducing available fishery habitat within Pilarcitos Creek, particularly for steelhead, is increased sedimentation and siltation, which may limit spawning grounds and

reduce the ability of fishes to capture their prey (RWQCB, 2001). Although these effects have not been quantified, there is a linkage between degradation of steelhead habitat and sedimentation within this watershed. Future studies by stakeholders and others may provide more conclusive data on the extent and effects of sedimentation within the creek (RWQCB, 2001).

Results of limited fishery sampling within Pilarcitos Creek during the mid-1990s (Balance Hydrologics, 1997) confirm that steelhead/rainbow trout successfully spawn and rear within reaches of Pilarcitos Creek both upstream and downstream of Stone Dam. Evidence of multiple year-classes (based on length frequency analysis) confirms successful rearing and oversummering of salmonids within the creek. The relative contribution of resident rainbow trout and anadromous steelhead to the population of fish inhabiting Pilarcitos Creek has not been determined. In addition to steelhead/rainbow trout, other resident fish species such as sculpin are expected to inhabit the creek. Specific instream flows needed to support resident fish populations downstream of Pilarcitos Reservoir or anadromous steelhead downstream of Stone Dam have not been identified.

Pilarcitos Reservoir

Pilarcitos Reservoir, at the base of Pilarcitos Creek, is one of three reservoirs in the Peninsula watershed; it contains populations of rainbow trout, Sacramento sucker, tule perch, and various species of sculpin (RWQCB, 2002). In 1931, Pilarcitos Reservoir was documented as having a good trout population (Skinner, 1962). During the Depression, bass were introduced to the reservoir to serve as a food source and are thought to have contributed to the decline of native fish due to predation. Conditions within Pilarcitos Reservoir are stratified and anoxic during the late summer and fall.

Crystal Springs Reservoir

Water from San Mateo Creek and Pilarcitos Creek can be diverted into Crystal Springs Reservoir, a lake that has been a designated fish and game refuge for many years (Skinner, 1962). A number of important and sensitive fish species are present within the reservoir, including such native fishes as rainbow trout. Crystal Springs Reservoir also contains populations of Sacramento sucker, tule perch, and various species of sculpin (RWQCB, 2002). During the Depression, bass were introduced to Crystal Springs Reservoir to serve as a food source; this planting of largemouth bass, the first in California, is thought to have contributed to the decline of native fish due to predation. Although rainbow trout have been collected throughout the reservoir, native fish species such as Sacramento sucker, tule perch, and various sculpin species appear to be either absent or few in number. Sacramento sucker and tule perch are not listed as threatened or endangered species; however, their decline as a result of the presence and operation of the reservoirs indicates their sensitivity to environmental disturbances. A variety of factors are thought to affect the abundance of resident fish within the reservoir, including predation by species such as largemouth bass and seasonal water quality conditions. Crystal Springs Reservoir exhibits stratification and anoxic conditions in late summer and fall.

San Andreas Reservoir

San Andreas Reservoir contains populations of rainbow trout, Sacramento sucker, tule perch, and various species of sculpin (RWQCB, 2002). Bass were also introduced to this reservoir during the Depression to serve as a food source and are thought to have contributed to the decline of native fish due to predation. San Andreas Reservoir, much like Crystal Springs Reservoir, contains a population of warmwater fishes (Skinner, 1962). San Andreas Reservoir remains well mixed, with relatively good water quality for fishery populations throughout the year.

5.5.5.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to fisheries, but generally considers that implementation of the proposed program would have a significant fisheries impact if it were to:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service

- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites

- Have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of an endangered, rare, or threatened species

Approach to Analysis

Changes in reservoir storage and water levels in the San Mateo Creek watershed attributable to the WSIP were estimated using the HH/LSM. An overview of the model is presented in Section 5.1. Detailed information on the model and the assumptions that underlie it is provided in Appendix H. Changes in flow in streams in the San Mateo and Pilararcitos watersheds and changes in reservoir storage and water levels in the Pilarcitos watershed attributable to the WSIP were estimated semi-quantitatively based on interviews with individuals knowledgeable about the historical, current, and expected future (with-WSIP) water system operations.

Impact Summary

Table 5.5.5-1 presents a summary of the impacts on water bodies in the Peninsula watershed that could result from implementation of the proposed water supply and system operations.

TABLE 5.5.5-1
SUMMARY OF IMPACTS – FISHERIES
IN SAN FRANCISCO PENINSULA STREAMS AND RESERVOIRS

Impact	Significance Determination
Impact 5.5.5-1: Effects on fishery resources in Crystal Springs Reservoir (Upper and Lower)	PSU
Impact 5.5.5-2: Effects on fishery resources in San Andreas Reservoir	LS
Impact 5.5.5-3: Effects on fishery resources along San Mateo Creek	LS
Impact 5.5.5-4: Effects on fishery resources in Pilarcitos Reservoir	PSM
Impact 5.5.5-5: Effects on fishery resources along Pilarcitos Creek below Pilarcitos Reservoir	PSM

LS = Less than Significant impact, no mitigation required
PSM = Potentially Significant impact, can be mitigated to less than significant
PSU = Potentially Significant impact, unavoidable

Impact Discussion

Impact 5.5.5-1: Effects on fishery resources in Crystal Springs Reservoir (Upper and Lower).

Results of hydrologic modeling indicate that average monthly storage within Crystal Springs Reservoir would be greater under proposed WSIP operations than under existing conditions. An increase in storage within the reservoir offers the potential for increased coldwater pool volume within the reservoir hypolimnion, which could benefit coldwater fish species inhabiting the stream downstream of the reservoir. In addition, increased reservoir storage would provide an increase in the volume of habitat available for resident fish species inhabiting the reservoir, including both warmwater and coldwater fish species. The increase in storage elevation under the WSIP could also provide greater opportunities for connectivity and migration of fish between the reservoir and upstream tributary habitat. As a result of these factors, increased reservoir storage under proposed operations is considered a beneficial impact on fishery resources.

Only minor changes in water quality conditions would occur within Crystal Springs Reservoir under proposed WSIP operations compared to existing conditions (see Section 5.5.1). Based on the general similarity in water quality conditions with and without the proposed program, potential changes in water quality in Crystal Springs Reservoir and related impacts on fishery resources would be less than significant.

Restoring the levels of the reservoir under the Lower Crystal Springs Dam Improvements project (PN-4) would eliminate approximately 750 linear feet of trout spawning habitat from Laguna and San Mateo Creeks, the two named tributaries to the reservoir, resulting in a total loss of approximately 1,500 linear feet of spawning habitat. However, upstream areas may provide suitable replacement habitat to support the population and this prospect is currently under evaluation in the project-level CEQA review for the Lower Crystal Springs Dam Improvements

project. Thus, implementation of Measure 5.5.5-1, Create New Spawning Habitat Above Crystal Springs Reservoir, if feasible, may reduce this impact to less than significant. The project-level CEQA review for the Lower Crystal Springs Dam Improvements project will further evaluate the severity of this impact and the efficacy of Measure 5.5.5-1. To be conservative, at the program-level of analysis, this impact is considered *potentially significant and unavoidable*.

Impact 5.5.5-2: Effects on fishery resources in San Andreas Reservoir.

Results of hydrologic modeling indicate that average monthly storage in San Andreas Reservoir would be similar under proposed operations and existing conditions. Reservoir storage would continue to fluctuate seasonally, as under existing conditions. Based on the similarity of water storage operations, potential impacts on resident fishery resources within San Andreas Reservoir under proposed operations are considered less than significant.

Only minor changes in water quality conditions would occur within San Andreas Reservoir under proposed WSIP operations compared to existing conditions (see Section 5.5.1). Based on the general similarity in water quality conditions with and without the proposed program, potential changes in water quality in San Andreas Reservoir and related impacts on fishery resources would be *less than significant*, and no mitigation measures would be required.

Impact 5.5.5-3: Effects on fishery resources along San Mateo Creek.

San Mateo Creek is an intermittent stream and would remain so under the proposed program. Similar to existing conditions, no releases would be made under the proposed program from Crystal Springs Reservoir to San Mateo Creek in normal, below-normal, or dry years. In wet and above-normal years, releases to the creek would be similar to those under existing conditions. The upper third of San Mateo Creek downstream of the reservoir provides suitable fishery habitat, while the lower creek reaches serve only as a potential migratory corridor. Since actual operations and fishery habitat conditions on San Mateo Creek would be comparable under existing and proposed operations, impacts on fisheries in San Mateo Creek would be *less than significant*, and no mitigation measures would be required.

Impact 5.5.5-4: Effects on fishery resources in Pilarcitos Reservoir.

Storage in Pilarcitos Reservoir varies seasonally. The reservoir typically fills in the winter and is drawn down in the spring and summer. By late summer, releases from the reservoir are typically limited to reservoir inflow. With the WSIP, the reservoir would be drawn down more rapidly than under the existing condition. The period in which the reservoir would be at its minimum elevation would be extended by days or weeks. The reduction in summer storage would reduce the volume

of habitat potentially available for resident aquatic species. This impact would be potentially significant.

Reductions in the volume of water stored within Pilarcitos Reservoir under proposed operations would be expected to reduce the coldwater pool volume within the reservoir hypolimnion, which could in turn have an adverse effect on resident coldwater species in the reservoir. However, because water is released from close to the surface of the reservoir, a cool water pool is usually retained below the level of the outlet. Still, WSIP-induced water quality impacts on fishery habitat in the reservoir would be potentially significant.

Overall, the impacts of the proposed program related to a reduction in the volume and suitability of habitat potentially available for resident aquatic species in Pilarcitos Reservoir would be *potentially significant*. Implementation of Measure 5.5.3-2, Revised Operations Plan for Pilarcitos Watershed Facilities, would maintain the current storage levels in the reservoir and reduce these impacts to a less-than-significant level.

Impact 5.5.5-5: Effects on fishery resources along Pilarcitos Creek below Pilarcitos Reservoir.

Pilarcitos Creek Below Pilarcitos Reservoir

Flow in Pilarcitos Creek would increase during many months as a result of the WSIP; however, flow reductions would occur during the summer of dry years. Under the proposed operations, instream flow releases (other than dam seepage and reservoir inflow) would cease in Pilarcitos Creek downstream of Pilarcitos Reservoir during summer months of dry years at an earlier date with the WSIP than under the existing condition. Flow reductions in Pilarcitos Creek downstream of Pilarcitos Reservoir under proposed operations would result in potentially significant impacts on resident trout, other resident fish species and aquatic resources, and habitat quality and availability for anadromous steelhead. In addition, as described above, releases from Pilarcitos Reservoir to Pilarcitos Creek are made from close to the surface of the reservoir, so summer and fall releases under existing conditions are warm. With the proposed program in place, summer and fall releases would also be warm (possibly warmer in the fall), because Pilarcitos Reservoir would be drawn down farther than under the existing condition. Exposure to higher water temperatures in the late summer and fall could significantly affect habitat quality and availability for coldwater fish species inhabiting Pilarcitos Creek below Pilarcitos Reservoir, including both resident trout and anadromous steelhead. This would be a potentially significant impact.

Pilarcitos Creek Below Stone Dam

Pilarcitos Creek below Stone Dam provides potential habitat for anadromous salmonids. Currently, there are occasional spills over Stone Dam when releases from Pilarcitos Reservoir and runoff into Pilarcitos Creek above Stone Dam exceed the capacity of the diversion at the dam. With implementation of the proposed program, occasional spills over Stone Dam would continue but with somewhat reduced frequency and magnitude. Spills over Stone Dam currently provide

up to one-third of the flow in this lower reach of Pilarcitos Creek. With the WSIP, spills would be reduced and flow in Pilarcitos Creek would be reduced in the winter months, when occasional large flows are important to migratory fish. Consequently, the reduction in flows due to WSIP operations and related impacts on fish habitat would be potentially significant. In addition, the National Marine Fisheries Service has raised concerns regarding stream flows in Pilarcitos Creek below Stone Dam, and the SFPUC is currently making experimental releases and undertaking studies in an effort to address these concerns.

Impact Conclusions

Overall, impacts on fishery resources along Pilarcitos Creek below Pilarcitos Reservoir related to elevated water temperatures in late summer and fall and reduced flows in the winter months would be *potentially significant.* Implementation of Measure 5.5.3-2, Revised Operations Plan for Pilarcitos Watershed Facilities, would reduce this potential impact to a less-than-significant level.

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5.5.6 Terrestrial Biological Resources

The following setting section describes the terrestrial biological resources within the streams and reservoirs of the San Francisco Peninsula that could be affected by the WSIP. The impact section (Section 5.5.6.2) provides a description of the effects of WSIP-induced changes in stream flow and reservoir levels on terrestrial biological resources.

5.5.6.1 Setting

The Peninsula watershed is a unique ecological resource that hosts extensive and varied habitats in a predominantly urbanized region. It supports the highest concentration of rare, threatened, and endangered species in the entire Bay Area (SFPUC, 1994; 2006). The watershed supports over 550 species of plants (Oberlander, 1953). A high diversity of animals can also be found in the Peninsula watershed, including many that require large areas of contiguous, relatively undisturbed habitat such as mountain lions, deer, bobcats, coyotes, bald eagles, and golden eagles. Due to the extent and variety of habitats, total vertebrate species diversity is likely to include virtually all species found in upland and freshwater habitats in San Mateo County.

This assessment of impacts focuses on sensitive natural communities such as riparian communities and wetlands, and on special-status species (excluding fish) specifically associated with streams and reservoirs that could be affected by WSIP operations. This section distinguishes between WSIP projects for which separate, project-level CEQA analysis would address operational impacts in greater detail (such as the Lower Crystal Springs Dam project [PN-4], which would affect Upper and Lower Crystal Springs Reservoirs and San Mateo Creek below the dam), and projects for which no further CEQA analysis would take place (such as the operation of San Andreas and Pilarcitos Reservoirs and Pilarcitos Creek).

Figure 4.6-1 in Section 4.6, Biological Resources, shows the habitat types found in the Peninsula watershed within the WSIP program area. Habitat types are broader groupings than natural communities, but are useful when describing both wildlife and vegetation resources together.

San Mateo Creek

Immediately below Crystal Springs Dam, seepage supports a small area of freshwater marsh. Below this, San Mateo Creek flows through a steep, largely undeveloped canyon where it supports a well-developed central coast arroyo willow (*Salix lasiolepis*) riparian forest, with coast live oak (*Quercus agrifolia*) riparian forest farther downstream. Coast live oak woodland, mixed evergreen forest, and coastal scrub grow on the adjacent uplands. San Mateo Creek then flows through the town of Hillsborough and the city of San Mateo, emptying into San Francisco Bay south of Coyote Point. In this section the creek is not culverted, but is closely surrounded by urbanization.

Riparian processes along San Mateo Creek have already been considerably affected by the presence of the Crystal Springs Dam. Sediment supply and base flows have been cut off to lower San Mateo Creek, and the magnitude of peak flows at all recurrence intervals has been greatly

diminished. Stream releases are infrequent under existing conditions and occur only when runoff into Crystal Springs Reservoir cannot be contained by available storage or conveyed elsewhere. There are no releases during the summer months, and none during normal, below-normal, and dry years.

Upper and Lower Crystal Springs Reservoirs

Lower Crystal Springs Reservoir is surrounded primarily by oak woodland and Douglas-fir (*Pseudotsuga menziesii*) forest on the western side, with oak woodland, serpentine grassland, valley needlegrass grassland, and non-native grassland on the eastern side. Lower Crystal Springs Reservoir supports a large area of valley and foothill freshwater marsh on its northwestern tip where San Andreas Creek enters the reservoir (referred to as Tracy Lake). This area currently supports more extensive freshwater marsh than it did in the 1950s, when Crystal Springs Dam was operated at full capacity (Oberlander, 1953). White alder riparian forest extends to Lower Crystal Springs Reservoir along San Mateo Creek. Central coast arroyo willow riparian forest is present along the smaller creeks, sometimes expanding where creeks enter the reservoir.

Upper Crystal Springs Reservoir is surrounded primarily by coast live oak woodland, with extensive areas of serpentine and valley needlegrass grassland and small areas of northern coastal scrub on the eastern side. Large areas of arroyo willow riparian forest and freshwater marsh are found at Adobe Marsh and at the mouth of Laguna Creek at the southeastern end. The overall extent of current freshwater marsh wetland vegetation surrounding Upper Crystal Springs Reservoir is less than existed historically, and many areas have converted to arroyo willow riparian forest (Oberlander, 1953; San Francisco Planning Department, 2001).

San Andreas Reservoir

San Andreas Reservoir is surrounded primarily by northern coastal scrub. In the absence of fire, a coast live oak tree layer is developing within the scrub on deeper soils. The eastern edge of the reservoir supports non-native grassland and exotic forests dominated by Monterey pine (*Pinus radiata*) and eucalyptus (*Eucalyptus* sp.). Some small areas of native grassland may also be present. The two northern arms of the reservoir support some of the largest freshwater marshes in the watershed. Depending on elevation, these marshy areas variously support cattails, bulrushes, spikerush, rush, and other emergent species. Historically, the freshwater marsh wetland was less extensive on the eastern arm of the upper portion of the reservoir; in 1993, this area was mapped as open water. The western upper arm of the reservoir supported more extensive freshwater marsh wetland. The truncated shoreline mapped by Oberlander (1953) suggests that there may have been an impoundment in this area that functioned to increase the extent of freshwater marsh.

Pilarcitos Creek and Reservoir

The vegetation above Pilarcitos Dam consists mostly of coastal scrub, with areas of Douglas-fir and redwood (*Sequoia sempervirens*) forest and mixed evergreen/coast live oak forest in the deeper and more sheltered slopes. A small area of freshwater marsh was mapped by Oberlander (1953) on the southern arm of the reservoir. Central coast arroyo willow riparian forest lines the

major tributaries to Pilarcitos Reservoir for a considerable distance upstream. Below Pilarcitos Dam, Pilarcitos Creek follows a deep canyon heavily wooded with Douglas-fir forest. A well-developed white alder (*Alnus rhombifolia*) riparian forest grows along the creek between Pilarcitos Dam and Stone Dam. Below Stone Dam, Pilarcitos Creek is lined with central coast arroyo willow riparian forest.

Natural Communities, including Sensitive Natural Communities

The *Peninsula Watershed Management Plan Environmental Impact Report* (San Francisco Planning Department, 2001) identified 14 natural communities occurring within the watershed, eight of which are listed as sensitive in the California Natural Diversity Database (CNDDB) (CDFG, 2006). Eleven natural communities, including all eight of the sensitive natural communities, occur adjacent to San Andreas, Pilarcitos, and Upper and Lower Crystal Springs Reservoirs and associated creeks. The natural community name, CNDDB code, sensitivity, and occurrence within the WSIP program area are presented in **Table 5.5.6-1** and briefly described below. More detail will be provided in the project-specific EIR for the Lower Crystal Springs Dam project (PN-4).

TABLE 5.5.6-1
POTENTIAL FOR OCCURRENCE OF NATURAL COMMUNITIES IN AND NEAR THE WSIP IN THE PENINSULA WATERSHED

	WSIP Program Location		
Natural Community	**Upper/Lower Crystal Springs Reservoirs and San Mateo Creek (PN-4)**	**San Andreas Reservoir**	**Pilarcitos Reservoir and Pilarcitos Creek**
Serpentine grassland	X		
Valley needlegrass grassland	X	X	
Non-native grassland	X	X	
Northern mixed chaparral	X	X	
Northern coastal scrub	X	X	X
Mixed evergreen forest/coast live oak woodland	X	X	X
Douglas-fir forest/redwood forest	X		X
Non-native forests	X	X	
Central coast arroyo willow riparian forest	X	X	X
White alder riparian forest			X
Central coast live oak riparian forest	X		
Coastal and valley freshwater marsh	X	X	X

[a] California Natural Diversity Database code; asterisk (*) indicates sensitive natural community (CDFG, 2006).

Grasslands

Serpentine grassland and valley needlegrass grassland are found on the open ridges of the Peninsula watershed, often on less fertile soils. Serpentine grassland is specifically associated with soils derived from serpentine rock. Both grasslands are characterized by a high proportion of native species, many perennial grasses, and low productivity. Typical perennial grasses include needlegrass (*Nassella* spp.), pine bluegrass (*Poa secunda*), fescue (*Festuca* spp.), and junegrass (*Koeleria cristata*). Within the WSIP study area, extensive areas of serpentine grassland are found along the eastern shores of Upper and Lower Crystal Springs Reservoirs. Valley needlegrass grassland is found on the eastern shores of San Andreas Reservoir and Upper and Lower Crystal Springs Reservoirs. Disturbed Valley needlegrass grassland may also be present in San Mateo Canyon below Crystal Springs Dam.

Non-native grassland is found in many areas with a history of disturbance. It is dominated by a variety of non-native annual grasses such as brome (*Bromus* spp.), oats (*Avena* spp.), and wild barley (*Hordeum* spp.) as well as herbs such as filaree (*Erodium* spp.), with less abundant native annual and perennial grasses and herbs. This community is found along the shores of San Andreas Reservoir and Upper and Lower Crystal Springs Reservoirs.

Chaparral and Scrub

Northern mixed chaparral and northern coastal scrub are shrub-dominated communities typically found on steep, rocky, exposed slopes. Both tend to form dense, rather impenetrable stands that are regenerated by periodic wildfires. On the Peninsula watershed, northern mixed chaparral is dominated by scrub oak (*Quercus dumosa*), chamise (*Adenostoma fascicularis*), and several species of ceanothus (*Ceanothus* spp.). Northern coastal scrub is dominated by coyote brush (*Baccharis pilularis*), poison-oak (*Toxicodendron diversilobum*), and bush monkeyflower (*Mimulus aurantiacus*). Northern coastal scrub is found on much of the western shore of San Andreas Reservoir, the shores of most of the upper, northern branches of Pilarcitos Reservoir, and in small areas around Upper and Lower Crystal Springs Reservoirs.

Forests and Woodlands

Mixed evergreen forest and coast live oak woodland are the most abundant forest communities on the watershed. These communities are typically found in more sheltered sites that have deeper soils than scrubs and grasslands. Mixed evergreen forest is dominated by coast live oak, California bay (*Umbellularia californica*), madrone (*Arbutus menziesii*), Douglas-fir, and big-leaf maple (*Acer macrophyllum*). It tends to form a closed canopy with shrubby or grassy understory and is found in more sheltered sites such as canyons. Coast live oak woodland is dominated by a single species, coast live oak, which forms a nearly closed canopy forest in favorable sites with deep soils and ample soil moisture, or open woodland with a grassy understory in drier areas. Mixed evergreen forest and coast live oak are found in nearly all of the deep canyons on the east side of San Andreas and Crystal Springs Reservoirs, and most of the sheltered western sides of these reservoirs. A small stand is also found on the west side of Pilarcitos Reservoir. Douglas-fir forest and redwood forest are tall, dense, forests dominated by Douglas-fir and coast redwood. Some of the largest old-growth stands in the Bay Area are found on the eastern slopes of the larger ridges in the Peninsula watershed. These communities extend to the shores of Pilarcitos

Reservoir. Small areas of Douglas-fir forest also occur on the western shore of Lower Crystal Springs Reservoir.

Riparian Forests

Central coast arroyo willow riparian forest occurs in moist canyons, usually with perennial stream flow or seepage. It is a dense, broadleaved, winter-deciduous forest dominated by arroyo willow (*Salix lasiolepis*), which grows as a large, tree-like shrub. This common riparian natural community is found in sections of Pilarcitos Creek both above Pilarcitos Reservoir and below Stone Dam, on the major tributaries draining into San Andreas and Upper and Lower Crystal Springs Reservoirs, and in portions of San Mateo Creek below Crystal Springs Dam. White alder riparian forest is a medium-tall, broadleaved, deciduous streamside forest dominated by white alder (*Alnus rhombifolia*) with a shrubby, deciduous understory. It is found along rapidly flowing perennial streams with coarse sediments and is more typical of the North Coast. It is found along Pilarcitos Creek between Pilarcitos Dam and Stone Dam and in San Mateo Creek between Mud Dam and Lower Crystal Springs Reservoir. Central coast live oak riparian forest is an evergreen riparian forest dominated by coast live oak. This community may be present in portions of San Mateo Creek below Crystal Springs Dam.

Coastal and Valley Freshwater Marsh

Coastal and valley freshwater marsh is a wetland community dominated by usually dense stands of perennial, emergent grass and grass-like plants up to 15 feet tall. Typical species include cattails (*Typha* spp.), tule (*Scirpus* spp.), rushes (*Juncus* spp.), and sedges (*Carex* spp.). Coastal and valley freshwater marsh is found in areas that are permanently flooded or saturated. Examples of this community are found around the perimeter of all of the reservoirs in the Peninsula watershed, usually in areas of gentle topography and fine-textured alluvial soils where streams deposit sediment. Upper and Lower Crystal Springs Reservoirs and San Andreas Reservoir support extensive areas of freshwater marsh, while Pilarcitos Reservoir has little of this habitat.

Key Special-Status Species and Other Species of Concern

The name and status of key plant and animal special-status species and species of concern with the potential to occur within the WSIP program area on the Peninsula watershed, based on the EIR for the *Peninsula Watershed Management Plan* (San Francisco Planning Department, 2001), are shown in Appendix D. **Tables 5.5.6-2** and **5.5.6-3** present the name, status, habitat, and potential for occurrence of key plant and animal species that could be affected by WSIP projects in the Peninsula watershed; these species are further discussed in the text below.

Because of proposed changes in the operation of Upper and Lower Crystal Springs Reservoirs and the presence of extensive serpentine grassland habitats along their shores, many species could be affected by the Lower Crystal Springs Dam project (PN-4). These species are discussed briefly below and will be described in more detail in the project-specific EIR. The consultant team (Lebednik, 2006) provided preliminary survey results of 2006 wildlife and botanical surveys for the Lower Crystal Springs Dam project area.

TABLE 5.5.6-2
KEY SPECIAL-STATUS PLANTS AND PLANT SPECIES OF CONCERN IN THE WSIP PENINSULA WATERSHED OPERATIONAL AREA

Common Name *Scientific Name*	USFWS/CDFG/ CNPS Status[b]	Potential to Occur, by WSIP Operational Area[a]			
			Upper/Lower Crystal Springs Reservoirs, San Mateo Creek	San Andreas Reservoir	Pilarcitos Reservoir and Creek
San Mateo thorn-mint *Acanthomintha duttonii*	FE/CE/1B*	Open areas in serpentine clay soils	Low potential		
Franciscan onion *Allium peninsulare* var. *franciscanum*	–/–/1B	Woodland, grassland, clay soils, often on serpentine	Present		
Bent-flowered fiddleneck *Amsinckia lunaris*	–/–/1B	Woodland and valley grassland	Potential	Potential	Potential
Fountain thistle *Cirsium fontinale var. fontinale*	FE/CE/1B*	Serpentine seeps	Present		
San Francisco collinsia *Collinsia multicolor*	–/–/1B	Closed-cone coniferous forest, coastal scrub, sometimes serpentinite	Present		
Western leatherwood *Dirca occidentalis*	–/–/1B	Mesic sites in forest, woodland, and scrub	Present	Potential	Potential
San Mateo woolly sunflower *Eriophyllum latilobum*	FE/CE/1B*	Openings in oak woodland on serpentine	Present		
Fragrant fritillary *Fritillaria liliacea*	–/–/1B	Clay soils, often on serpentine	Present nearby		
Marin western flax *Hesperolinon congestum*	FT/CT/1B*	Grassland and chaparral, often on serpentine	Present		
Hillsborough chocolate lily *Fritillaria biflora* var. *ineziana* (=*F. grayiana*)	–/–/1B	Woodland and grassland, often on serpentine	Low potential		
Crystal Springs lessingia *Lessingia arachnoidea*	–/–/1B	Woodland, scrub, grassland, usually on serpentine	Present		
Arcuate bush mallow *Malacothamnus arcuatus* (=*M. fasciculatus*)	–/–/1B	Chaparral on gravelly alluvium	Present	Potential	Potential
Dudley's lousewort *Pedicularis dudleyi*	–/CR/1B*	Maritime chaparral, north coast coniferous forest, and cismontane woodland; deep shady woods of redwood forests	Low potential		Potential
White-rayed pentachaeta *Pentachaeta bellidiflora*	FE/CE/1B*	Open dry rocky slopes and grassy areas, usually on serpentine soils	Low potential		

[a] The WSIP operational area is the extent that could be affected by program operations, such as below reservoir maximum elevations, or within riparian areas where changes in flows could affect habitat.
[b] Federal (USFWS), state (CDFG), and California Native Plant Society protection status codes are as follows:
FC: Federal candidate for listing
FE: Federal endangered
FT: Federal threatened
FD: Federal delisted
CE: California endangered
CT: California threatened
CR: California rare
1B: California Native Plant Society rare and endangered
–: Indicates no federal or state protection
* Indicates key special-status species, defined as having a state or federal listing as rare, threatened, or endangered.

SOURCES: CDFG, 2007; CNPS, 2006; Lebednik, 2006.

TABLE 5.5.6-3
KEY SPECIAL-STATUS ANIMALS AND ANIMAL SPECIES OF CONCERN IN THE WSIP PENINSULA WATERSHED OPERATIONAL AREA

Common Name *Scientific Name*	USFWS/CDFG Status[b]	Habitat	WSIP Operational Area[a]		
			Upper/Lower Crystal Springs Reservoirs, San Mateo Creek	San Andreas Reservoir	Pilarcitos Reservoir and Creek
Invertebrates					
Bay checkerspot butterfly *Euphyhydras editha bayensis*	FT/–*	Serpentine bunchgrass and valley needlegrass grassland	Low potential		
Mission blue butterfly *Plebejus (=Icaricia) icarioides bayensis*	FE/–*	Grasslands supporting *Lupinus albifrons, L. variicolor,* and *L. formosus* larval host plants		Potential	
Reptiles and Amphibians					
California red-legged frog *Rana aurora draytonii*	FT/CSC*	Slow-moving streams and ponds	Present	Present	Present
Foothill yellow-legged frog *Rana boylii*	–/CSC*	Shallow, moving water with sunny banks	Potential in tributary streams	Potential	Potential
Western pond turtle *Emys marmorata*	–/CSC	Permanent water such as streams or ponds	Present	Potential	Potential
San Francisco garter snake *Thamnophis sirtalis tetrataenia*	FE/CE, FP*	Freshwater marshes, ponds, and slow-moving streams with dense cover	Present	Present	Present
Birds					
Cooper's hawk *Accipiter cooperi*	–/CSC	Nests in deciduous riparian vegetation and oaks	Potential	Potential	Potential
Sharp-shinned hawk *Accipiter striatus*	–/CSC	Nests in deciduous riparian vegetation and oaks	Potential	Potential	Potential
Tricolored blackbird *Agelaius tricolor*	–/CSC	Colonial nester in emergent vegetation; forages over open water	Present	Potential	
Bell's sage sparrow *Amphispiza belli belli*	–/CSC	Nests in chaparral and coastal scrub	Potential	Potential	Potential
Marbled murrelet *Brachyramphus marmoratus*	FT/CE*	Nests high in old-growth conifers; feeds on near-shore fish			Present nearby
Vaux's swift *Chaetura vauxi*	–/CSC	Nests in hollow trees; forages over open water, woodlands	Present	Potential	Potential
Northern harrier *Circus cyaneus*	–/CSC	Nests and forages in wet meadows	Potential	Potential	
Merlin *Falco columbarius*	–/CSC	Winter visitor in foothills, valleys	Potential	Potential	Potential
Peregrine falcon *Falco peregrinus anatum*	FD/CE, FP*	Nests in cliffs and outcrops; forages near wetlands and other water	Potential	Potential	Potential

TABLE 5.5.6-3 (Continued)
KEY SPECIAL-STATUS ANIMALS AND ANIMAL SPECIES OF CONCERN IN THE WSIP PENINSULA WATERSHED OPERATIONAL AREA

Common Name *Scientific Name*	USFWS/CDFG Status[b]	Habitat	WSIP Operational Area[a]: Upper/Lower Crystal Springs Reservoirs, San Mateo Creek	WSIP Operational Area[a]: San Andreas Reservoir	WSIP Operational Area[a]: Pilarcitos Reservoir and Creek
Saltmarsh common yellowthroat *Geothlypis trichas sinuosa*	–/CSC	Nests and forages in riparian scrub	Present	Potential	
Loggerhead shrike *Lanius ludovicianus*	–/CSC	Open country for hunting; nests in riparian woodland and open woodlands	Potential	Potential	Potential
California black rail *Laterallus jamaicensis coturniculus*	–/CT*	Mainly nests in saltmarsh but may also occur in freshwater and brackish marshes at low elevations	Potential	Potential	
Double-crested cormorant *Phalcrocorax auritus*	–/CSC	Colonial nester on coastal cliffs and along lake margins; forages in open water	Present	Potential	
Bank swallow *Riparia riparia*	–/CSC	Colonial nester in riparian cliffs	Potential	Potential	
Mammals					
Pallid bat *Antrozous pallidus*	–/CSC	Roosts in trees; forages over grassland	Potential		
Pacific western big-eared bat *Corynorhinus (=Plecotus) townsendii*	–/CSC	Roosts in caves and buildings; forages in open country	Potential	Potential	
Small-footed myotis *Myotis ciliolabrum*	–/CSC	Roosts in caves and trees; forages in open country	Potential	Potential	Potential
Long-eared myotis *Myotus evotis*	–/CSC	Roosts in hollow trees and buildings; forages at streams and ponds	Potential	Potential	Potential
Fringed myotis *Myotis thysanodes*	–/CSC	Roosts in hollow trees and buildings; forages at forest edge	Potential	Potential	Potential
Long-legged myotis *Myotis volans*	–/CSC	Roosts in caves, old buildings and under bark	Potential	Potential	Potential
Yuma myotis *Myotis yumanensis*	–/CSC	Roosts in riparian vegetation; forages over open water	Potential	Potential	Potential
San Francisco dusky-footed woodrat *Neotoma fuscipes annectens*	–/CSC	Many forest habitats, especially with oaks	Present	Potential	Potential

[a] The WSIP operational area is the extent that could be affected by program operations, such as areas below maximum reservoir water levels, or within riparian areas where changes in flows could affect habitat.

[b] Federal (USFWS) and state (CDFG) protection status codes are as follows:
FC: Federal candidate for listing
FE: Federal endangered
FT: Federal threatened
FD: Federal delisted
CE: California endangered
CT: California threatened
CP: California fully protected
CSC: California species of special concern
– Indicates no federal or state protection
* Indicates key special-status species, defined as having a state or federal listing as endangered or threatened.

SOURCES: CDFG, 2007; Lebednik, 2006.

Serpentine-Associated Plants

Several upland special-status plants occur in serpentine-influenced habitats near the margins of Upper and Lower Crystal Springs Reservoirs, especially on the eastern side of Upper Crystal Springs Reservoir, where a large serpentine outcrop adjoins the reservoir. Franciscan onion (*Allium peninsulare* var. *franciscanum*, federal species of concern, CNPS List 1B), fountain thistle (*Cirsium fontinale* var. *fontinale*, federal endangered, California endangered), Marin western flax (*Hesperolinon congestum*, federal threatened, California threatened), and Crystal Springs lessingia (*Lessingia arachnoidea*, federal species of concern, CNPS List 1B) have been observed in serpentine grassland below the elevation of 291 feet along the eastern shoreline of Upper Crystal Springs Reservoir (Lebednik, 2006). San Mateo thorn-mint (*Acanthomintha duttonii*, federal endangered, California endangered), Hillsborough chocolate lily (*Fritillaria grayiana*, CNPS List 1B), fragrant fritillary (*Fritillaria liliacea*, CNPS List 1B), and white-rayed pentachaeta (*Pentachaeta bellidiflora*, federal endangered, California endangered, CNPS List 1B) are known to occur in serpentine grasslands near Upper Crystal Springs Reservoir, but have not been identified in the WSIP program area during recent protocol-level surveys. San Mateo woolly sunflower (*Eriophyllum latilobum*, federal endangered, California endangered, CNPS List 1B) is known to occur serpentine soils in woodland openings in San Mateo Canyon.

Other Upland Plants

Western leatherwood (*Dirca occidentalis*, CNPS List 1B) occurs in woodland, forest, and scrub habitats in many localities in the Peninsula watershed, and suitable habitat is present in the vicinity of all three reservoirs. Arcuate bush mallow (*Malacothamnus fasciculatus=M. arcuatus*, CNPS List 1B) grows in chaparral on gravelly alluvium. It was observed on the shore of Upper and Lower Crystal Springs Reservoirs in 2006, and suitable habitat may also be present in coastal scrub near the other reservoirs. Although not observed during 2006 field surveys (Lebednik, 2006), suitable habitat is present in the vicinity of Upper and Lower Crystal Springs Reservoirs for bent-flowered fiddleneck (*Amsinckia lunaris*, CNPS List 1B) and for Dudley's lousewort (*Pedicularis dudleyi*, federal species of concern, California rare, CNPS List 1B) near Upper and Lower Crystal Springs Reservoirs and Pilarcitos Reservoir and Creek.

Perennial Grassland Invertebrates

Bay checkerspot butterfly (*Euphyhydras editha bayensis*, federal threatened), is discussed in Chapter 4, Section 4.6. It is believed to be extirpated from the Peninsula watershed lands. Mission blue butterfly (*Icaricia icarioides missionensis*, federal endangered) is found in native grasslands and coastal scrub, where it depends on three perennial species of lupine (*Lupinus* spp.) for its larval foodplant. This species was originally believed to be restricted to San Francisco as far south as San Bruno Mountain; however, a population was discovered in the vicinity of San Andreas Dam in 1985 (San Francisco Planning Department, 2001). It is not known to occur in the vicinity of Upper and Lower Crystal Springs Reservoirs, but foodplants were observed in this area during surveys in 2006 (Lebednik, 2006).

Aquatic-Dependent Reptiles and Amphibians

California red-legged frog (*Rana aurora draytonii*, federal threatened, California species of special concern) is discussed in Section 4.6. According to recent surveys (LSA, in prep.), the distribution of California red-legged frog in the Peninsula watershed is patchy despite the presence of widespread, apparently suitable habitat. Within the WSIP program area, the species is known to occur in Upper and Lower Crystal Springs Reservoirs and Tracy Lake, San Andreas Reservoir, Stone Dam, Pilarcitos Creek, San Mateo Creek below Crystal Springs Dam, and on the parapet of the dam itself, as well as in many other localities within the Peninsula watershed (CDFG, 2006; Swaim, 2006; CDFG, 2007).

Foothill yellow-legged frog (*Rana boylii*, federal species of concern, California species of special concern) is a stream-dwelling species, preferring shallow, flowing water, preferentially in small to moderate sized streams. Although this species is historically known to occur in low-elevation streams in the Sierra Nevada, Transverse Ranges, and Coast Ranges northward to Oregon, its current distribution is not well known. There are historical records for many streams on the San Francisco Peninsula, including some in or near the Peninsula watershed (Swaim, 2006), but the current extent of the species in the Peninsula watershed is not known. Potential habitat may be present in Pilarcitos Creek and the tributaries to San Andreas and Upper and Lower Crystal Springs Reservoirs. Western pond turtle (*Actinemys = Clemmys marmorata*, federal species of concern, California species of special concern) lives in permanent water such as lakes, ponds, and deep areas in streams. It requires logs, rocks, or emergent vegetation for basking. Western pond turtle is known to occur in Upper and Lower Crystal Springs Reservoirs, and suitable habitat is present at San Andreas Reservoir and Pilarcitos Reservoir.

San Francisco garter snake (*Thamnophis sirtalis tetrataenia*, federal endangered, California endangered) is discussed in Section 4.6. Within the WSIP program area on the Peninsula watershed, this species is known to occur in San Andreas Reservoir, Upper and Lower Crystal Springs Reservoirs, the Pulgas Water Temple, the upper headwaters of Pilarcitos Creek, the vicinity of Pilarcitos Reservoir, and at Stone Dam.

Marbled Murrelet

The marbled murrelet (*Brachyramphus marmoratus*, federal threatened) is a small, diving seabird that nests in large trees in coniferous forests as much as 50 miles inland, and forages on small fish and invertebrates in near-shore marine waters. A nesting murrelet was detected in 1998 and 2003 on the west side of Pilarcitos Creek within designated critical habitat for the species.

Riparian-Dependent Birds

Several bird species of special concern are closely associated with the riparian habitats in the WSIP program area. Riparian trees throughout the watershed have a moderate potential to support nesting and foraging Cooper's hawk (*Accipiter cooperi*, California species of special concern) and sharp-shinned hawk (*A. striatus*, California species of special concern). The riparian vegetation at the southern end of Upper Crystal Springs Reservoir supports a breeding population of saltmarsh common yellowthroat (*Geothlypis trichas sinuosa*, California species of special concern). Suitable habitat may also be present at San Andreas Reservoir. Loggerhead shrike

(*Lanius ludovicianus*, California species of special concern) nests in riparian and other woodlands and forages over open country. It may be present throughout the Peninsula watershed in suitable habitat.

Marsh- and Lake-Dependent Birds

Tricolored blackbird (*Agelaius tricolor*, California species of special concern) has been observed during the breeding period in the vicinity of Upper and Lower Crystal Springs Reservoirs and thus may breed there. Suitable habitat may also be present at San Andreas Reservoir. Northern harrier (*Circus cyaneus*, California species of special concern) nests and forages in wet meadows and pastures such as those found at San Andreas Reservoir and Upper and Lower Crystal Springs Reservoirs. California black rail (*Laterallus jamaicensis coturniculus*, California threatened) generally breeds in saltmarsh habitat, but sometimes breeds in freshwater marsh at low elevations. Suitable habitat may be present at Upper and Lower Crystal Springs Reservoirs and San Andreas Reservoir. Double-crested cormorant (*Phalacrocorax auritus*, California species of special concern) nests in rookeries on cliffs and along lake margins, and forages for fish. It has been observed at Crystal Springs Reservoir and may also forage at San Andreas Reservoir. The bank swallow (*Riparia riparia*, California threatened) nests in banks along large rivers and forages over open water. Although there are no current records for this species in the Peninsula watershed, it may forage at Crystal Springs and San Andreas Reservoirs. Peregrine falcon (*Falco peregrinus anatum*, federal delisted, California endangered) nests in cliffs and outcrops and forages near wetlands and open water. Foraging habitat may be present throughout the Peninsula watershed, especially near Crystal Springs and San Andreas Reservoirs.

Upland Birds

Bell's sage sparrow (*Amphispiza belli belli*, California species of special concern) nests in chaparral and coastal scrub. Suitable habitat may be present on the shores of all of the reservoirs. Vaux's swift (*Chaetura vauxi*, California species of special concern) nests in hollow trees and forages over woodlands and open water. The species was observed at Upper and Lower Crystal Springs Reservoirs, and suitable habitat may be present near San Andreas and Pilarcitos Reservoirs. Merlin (*Falco columbarius*, California species of special concern) is a winter visitor and may forage in all project areas.

Mammals

Pallid bat (*Antrozous pallidus*, California species of special concern) roosts in trees and forages over open grassland. The species could occur throughout the watershed, but foraging areas within the WSIP program area would be found primarily along the shores of Upper and Lower Crystal Springs Reservoirs. Pacific western big-eared bat (*Corynorhinus townsendii*) roosts in caves and buildings and forages in open country. Suitable habitat is present at Upper and Lower Crystal Springs Reservoirs and San Andreas Reservoir. Small-footed myotis (*Myotis ciliobabrum*, California species of special concern) roosts in trees as well as old buildings and caves and forages in open country. Like the pallid bat, the primary foraging areas near the WSIP program area would be along the shores of Upper and Lower Crystal Springs Reservoirs, but roosting habitat would be present throughout the program area within the Peninsula watershed. Long-

eared myotis (*Myotis evotis*, California species of special concern) roosts in hollow trees and forages along rivers, streams, and ponds. It would be expected to occur throughout the WSIP program area in the Peninsula watershed. Fringed myotis (*Myotis thysanodes*, California species of special concern) roosts in trees and forages at the forest edge. It would be expected to occur throughout the WSIP program area. Long-legged myotis *(Myotis volans*) roosts in hollow trees and feeds primarily in open areas. Suitable roosting habitat could be present throughout the WSIP program area in the Peninsula watershed, but foraging areas would be present primarily at the margins of San Andreas and Upper and Lower Crystal Springs Reservoirs. Yuma myotis (*Myotis yumanensis*, California species of special concern) roosts in trees and crevices and forages over emergent vegetation and still water. It would be most likely to occur near the reservoirs—Pilarcitos, San Andreas, and Upper and Lower Crystal Springs.

The San Francisco dusky-footed woodrat (*Neotoma fuscipes annectens*, California species of special concern) inhabits oak woodlands where it forages primarily on oak leaves. Suitable habitat is present in oak woodlands throughout the Peninsula watershed.

5.5.6.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to terrestrial biological resources, but generally considers that implementation of the proposed program would have a significant biological impact if it were to:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFG or USFWS
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the CDFG or USFWS
- Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including but not limited to marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites
- Have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, or reduce the number or restrict the range of a rare or endangered plant or animal
- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance

- Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan

Approach to Analysis

The assessment of WSIP operational impacts on terrestrial biological resources is based primarily on the extent to which altered operations would change the existing habitat near reservoirs and creeks. Operational changes consist of increased diversions during winter high flows, increased releases to streams to maintain minimum flows, and changes in the elevation, annual range, and seasonal timing of reservoir water levels. Section 5.5.1 presents an assessment of the changes in hydrology in the Peninsula watershed that would occur under the WSIP.

This section discusses impacts related to sensitive habitats, key special-status species, other species of concern, and common habitats and species. The discussion of riparian and wetland habitats addresses the second and third significance criteria listed above. "Key special-status species" include species that are formally listed as endangered or threatened under the state or federal endangered species acts, as well as a few other species (such as foothill yellow-legged frog) that are afforded some degree of legal protection and have a high risk of local population decline or extirpation. The key special-status species discussion addresses the first significance criterion. "Other species of concern" and "common habitats and species" are more general categories relevant to the fourth and fifth significance criteria.

There would be no impacts related to conflicts with local policies or ordinances protecting biological resources or the provisions of a habitat conservation plan (the last two significance criteria). The SFPUC has prepared a management plan for the Peninsula watershed and is preparing a habitat conservation plan, but the WSIP would be consistent with their provisions.

The responses of terrestrial biological resources to changes in stream and reservoir operations are complex in both space and time. This section describes the general impacts associated with certain categories of operational changes to reservoirs and streams. The project EIR for the Lower Crystal Springs Dam project (PN-4) would address operational impacts in detail. The other Peninsula Region projects would have limited, if any, operational impacts on creeks and reservoirs. Potential impacts on San Andreas Reservoir, Pilarcitos Reservoir, and Pilarcitos Creek are analyzed in this PEIR at a project level because the operational effects on these facilities would not be analyzed in a project-specific EIR.

Unlike the Alameda Creek watershed and Calaveras Reservoir, which have experienced DSOD-mandated operational changes for a relatively short period of time, Crystal Springs Reservoir has been maintained at lower, DSOD-mandated water levels since 1983—nearly 25 years. The freshwater marsh and riparian habitats have adapted to the prevailing conditions, and no reference to earlier operational conditions is required in this assessment of impacts.

Impact Summary

Table 5.5.6-4 presents a summary of the impacts on terrestrial biological resources in the Peninsula watershed that could result from implementation of the proposed water supply and system operations.

TABLE 5.5.6-4
SUMMARY OF IMPACTS –
TERRESTRIAL BIOLOGICAL RESOURCES IN THE PENINSULA WATERSHED

Impacts	Sensitive Habitats	Key Special-Status Species	Other Species of Concern	Common Habitats and Species
Impact 5.5.6-1: Impacts on biological resources in Upper and Lower Crystal Springs Reservoirs	PSM	PSM	PSM	PSM
Impact 5.5.6-2: Impacts on biological resources in San Andreas Reservoir	LS	LS	LS	LS
Impact 5.5.6-3: Impacts on biological resources along San Mateo Creek below Lower Crystal Springs Dam	LS	LS	LS	LS
Impact 5.5.6-4: Impacts on biological resources in Pilarcitos Reservoir	LS	PSM	LS	LS
Impact 5.5.6-5: Impacts on biological resources along Pilarcitos Creek below Pilarcitos Reservoir	PSM	LS	LS	LS
Impact 5.5.6-6: Impacts on biological resources along Pilarcitos Creek below Stone Dam	LS	LS	LS	LS
Impact 5.5.6-7: Conflicts with the provisions of adopted conservation plans or other approved biological resource plans	LS			

LS = Less than Significant impact, no mitigation required
PSM= Potentially Significant impact, can be mitigated to less than significant

Impact Discussion

Impact 5.5.6-1: Impacts on biological resources in Upper and Lower Crystal Springs Reservoirs.

Sensitive Habitats

Elevating the average storage and reservoir levels under the WSIP would inundate all existing freshwater marsh and riparian habitats below an elevation of 283 feet, resulting in the loss of these sensitive habitats. Freshwater marsh would become established at higher elevations in response to higher reservoir levels. As the reservoir fills, there could be a short-term reduction in the overall extent of freshwater marsh, although the greater perimeter of the reservoir at the higher levels could eventually support an increase in the extent of these habitats. This impact would be potentially significant.

Under the WSIP, the average monthly water levels in Crystal Springs Reservoir would fluctuate more than under the existing condition. This increased fluctuation would be due in part to

periodic drawdown (up to 16 feet) for Hetch Hetchy system maintenance, which would occur approximately every five years. This drawdown would expose deep-water emergent vegetation such as cattails and tules and could dry the soils supporting shallow emergent vegetation and wet meadow vegetation. However, the maintenance would be scheduled during the onset of cool fall or early winter weather (October–December), when wetland vegetation is entering its winter dormancy period. Provided the reservoir was refilled during the winter, impacts on sensitive habitats related to this change in operations would be less than significant, and no mitigation measures would be required.

Other than the periodic drawdown, the annual range of fluctuation in reservoir water levels would be similar to levels under existing conditions; therefore, the impact on riparian and wetland resources would be less than significant, and no mitigation measures would be required.

The WSIP proposes to maintain maximum reservoir water levels for longer periods during the summer than under existing conditions. This operational strategy could favor perennial freshwater marsh habitats over willow scrub, but any such effect cannot be quantified at the program level of analysis. Therefore, this PEIR conservatively considers this impact to be potentially significant.

Sensitive upland habitats would be affected by the higher reservoir water levels. Maximum water levels would be sustained higher and longer with the WSIP than under existing conditions (or before the DSOD-imposed operational restrictions). Habitats and species that could not tolerate these longer periods of inundation would be lost, including oak woodland, mixed evergreen forest, serpentine grassland, and valley needlegrass grassland. This impact would be potentially significant.

The EIR for the Lower Crystal Springs Dam project (PN-4) will provide a more detailed analysis of project impacts, including a determination of the acreage of sensitive upland, wetland, and riparian habitat that would be affected by the change in reservoir water levels. However, this PEIR conservatively considers the effects of the WSIP on sensitive upland, wetland, and riparian habitats to be *potentially significant.*

Key Special-Status Species

Proposed operation of Upper and Lower Crystal Springs Reservoirs under the WSIP would affect several key special-status species. Populations of serpentine-associated fountain thistle and Marin western flax would be inundated and their habitat potentially permanently lost. At the program level of analysis, this impact is considered potentially significant. More detailed impact analysis will be conducted as part of the project-level CEQA review for the Lower Crystal Springs Dam project (PN-4).

WSIP-related operations could also affect San Francisco garter snake and California red-legged frog in several ways. Direct mortality by drowning could occur if the reservoir level is raised while San Francisco garter snakes are in hibernation. Both species would experience a loss of habitat throughout Upper and Lower Crystal Springs Reservoirs when existing freshwater marsh vegetation is inundated. Once freshwater marsh wetland is established at higher levels, the WSIP could increase the extent of available habitat for California red-legged frog and San Francisco

garter snake. However, raising the water level in reservoirs could permit largemouth bass (*Micropterus salmoides*) and other predators to gain access to habitat for San Francisco garter snake and California red-legged frog in areas that are currently isolated due to elevational barriers. Examples include Tracy Lake in the northern arm of Lower Crystal Springs Reservoir, and the proposed Laguna Creek sedimentation basin at the southern end of Upper Crystal Springs Reservoir. Thus, at the program level of analysis, potentially significant adverse and beneficial impacts on habitat for special-status species would be expected to occur due to higher and more variable water levels in Upper and Lower Crystal Springs Reservoirs. Impacts will be analyzed in more detail in the project-specific EIR for the Lower Crystal Springs Dam project (PN-4).

Annual summer drawdown has been cited as a potential problem for San Francisco garter snakes because the exposed, unvegetated shoreline separates emergent vegetation foraging habitat from water and protective cover (Barry, no date). Hydrologic models of the proposed program indicate that summer drawdown would be about the same as the current pattern, except for the drawdown that would occur for periodic maintenance. San Francisco garter snakes usually enter their winter hibernation period by mid-November (Barry, no date). Because the drawdown period overlaps somewhat with the active period of this species, this impact would be potentially significant with respect to foraging habitat for both adult and young garter snakes.

Other key special-status species that could be affected by reservoir operations under the WSIP include peregrine falcon and black rail. Both species utilize freshwater marsh habitats, but to a limited degree. Therefore, impacts on these species due to alteration of habitats would be less than significant.

Overall, the effects of the WSIP on key special-status species would be *potentially significant*.

Other Species of Concern

The loss of existing habitat and ultimate establishment of habitat at higher elevations would also affect a number of reptile, bird, and bat species of concern that depend on freshwater marsh and riparian habitat. Those that depend on freshwater marsh habitat would experience a loss of habitat when the reservoir level is raised, but would ultimately benefit when freshwater marsh becomes established at higher elevations. Such species include western pond turtle, tricolored blackbird, saltmarsh yellowthroat, northern harrier, Vaux's swift, and double-crested cormorant, all known to occur at the reservoirs. Individuals of these species could be directly affected by a rise in water level during the breeding season, and a temporary loss of suitable habitat could result if wetland vegetation changes occur. Both of these changes would result in potentially significant impacts.

Bird and mammal species of concern that depend on large trees and woodland for nesting, roosting, or foraging would be adversely affected by the loss of upland trees along the shoreline. Such species include Cooper's hawk, sharp-shinned hawk, loggerhead shrike, several bat species, and San Francisco dusky-footed woodrat. Species of concern that depend on grassland and coastal scrub, including Bell's sage sparrow and pallid bat, could be affected by the loss of these habitats when reservoir water levels are raised. Due to the extent of habitat and the number of

species that would be affected, impacts on species of concern due to the loss of upland habitat would be potentially significant.

Serpentine- and grassland-associated plant species of concern and their habitats could be lost due to increased water levels at Upper and Lower Crystal Springs Reservoirs, depending on species tolerance for extended inundation, saturation of the seed bank, and the length of inundation. Species that could be affected include Franciscan onion, Crystal Springs lessingia, western leatherwood, and arcuate bush mallow. San Francisco collinsia would potentially be affected by loss of forested or coastal scrub habitat. Impacts due to the loss of habitat and populations of these species of concern would be potentially significant.

Overall, the effects of the WSIP on other species of concern would be *potentially significant*.

Common Habitats and Species

The WSIP proposes to maintain Upper and Lower Crystal Springs Reservoirs at maximum levels for longer periods during the summer than under existing conditions, and for longer periods than under the DSOD imposed operational restrictions. Many upland plant species can tolerate inundation for brief periods, especially during their winter dormant period, but lack adaptations for surviving extended flooding during their period of active growth. Longer periods of maximum reservoir levels may result in mortality of valley oaks, coast live oaks, and other upland species at elevations below 283 feet. The loss of common upland habitats and species at the periphery of Upper and Lower Crystal Springs Reservoirs is considered a *potentially significant* impact because of the extent of area involved.

Impact Conclusions

Impacts on sensitive habitats, key special-status species, species of concern, and common habitats and species at Upper and Lower Crystal Springs Reservoirs would be *potentially significant*. For all resources except plant species adapted to serpentine seeps, such as the fountain thistle, implementation of Measure 5.5.6-1a, Adaptive Management of Freshwater Marsh and Wetlands at Upper and Lower Crystal Springs Reservoirs, and Measure 5.5.6-1b, Compensation for Impacts on Terrestrial Biological Resources, would be sufficient to fully mitigate impacts of the WSIP. For the fountain thistle (key special-status species) and other plant species adapted to serpentine seeps, the additional implementation of Measure 5.5.6-1c, Compensation for Serpentine Seep-Related Special-Status Plants, would reduce the impact to a less-than-significant level.

Impact 5.5.6-2: Impacts on biological resources in San Andreas Reservoir.

Sensitive Habitats

With the WSIP, San Andreas Reservoir would be maintained in much the same pattern as it is under existing conditions, and operation of the reservoir would not substantially affect sensitive freshwater marsh habitats. Every fifth year, the reservoir would be drawn down for maintenance

during the winter months, when freshwater marsh vegetation is not typically in active growth. As a result, impacts on sensitive habitat at San Andreas Reservoir would be *less than significant.*

Key Special-Status Species

Since the composition and extent of emergent vegetation is not expected to change significantly at San Andreas Reservoir as a result of WSIP operations, impacts on San Francisco garter snake and California red-legged frog would be *less than significant.* Since the maximum reservoir water level would not change, no impact would occur on key terrestrial upland special-status species such as Mission blue butterfly.

Other Species of Concern

Since changes in the extent and composition of freshwater emergent and upland habitat are expected to be minimal, no impact would occur on upland plant species such as western leatherwood, and arcuate bush mallow. Likewise, any impact on western pond turtle, foraging and roosting bats, tricolored blackbird, northern harrier, merlin, peregrine falcon, Vaux's swift, saltmarsh yellowthroat, and double-crested cormorant would be *less than significant*.

Common Habitats and Species

Impacts on common habitats and species would be *less than significant*, since the extent and composition of upland and wetland habitats are expected to remain stable.

Impact Conclusions

Impact on sensitive habitats, key special-status species, species of concern, and common habitats and species at San Andreas Reservoir would be *less than significant*.

Impact 5.5.6-3: Impacts on biological resources along San Mateo Creek below Lower Crystal Springs Dam.

Sensitive Habitats

Under the WSIP, Crystal Springs Dam and Reservoir would be operated in much the same way as under existing conditions with respect to maximizing storage and minimizing releases to San Mateo Creek. Because the volume, magnitude, and frequency of releases are projected to be much the same as at present, the impact of the WSIP on riparian vegetation in San Mateo Creek would be *less than significant*.

Key Special-Status Species

Section 4.6, Biological Resources, discusses impacts on freshwater-marsh-dwelling species (such as California red-legged frog) due to the alteration of freshwater marsh habitat immediately below the dam. Since releases from Crystal Springs Dam to San Mateo Creek are projected to be much the same as under existing conditions, any impacts on aquatic-dependent key special-status

species would be *less than significant*. WSIP operations would not affect key special-status plants such as San Mateo woolly sunflower.

Other Species of Concern

Any impacts on riparian- and creek-associated species of concern (such as western pond turtle) would be so small as to not be quantifiable and would therefore be *less than significant*.

Common Habitats and Species

Operations under the WSIP would not affect common upland habitats. The impacts on common species would be *less than significant*.

Impact Conclusions

Impacts of WSIP operations on sensitive habitats and key special-status species at San Mateo Creek would be *less than significant*.

Impact 5.5.6-4: Impacts on biological resources in Pilarcitos Reservoir.

Sensitive Habitats

Greater drawdown of the reservoir under the WSIP would increase the extent of unvegetated, weedy, or seasonal wetland areas below the maximum water levels. Existing freshwater emergent vegetation is already limited to areas that receive groundwater seepage or year-round surface water flow at the mouths of the tributary streams. Although the greater drawdown could slightly reduce the extent of areas supporting sensitive freshwater marsh habitat, this impact would be *less than significant*.

Key Special-Status Species

Proposed operations at Pilarcitos Reservoir would slightly reduce the extent of suitable habitat at Pilarcitos Reservoir for California red-legged frog and San Francisco garter snake, a *potentially significant* impact. However, the extent and condition of adjacent upland vegetation would not be affected by the proposed reservoir operations. As a result, this impact would not apply to nesting or foraging upland habitats for species such as marbled murrelet.

Other Species of Concern

Proposed operations at Pilarcitos Reservoir could slightly reduce the extent of suitable habitat for western pond turtle, Vaux's swift, Yuma myotis, long-eared myotis, and bird species that forage over open water and emergent vegetation, but this impact would be *less than significant*. However, the extent and condition of adjacent upland vegetation would not be affected by the proposed reservoir operations. As a result, this impact would not apply to nesting or foraging upland habitats for species such as Cooper's hawk, sharp-shinned hawk, Bell's sage sparrow, Vaux's swift, merlin, peregrine falcon, loggerhead shrike, special-status bat species, San Francisco dusky-footed woodrat, and western leatherwood.

Common Habitats and Species

No impact on common habitats would occur as a result of WSIP operations. The potential impact on common species that depend on water levels in Pilarcitos Reservoir and flow in Pilarcitos Creek would be *less than significant*.

Impact Conclusions

Impacts on key special-status species at Pilarcitos Reservoir would be *potentially significant*. Implementation of Measure 5.5.3-2, Revised Operations Plan for Pilarcitos Watershed Facilities, would maintain reservoir storage levels similar to existing conditions and would reduce this impact to a less-than-significant level.

Impact 5.5.6-5: Impacts on biological resources along Pilarcitos Creek below Pilarcitos Reservoir.

Sensitive Habitats

Under the WSIP, flow in Pilarcitos Creek between Pilarcitos Dam and Stone Dam would increase during normal and better rainfall years, a beneficial impact. In the summer months of dry years, the period during which releases from Pilarcitos Reservoir cease would be extended, potentially for up to three months. White alder, the dominant species in the riparian forest in this section, requires flowing water and without it could become stressed or could die. Although there is some seepage from Pilarcitos Dam as well as flow from lateral tributaries, this seepage would decrease during an extended drought. The channel-forming processes in Pilarcitos Creek would be reduced insignificantly under the WSIP. Thus, some changes in flow would be beneficial and some adverse. Conservatively, the overall impact on sensitive riparian habitat is considered *potentially significant*.

Key Special-Status Species

Flows in Pilarcitos Creek below Pilarcitos Dam would have a minor impact on riparian habitat; therefore, the impact on habitat for foothill yellow-legged frog would be *less than significant*.

Other Species of Concern

Proposed operations at Pilarcitos Reservoir could slightly reduce the extent of suitable habitat for western pond turtle, Vaux's swift, Yuma myotis, long-eared myotis, and bird species that forage over open water and emergent vegetation, but this impact would be less than significant. However, the extent and condition of adjacent upland vegetation would not be affected by the proposed reservoir operations. As a result, this impact would not apply to nesting or foraging upland habitats for species such as Cooper's hawk, sharp-shinned hawk, Bell's sage sparrow, Vaux's swift, merlin, peregrine falcon, loggerhead shrike, special-status bats, San Francisco dusky-footed woodrat, western leatherwood, and Dudley's lousewort.

Flows in Pilarcitos Creek below Pilarcitos Dam and below Stone Dam would have a less-than-significant impact on riparian habitat; therefore, the impact on habitat for foothill yellow-legged frog and any special-status birds and bats that forage over streams would be less than significant.

Overall, WSIP impacts on other species of concern would be *less than significant.*

Common Habitats and Species

No impacts on common habitats would occur as a result of WSIP operations. The potential impact on common species that depend on water levels in Pilarcitos Reservoir and flow in Pilarcitos Creek would be *less than significant.*

Impact Conclusions

Impacts on sensitive riparian habitat at Pilarcitos Creek below Pilarcitos Reservoir would be *potentially significant.* Implementation of Implementation of Measure 5.5.3-2, Revised Operations Plan for Pilarcitos Watershed Facilities, would maintain reservoir storage levels similar to existing conditions and would reduce this impact to a less-than-significant level.

Impact 5.5.6-6: Impacts on biological resources along Pilarcitos Creek below Stone Dam.

Sensitive Habitats

The central coast arroyo willow riparian forest below Stone Dam, which relies on seepage and on the contribution of tributary creeks, would not be significantly affected by the WSIP. The overall reduction in high winter flows would result in a slight incremental reduction in channel-forming processes, but the overall impact on sensitive riparian resources along Pilarcitos Creek below Stone Dam would be *less than significant.*

Key Special-Status Species

Flows in Pilarcitos Creek below Stone Dam would have a minor impact on riparian habitat; therefore, the impact on habitat for foothill yellow-legged frog would be *less than significant.*

Other Species of Concern

Flows in Pilarcitos Creek below Stone Dam would have a minor impact on riparian habitat; therefore, the impact on habitat for foothill yellow-legged frog and any special-status birds and bats that forage over streams would be *less than significant*.

Common Habitats and Species

No impacts on common habitats would occur as a result of WSIP operations. The potential impact on common species that depend on water levels in Pilarcitos Reservoir and flow in Pilarcitos Creek would be *less than significant.*

Impact Conclusions

Impacts on biological resources along Pilarcitos Creek below Stone Dam would be *less than significant*, and no mitigation measures would be required.

Impact 5.5.6-7: Conflicts with the provisions of adopted conservation plans or other approved biological resources plans.

The only plan relevant to proposed WSIP operations is the *Peninsula Watershed Management Plan*. The WSIP program as a whole would be consistent with the provisions of this plan, which places priority on resource protection while ensuring that the objective of delivering adequate, high-quality water is met. The SFPUC is currently preparing a habitat conservation plan for the Peninsula watershed; however, WSIP operations are not considered in this plan, which covers only existing operations. Therefore, impacts related to conflicts with adopted plans would be *less than significant.*

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5.5.7 Recreational and Visual Resources

Chapter 4, Section 4.12, Recreational Resources, provided a general overview of the park and recreational facilities and resources near proposed WSIP facility projects. This section discusses specific recreational resources and activities within the Peninsula watershed that could be affected by the proposed water supply and system operations. The discussion focuses primarily on water-related recreation, including fishing, swimming, boating, rafting, or activities such as scenic viewing, walking, hiking, or camping adjacent to water bodies, that could be affected by the WSIP.

5.5.7.1 Setting

The water features of interest for this analysis are the four SFPUC Peninsula reservoirs (Upper Crystal Springs Reservoir, Lower Crystal Springs Reservoir, San Andreas Reservoir, and Pilarcitos Reservoir) and San Mateo and Pilarcitos Creeks. All four reservoirs and portions of the two creeks are located within the SFPUC Peninsula watershed, as shown on Figure 5.5.1-2. The recreational uses and visual resources in the Peninsula watershed that could be affected by the WSIP water supply or system operations are described below.

As described in Section 4.2, Plans and Policies, and 4.3, Land Use and Visual Quality, the Peninsula watershed area is protected by two easements that were established through a four-party agreement among the CCSF, the U.S. Department of the Interior, the California Department of Transportation, and San Mateo County. The scenic and recreation easement covers 4,000 acres located in the eastern periphery of the watershed, generally along the I-280 corridor and adjacent to the communities to the east. The easement abuts Upper and Lower Crystal Springs Reservoirs and the southern end of San Andreas Reservoir. Recreational activities are permitted in this easement area, but are limited to those considered compatible with water quality protection. Portions of these reservoirs are visible from trails within the easement, but public access to the four reservoirs is prohibited, along with all forms of water sports. The scenic easement, which covers 19,000 acres, does not permit recreational activities. This area encompasses the four reservoirs and a stretch of Pilarcitos Creek (SFPUC, 2002). Only a very short stretch of San Mateo Creek is located within the scenic easement; the rest of the creek is outside of both easements and outside of Peninsula watershed lands.

The *Peninsula Watershed Management Plan* also prohibits recreational activities that are detrimental to watershed resources, including swimming, boating, fishing, and hiking at or near the shoreline (SFPUC, 2002).

Recreational Uses

Public trails in the watershed provide both recreational opportunities and scenic views of the Upper Crystal Springs, Lower Crystal Springs, Pilarcitos, and San Andreas Reservoirs. The trails are generally located between the reservoirs and I-280, along the eastern edge of the watershed, where they are easily accessible from the adjacent communities. They are available to the public for hiking, running, bicycling, rollerblading, and horseback riding (though horseback riding and bicycles are allowed only on certain designated trails).

Sawyer Camp Trail

When the SFPUC fenced off the watershed lands in the vicinity of Crystal Springs Reservoir, it left the six-mile Sawyer Camp Trail open to the public for nonmotorized recreational use. This trail, once the main highway between San Francisco and Half Moon Bay, is visited by approximately 300,000 people each year. The trail parallels Crystal Springs and San Andreas Reservoirs and is currently managed by San Mateo County under the name Crystal Springs Park. San Mateo County envisions the Sawyer Camp Trail as an uninterrupted multi-use route from San Bruno to Woodside (San Mateo County, 2007).

San Andreas Trail

The San Andreas Trail extends from San Bruno Avenue on the north to Hillcrest Boulevard on the south, where it connects to the Sawyer Camp Trail. In its northerly section, this popular trail provides scenic views of San Andreas Reservoir. A portion of the trail is paved and is heavily used by bicyclists, joggers, and hikers (San Mateo County, 2006).

Sweeney Ridge Trail

The Sweeney Ridge Trail, which extends from the end of Sneath Lane in San Bruno to the San Francisco Bay Discovery Site (a National Historic Landmark), provides views of the northern watershed and San Francisco Bay (San Mateo County, 2006).

Fifield-Cahill Ridge Trail

Since 2003, the Fifield-Cahill Ridge Trail has been open to the public on a reservation-only basis, with groups of up to 20 people led by docents three days a week. This trail segment is the SFPUC-managed component of the 400-mile-long Bay Area Ridge Trail (SFPUC 2007b).

Connector Trails

Numerous connector trails cross I-280 and provide linkages to communities to the east such as San Mateo, Belmont, and Redwood City. In addition, portions of the San Andreas Reservoir are visible from Junipero Serra County Park (located to the northeast of SFPUC Peninsula watershed).

Pulgas Water Temple

The Pulgas Water Temple is located south of the Upper Crystal Springs Reservoir, east of Cañada Road. It consists of a Roman Renaissance–style structure and pool, surrounded by manicured lawns, landscaping, and a parking lot. The site is open to the public on weekdays and for special events such as weddings, as well as on weekends (SPFUC, 2007c).

Crystal Springs Golf Course

There is one golf course within the watershed, the Crystal Springs Golf Course, but it does not offer any forms of water recreation to the public.

Pilarcitos Creek

Pilarcitos Creek starts at Pilarcitos Reservoir within the SFPUC Peninsula watershed. No water recreation or access to this reservoir is allowed. The creek runs south until it reaches Highway 92, then runs west through portions of the Golden Gate National Recreation Area (GGNRA) and Rancho Corral de Tierra[1] to its mouth on the Pacific Ocean within Half Moon Bay State Beach. Numerous public trails throughout the GGNRA and Rancho Corral de Tierra provide access to Pilarcitos Creek. No organized recreational activities are established within or adjacent to the creek.

Trails within Half Moon Bay State Beach run adjacent to and across Pilarcitos Creek, and the public is allowed access to portions of the creek (Bay Area Hiker, 2007).

San Mateo Creek

San Mateo Creek starts at Lower Crystal Springs Reservoir within the SFPUC Peninsula watershed (see above for a description of activities allowed within the watershed). The creek runs east through the town of Hillsborough and city of San Mateo to San Francisco Bay. The San Mateo Creek Trail, maintained by San Mateo County, runs adjacent to the creek for several miles. The creek is not part of any City-managed recreation facility until it reaches San Mateo's Shoreline Parks on San Francisco Bay. Shoreline Parks, which includes Ryder Park and Seal Point Park, includes amenities such as trails, picnic areas, play areas, and an outdoor classroom. These parks incorporate the natural features of the creek and shoreline to some extent and provide some wilderness-based recreation, but are primarily paved and developed. The creek does not appear to be used for any purpose other than as a scenic resource (City of San Mateo, 2007).

Crystal Springs, Pilarcitos, and San Andreas Reservoirs

These reservoirs are located entirely within the SFPUC Peninsula watershed lands. As mentioned above, public access to the interior portion of these watershed lands is prohibited, and the reservoirs are not available for water-related recreation.

Visual Quality Considerations

Due to its use for water collection and storage, the Peninsula watershed area has been protected from urbanization. A wide variety of habitats exist on the watershed due to its diversity of climate, topography, geology and soils. These include old growth Douglas fir forests, grasslands dominated by native bunchgrasses, areas of coastal scrub and chaparral, stream corridors, and wetlands (SFPUC, 2007a). While many of the SFPUC facilities located within the Peninsula watershed are aboveground structures, they are typically screened with existing vegetation and blend with the watershed's landscape. The reservoirs appear as visually prominent water features in views from nearby trails and surrounding ridges as well as from I-280 and Highway 92.

[1] In 1995, Congress gave approval for the National Park Service to acquire the Rancho Corral de Tierra property. The Peninsula Open Space Trust, which owns the property, is currently working to secure federal appropriations for its interest in the property. Once the federal government has purchased the property, the National Park Service will add it to the GGNRA. The acquisition could take three years or longer, depending on congressional appropriations (Ortega, 2006).

The provisions of the scenic and scenic and recreation easements include the following:

- Except as required to accomplish the improvements hereinafter permitted or as otherwise permitted to the Grantor hereunder, the general topography of the landscape shall be maintained in its present condition and so substantial excavation or topographic changes shall be made without the concurrence of a regional representative of the Department of the Interior…

- Except as required to accomplish the purposes and uses herein permitted to Grantor, there shall be no cutting or permitting of cutting, destroying or removing any timber or brush without the concurrence in writing by a regional representative of the Department of the Interior…

As discussed in Chapter 4, Section 4.2, Plans and Policies, the *Peninsula Watershed Management Plan* includes the following policy related to visual quality:

- *Policy WA 9*: If new facilities require additional new locations, require that view shed studies be conducted to minimize, eliminate or conceal the violation of scenic values.

However, the proposed WSIP water supply and system operations analyzed in this section would not require any new facilities, other than those already discussed and analyzed in Section 4.3, Land Use and Visual Quality. Therefore, this policy is not addressed further in this section.

5.5.7.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to recreation or visual resources, but generally considers that implementation of the proposed program would have a significant impact on these resources if it were to:

Recreation

- Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated (Secondary impacts of growth are evaluated in Chapter 7, Growth-Inducement Potential and Indirect Effects of Growth)

- Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment (Secondary impacts of growth are evaluated in Chapter 7)

- Physically degrade existing recreational resources

The physical degradation of existing resources could occur if the WSIP were to: (1) remove or damage existing recreational resources directly; (2) cause environmental impacts (such as air quality or noise effects) that would indirectly result in deterioration in the quality of the recreational experience; or (3) disrupt access to existing recreation facilities (which would divide a community from some of the established amenities used by its members).

Visual Quality

- Have a substantial adverse effect on a scenic vista
- Substantially damage scenic resources, including but not limited to trees, rock outcroppings, and other features of the built or natural environment that contribute to a scenic public setting
- Substantially degrade the existing visual character or quality of the site and its surroundings

Approach to Analysis

The WSIP would change water levels in reservoirs and alter flow in streams in the Peninsula watershed. WSIP-induced changes in reservoir water levels in the San Mateo Creek watershed were estimated using the HH/LSM (see Appendix H). WSIP-induced changes in reservoir water levels in the Pilarcitos Creek watershed and stream flow in the Pilarcitos Creek and San Mateo Creek watersheds were estimate semi-quantitatively. A specialist in recreation and visual resources assessed the impacts of the WSIP on these environmental elements using the estimated WSIP-induced changes in reservoir water levels and stream flow (see Section 5.5.1).

Impact Summary

Table 5.5.7-1 presents a summary of the impacts on recreational and visual resources in the Peninsula watershed that could result from implementation of the proposed water supply and system operations.

TABLE 5.5.7-1
SUMMARY OF IMPACTS – RECREATIONAL AND VISUAL RESOURCES IN THE PENINSULA WATERSHED

Impact	Significance Determination
Impact 5.5.7-1: Effects on recreational facilities and/or activities	LS
Impact 5.5.7-2: Visual effects on scenic resources or the visual character of water bodies	LS

LS = Less than Significant impact, no mitigation required

Impact Discussion

Impact 5.5.7-1: Effects on recreational facilities and/or activities.

The WSIP would have no impact on water-related recreational facilities or other recreational activities in the Peninsula watershed. As described in the Setting, no water recreation is allowed on the SFPUC reservoirs; because there would be no change to this policy under the WSIP, no impacts on recreation would occur as a result of water level changes in the Peninsula reservoirs. In addition, new trails are prohibited at or near the shoreline, so no land-based recreation would be affected. With respect to recreation in and along the creeks in the watershed, there is either (1) no

or only very limited water recreation occurring at present, and/or (2) the WSIP-related flow changes described in Section 5.5.1 would not appreciably change creek flows to an extent that existing recreational use would be affected. The changes in stream flow or reservoir levels would not physically degrade existing recreational resources. Therefore, impacts on recreation associated with the proposed WSIP system operations would be *less than significant*, and no mitigation is required.

Impact 5.5.7-2: Visual effects on scenic resources or the visual character of water bodies.

As described in Section 5.5.1 flow changes and reservoir water level changes that would occur under the WSIP in the future are not beyond the range of flow and water level variation that occurs now. The Lower Crystal Springs Dam Improvements project (PN-4) would restore the historic reservoir capacity and would raise the water level to historic conditions. The reservoir is visible from a number of trails, parks, and scenic roads. However, while the higher reservoir water level could change the visual appearance at close range, it would not change the scenic quality of the reservoir, either at close range or from distant viewpoints. Therefore, visual impacts associated with the proposed WSIP system operations would be *less than significant*, and no mitigation is required.

References – Recreational and Visual Resources

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San Francisco Public Utilities Commission (SFPUC), Pulgas Water Temple description, http://sfwater.org/mto_main.cfm/MC_ID/20/MSC_ID/177/MTO_ID/308, accessed June 12, 2007c.

San Mateo County, Environmental Services Agency, Crystal Springs (Sawyer Camp Trail), http://www.co.sanmateo.ca.us/smc/department/home/0,,5556687_12305993_12328403,00.html, accessed June 12, 2007.

ATTACHMENT 5-A
Mitigation for Chapter 5 Impacts

Introduction

This attachment is an excerpt from Chapter 6, Mitigation Measures, that presents all mitigation measures for impacts described in Chapter 5. Mitigation measures for PSM, PSU, and SU impacts identified in Sections 5.3 through 5.6 are presented under the respective environmental resource topic, such as Fisheries or Terrestrial Biological Resources. No PSM, PSU, or SU cumulative impacts related to WSIP water supply and system operations were identified (Section 5.7). All mitigation measures are numbered to correspond to the same impact numbers, although in some cases, the same measure would mitigate more than one impact and the numbering corresponds to the first impact identified and cross-referenced so that measures are not duplicated.

Mitigation Measures to Minimize Water Supply and System Operations Impacts

Plans and Policies (Section 5.2)

System Measures

None required.

Tuolumne River System and Downstream Water Bodies

Stream Flow and Reservoir Water Levels (Section 5.3.1)

System Measures

None required.

Geomorphology (Section 5.3.2)

System Measures

None required.

Surface Water Quality (Section 5.3.3)

System Measures

None required.

Surface Water Supplies (Section 5.3.4)

System Measures

None required.

Groundwater (Section 5.3.5)

System Measures

None required.

Fisheries (Section 5.3.6)

System Measures

Overview of Measures 5.3.6-4a, 5.3.6-4b, and 5.3.7-6

The SFPUC will attempt to implement Measure 5.3.6-4a as described below, which could mitigate both Impacts 5.3.6-4 and 5.3.7-6 to a less than significant level. Measure 5.3.6-4a involves some uncertainty because its implementation depends on the SFPUC negotiating and reaching agreement with MID/TID and possibly other water agencies. If Measure 5.3.6-4a proves to be infeasible, the SFPUC will implement Measure 5.3.6-4b to lessen fisheries impacts and Measure 5.3.7-6 to lessen impacts on riparian vegetation.

Avoidance of Flow Changes by Reducing Demand for Don Pedro Reservoir Water

Measure 5.3.6-4a: The SFPUC will pursue a water transfer arrangement with MID/TID and/or other water agencies such that the water acquired is developed through actions that result in reduction of demand on Don Pedro Reservoir as a result of conservation, improved delivery efficiency, inter-agency water transfer or use of an alternative supply such as groundwater. The TID and MID would deliver less water from Don Pedro Reservoir. The consequent increase in water storage in Don Pedro Reservoir would offset the reduction in inflow to Don Pedro Reservoir attributable to the WSIP. The release pattern from La Grange Dam would be the same or similar to the existing condition thus lessening or eliminating Impacts 5.3.6-4 and 5.3.7-6. The actions necessary to reduce demand for Don Pedro Reservoir water may themselves have environmental effects. See Section 6.5 for a review of potential environmental effects associated with the expected actions of this mitigation measure. Further environmental review would be undertaken prior to approving a specific water transfer agreement.

Fishery Habitat Enhancement

Measure 5.3.6-4b: If Measure 5.3.6-4a is not implemented, then the SFPUC will mitigate potential fishery effects on the lower Tuolumne River by implementing (or funding) one of

the following two habitat enhancement actions directed at fish habitat improvements that are designed to sustain fishery resources under the river's flow regime, which are consistent with the Habitat Restoration Plan for the Lower Tuolumne River Corridor: gravel augmentation, or isolating or filling a captured former gravel quarry pit along the river.

Spawning gravel enhancement will be implemented to increase spawning success in the reach downstream of La Grange Dam and to increase the availability of substrate for macroinvertebrate production that would be used as an enhanced food supply by rearing juvenile salmon and steelhead and other species. The spawning gravel augmentation project will involve the planning, design, permitting, purchase, placement, and monitoring of suitable gravel to be placed at three riffle locations within the spawning reach between Basso Bridge and La Grange Dam that meets the criteria for suitable habitat as described in the Habitat Restoration Plan for the Lower Tuolumne River Corridor at each location. The gravel will preferentially be rounded river rock of native origin that would be sized and pre-washed before placement into the river. The depth and quality (e.g., percentage fines and cementation) of gravel will be monitored at five-year intervals and if the gravel deposits do not meet the criteria for suitable habitat SFPUC will be obligated to further augment or enhance the gravel deposits. The SFPUC will continue this gravel augmentation project and periodic monitoring as part of long-term system operations.

Alternately, the SFPUC will remove from the lower river channel one of the former gravel quarry pits that has been "captured" by the river and acts as predator zones for fish such as largemouth and striped bass to prey on rearing and emigrating juvenile salmonids. This could be accomplished by filling the pit or installing a levee berm around the pit to isolate it permanently from the river channel. The SFPUC could implement this action directly or fund implementation by another entity involved in river restoration.

Terrestrial Biological Resources (Section 5.3.7)

System Measures

Controlled Releases to Recharge Groundwater in Streamside Meadows and Other Alluvial Deposits

Measure 5.3.7-2: To mitigate for potential WSIP effects on meadow resources along the Tuolumne River below Hetch Hetchy Reservoir, the SFPUC will manage releases from Hetch Hetchy Reservoir during the spring to recharge groundwater in the riverside meadows in the Poopenaut Valley and streamside alluvial deposits. The goal of the release pattern will be to approximate conditions characteristic of most Sierra meadows, which are mainly wetlands or semi-wetlands supporting a cover of both emergent wetlands plants and upland vegetation (Ratliff, 1982), and which depend on precipitation and upslope flows to recharge the upper soil layers with water (Ratliff, 1985). The performance standard to be achieved by this measure is no net loss of the extent, diversity, and condition of the existing meadow and wetland vegetation types in the Poopenaut Valley.

The SFPUC will manage reservoir releases for this purpose by releasing the expected available volume of water in the reservoir in a pattern that provides flows of a magnitude that inundate the meadows and streamside alluvial deposits for as long as possible. For example, rather than making releases at a constant rate each day (e.g., releasing 1,000 cfs

for seven days), the SFPUC could release the same volume of water but with varying cfs rates, creating flow pulses to meet the objective.

As part of this measure the SFPUC will gather baseline data regarding the extent, species composition and condition of the existing meadow vegetation within the Poopenaut Valley. Some of these environmental baseline data may be available as a result of current study efforts in the Poopenaut Valley[1]. As needed, the SFPUC will augment this information by carrying out vegetation composition surveys in the meadow before implementing the WSIP and at 5 year intervals after WSIP implementation to assess the efficacy of mitigation releases in maintaining or improving the percentage cover of meadow species as described by Ratliff (1985). The basic methodology for baseline vegetation survey and subsequent mitigation monitoring will be generally accepted quantitative vegetation sampling methods to permit statistical comparison of vegetation composition over time, as well as mapping the meadow vegetation in the Poopenaut Valley. If a significant decline in the extent or diversity of native meadow vegetation occurs, releases will be modified as needed to achieve the mitigating effect of sustaining the existing meadow communities.

Avoidance of Flow Changes by Reducing Demand for Don Pedro Reservoir Water

See **Measure 5.3.6-4a** in the Fisheries section, above. This measure also addresses impact 5.3.7-6 Impacts on biological resources along the Tuolumne River below La Grange. The SFPUC will attempt to implement Measure 5.3.6-4a as described above, which could mitigate both Impacts 5.3.6-4 and 5.3.7-6 to a less than significant level. Measure 5.3.6-4a involves some uncertainty because its implementation depends on the SFPUC negotiating and reaching agreement with MID/TID and possibly other water agencies. If Measure 5.3.6-4a proves to be infeasible, the SFPUC will implement Measure 5.3.6-4b to lessen fisheries impacts and Measure 5.3.7-6 to lessen impacts on riparian vegetation.

Lower Tuolumne River Riparian Habitat Enhancement

Measure 5.3.7-6: To mitigate the WSIP effects on riparian vegetation, the SFPUC will both protect and enhance one mile of riparian vegetation along the contemporary floodplain of the lower Tuolumne River. This will include funding the acquisition of fee title to or a conservation easement over riparian land totaling one mile (consisting of one or multiple sites) in order to permanently protect that land, and also funding riparian enhancement and on-going vegetation management to maintain the enhanced riparian values in perpetuity along one mile of river. The enhancement and management may be carried out along one river mile either on the land acquired by the SFPUC as described above or on land already under the permanent management of a public agency or conservation organization.

The SFPUC will implement this measure consistent with the Habitat Restoration Plan for the Lower Tuolumne River Corridor (McBain and Trush, 2000) and in coordination with the Tuolumne River Technical Advisory Committee. The SFPUC will also strive to

[1] In 2006 the SFPUC, National Park Service (and USFWS) began a collaborative study effort in the Poopenaut Valley. The effort has led to geomorphology test releases in May 2006, fieldwork in the channel in 2006 and 2007 to examine sediment transport and deposition relationships with flow. Two transects with ten recording piezometers have been installed across the meadow to measure groundwater recharge and drainage patterns. Supplementary stream staff gages have been installed to allow manual readings during high flows. Surveys have been done of the meadow to define the topography and the location and elevation of the piezometers. Infiltration of water from the stream to the meadow soils will be monitored during high flows to develop a better understanding of groundwater dynamics in the meadow so that reservoir operations, flow pulses, and minimum streamflow releases can be managed to improve meadow conditions within the constraints of water supply and facility limitations.

implement these projects in partnership with those groups currently working to restore riparian floodplains on the lower Tuolumne River.

The SFPUC may implement riparian enhancement in accordance with site locations and plans already developed as part of the Habitat Restoration Plan for the Lower Tuolumne River Corridor or on other appropriate sites along the river. For sites that haven't already had plans developed, a riparian enhancement plan will be prepared for each. The plan shall include, but not be limited to, the following:

- Clearly stated objectives and goals consistent with the Habitat Restoration Plan for the Lower Tuolumne River Corridor (McBain and Trush, 2000).
- Location, size, and type of mitigation actions proposed.
- Documentation of performance and monitoring standards.
- Performance and monitoring standards shall indicate success criteria to be met within 5 years for vegetation, removal of exotic species, etc. Adaptive management standards shall include contingency measures that shall outline clear steps to be taken if and when it is determined, through monitoring or other means, that the enhancement or restoration techniques are not meeting success criteria.
- Documentation of the necessary long-term management and maintenance requirements, and provisions for sufficient funding.

Recreational and Visual Resources (Section 5.3.8)

System Measures

None required.

Energy Resources (Section 5.3.9)

System Measures

None required.

Alameda Creek Watershed Streams and Reservoirs

Stream Flow and Reservoir Water Levels (Section 5.4.1)

System Measures

Diversion Tunnel Operation

Measure 5.4.1-2: The SFPUC will establish and implement written operational criteria for the Alameda Creek Diversion Dam that directs that the diversion dam and tunnel shall be operated to pass flows down Alameda Creek when diversion of those flows is not required to maintain desired levels in Calaveras Reservoir in order to provide the maximum possible days of winter and spring flows in Alameda Creek below the diversion dam.

This measure reinforces the way the SFPUC generally operates the diversion tunnel now: that diversion gates are closed in the spring once desired Calaveras Reservoir storage have been reached. However, at times additional flows have been diverted from Alameda Creek after reservoir storage levels have been achieved such that the "excess" water has subsequently been released from the reservoir to maintain the appropriate water level. This measure would formalize Alameda Creek diversion procedures to maintain flows in Alameda Creek to the extent they are not needed to achieve required reservoir storage. This measure would reduce the flow reduction impact but not to a level that is less than significant.

Geomorphology (Section 5.4.2)

System Measures

None required.

Surface Water Quality (Section 5.4.3)

System Measures

None required.

Groundwater (Section 5.4.4)

System Measures

None required.

Fisheries (Section 5.4.5)

System Measures

Minimum Flows for Resident Trout on Alameda Creek

Measure 5.4.5-3a: The SFPUC shall develop and carry out as part of the implementation of the Calaveras Dam Replacement (SV-2) project, an operational plan to implement minimum stream flows when precipitation generates runoff into the creek below the diversion dam to the Calaveras Creek confluence from December 1 through April 30 to support resident trout spawning and egg incubation. This is the period when winter precipitation typically would produce flows for spawning and egg incubation. The operational plan will identify the specific minimum flow requirements to support resident trout spawning and egg incubation, a detailed monitoring plan to survey and document trout spawning and egg incubation and any diversion facility modifications that are needed to implement the minimum stream flows.

Minimum flow requirements to support resident trout spawning and egg incubation vary depending on stream reach conditions. Although site-specific studies are needed to determine an appropriate minimum flow requirement for each specific creek reach, based on the general size and characteristics of the Alameda Creek channel immediately downstream of the diversion structure it has been suggested that a minimum flow on the

order of 10 cfs may be needed to support trout spawning and egg incubation. The SFPUC's Natural Resources Division will complete the site-specific studies needed to determine the appropriate minimum stream flow for this reach of the creek; studies may show that the minimum flow requirement is more or less than 10 cfs. This minimum flow requirement would be met when precipitation would naturally generate runoff in the creek (below the diversion dam) under unimpaired conditions between December 1 and April 30. When precipitation generates runoff in the creek, the SFPUC shall provide for bypass of flow up to the required minimum flow amount. The operational plan will allow for adapting minimum flow amounts to support resident trout spawning and egg incubation based on the monitoring results and best available scientific information.

The monitoring plan will be provided to appropriate resource agencies for review and comment and will subsequently be implemented by the SFPUC's Natural Resources Division staff. Monitoring results shall be provided to the resource agencies as requested. Monitoring shall occur for a minimum of five years and a maximum of ten years following completion of the Calaveras Dam Replacement project. At the completion of the monitoring period the SFPUC shall produce a draft comprehensive report describing the methods, data collected, and results used to assess the performance of the minimum streamflow in providing suitable habitat for resident trout spawning and egg incubation.

The Alameda Creek Fisheries Restoration Workgroup is currently overseeing collaborative studies to better characterize the flow-habitat relationships for trout spawning within Alameda Creek, and the SFPUC is providing staff and funding to support this effort. Information from these studies will also be used in developing the specific range of minimum stream flows needed to support suitable habitat within the reach below the diversion dam to the Calaveras Creek confluence. Identification of any SFPUC facilities modifications needed to allow the designated minimum flow to pass downstream of the diversion dam will be described and evaluated as necessary in the project-level EIR for the Calaveras Dam Replacement project (SV-2).

This measure addresses two areas of impact to the resident trout fishery in Alameda Creek below the diversion dam. First, it addresses the decrease in flow below the diversion dam that would occur under the WSIP as a result of re-instituting flow diversions to Calaveras Reservoir once the dam is replaced (WSIP Project SV-2) and current DSOD storage capacity restrictions are removed. Second, it addresses the loss of fish from the lower creek system that would result from fish entrainment through the unscreened diversion tunnel to Calaveras Reservoir. Providing for minimum stream flows in Alameda Creek below the diversion dam, as required by the mitigation measure, would support resident trout spawning and egg incubation and it is expected that this measure would be sufficient to sustain the trout population in this reach of the creek. This would fully address/mitigate for both areas of WSIP impact to the resident trout fishery below the diversion dam. If monitoring indicates that this measure is adequate to sustain the resident trout population below the diversion dam, then no additional mitigation action would be required. If monitoring indicates that this measure does not sustain the resident trout fishery in this reach, then the SFPUC shall either modify the minimum stream flow to enhance downstream habitat conditions to fully meet the mitigation requirement or also implement Measure 5.4.5-3b Diversion Restrictions or Fish Screens.

Alameda Diversion Dam Diversion Restrictions or Fish Screens

Measure 5.4.5-3b: If, after 10 years of monitoring results for Measure 5.4.5-3a, Minimum Flows for Resident Trout in Alameda Creek, indicate that the measure does not sustain the resident trout population in Alameda Creek below the diversion dam, then the SFPUC shall also implement additional measures as follows: either implement seasonal restrictions on Alameda Creek diversions to Calaveras Reservoir to protect the downstream resident trout fishery during the critical spawning period (December 1 through April 30) or install and operate a fish passage barrier to "screen" the diversion facility (screening could consist of a behavioral barrier, such as electrical or sound barrier that deters fish, or a physical barrier – such as a screen facility).

SFPUC shall consult with the appropriate resource agencies, including CDFG, to first review the monitoring results for Measure 5.4.5-3a and determine the need for any further mitigation actions. If needed, SFPUC will consult with the appropriate resource agencies to develop appropriate seasonal restrictions on diversions. This could involve establishing a set annual time period for diversion restrictions or annual monitoring of fishery conditions that would then trigger implementation of diversion restrictions.

Alternatively, the SFPUC will implement a fish passage barrier if determined to be feasible. During the 10-year monitoring and evaluation period for Measure 5.4.5-3a, the SFPUC will evaluate the feasibility of installing and operating a fish passage barrier. The feasibility study will include an engineering evaluation of the existing site and diversion structure, access for construction and power supplies to the site, the application of various alternative designs, and identification of a preferred design if determined to be feasible. If it is determined that a fish passage barrier is needed to protect resident trout at the diversion structure then engineering design will be completed and be sufficiently detailed to allow permitting and completion of construction within a period of 24 months after the date that the additional mitigation is determined to be required.

Terrestrial Biological Resources (Section 5.4.6)

System Measures

Compensation for Impacts on Terrestrial Biological Resources

Measure 5.4.6-1: This measure mitigates for water supply and systemwide operation effects on resources within the Alameda Creek watershed. These impacts would occur primarily through operation of the Calaveras Dam Replacement project (SV-2).

The SFPUC will compensate for sensitive wetland, riparian and upland habitats and habitats which support key special-status species or other species of concern lost as a result of WSIP system operation. Similar habitat will be identified, protected, restored, enhanced, created and managed off-site[2] to ensure no net loss of habitat extent or function. A qualified biologist will quantify the magnitude and extent of impacts to wetlands, sensitive habitats, and key special-status species and other species of concern, and the SFPUC will develop and implement mitigation and compensation plans that meet the appropriate regulatory requirements and permit conditions with respect to compensation ratios, other

[2] Off-site means the compensatory action is located other than within the project construction footprint, but could be on lands already under SFPUC ownership. Measure 4.6-2 addresses compensatory actions to be taken within the construction footprint.

conservation measures and management requirements to mitigate project impacts to less than significant levels.

The SFPUC will obtain required permits and comply with applicable environmental regulations addressing sensitive habitats and species. Compensatory lands—including those restored or enhanced as well as those acquired or designated as protected as part of program mitigation--will be established in perpetuity with a commitment that such lands will not be used for any purpose that conflicts with the primary purpose of maintaining intact wildlife and plant habitat.

One alternative for implementing such habitat compensation is the Habitat Reserve Program (HRP) currently being developed by the SFPUC. The purpose of the HRP is to provide a comprehensive, coordinated approach to mitigation and related regulatory compliance for WSIP projects and operations. This related SFPUC project is described further in Chapter 3.0, Section 3.11. Under the proposed HRP, the SFPUC would proceed as soon as possible with identifying, securing (through designation, management agreement, conservation easement, or acquisition of fee title) and improving lands to be used for habitat compensation so that mitigation is underway concurrent with habitat loss related to WSIP program activities, further ensuring no net loss of resources. The proposed HRP is scheduled for CEQA environmental review in 2007 and is targeted for implementation as soon as possible thereafter. Once the HRP is approved and implemented, the SFPUC will use this as one vehicle or method for implementing the mitigation requirements for individual WSIP projects. Otherwise, where appropriate and necessary, the SFPUC will develop and implement appropriate habitat compensation mitigation for individual WSIP projects and their associated operational impacts.

Operational Procedures for Calaveras Dam Releases

Measure 5.4.6-3: During project-level CEQA review on the Calaveras Dam Replacement project (SV-2), the SFPUC will develop operational procedures for managing planned releases from Calaveras Dam to minimize habitat impacts on amphibians, their egg masses, and tadpoles. The goal of such releases, apart from benefits to fish, is to mimic a more natural pattern of hydrology regime as much as possible. The procedures will specify the minimum amount and frequency of planned releases and the rate of the increase and decrease of any individual release event. One of the specific goals of such releases would be to reduce the risk of mortality to breeding amphibians. Such operational procedures will be developed prior to completion of construction of the Calaveras Dam Replacement project. In addition, instream flow releases required under CDFG agreement with SFPUC (see Table 5.4.1-9) would begin upon completion of construction.

Recreational and Visual Resources (Section 5.4.7)

System Measures

None required.

San Francisco Peninsula Streams and Reservoirs

Stream Flow and Reservoir Water Levels (Section 5.5.1)

System Measures

None identified

Geomorphology (Section 5.5.2)

System Measures

None required.

Surface Water Quality (Section 5.5.3)

System Measures

Revised Operations Plan for Pilarcitos Watershed Facilities

Measure 5.5.3-2: The SFPUC will develop an operations plan for Pilarcitos Reservoir, Stone Dam, and associated diversions that would manage storage in Pilarcitos Reservoir and releases to Pilarcitos Creek so that flows in Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam would be similar to those that occur under the existing condition. This could be achieved by supplying Coastside CWD's increased future purchase request from Crystal Springs Reservoir in a pattern of diversion that would allow Pilarcitos Reservoir to be operated in a manner that approximates historical operations. Because, with this mitigation measure in place, storage in Pilarcitos Reservoir would be similar with the WSIP and under existing conditions, spills at Stone Dam with the WSIP and under existing conditions would also be similar.

Groundwater (Section 5.5.4)

System Measures

None required.

Fisheries (Section 5.5.5)

System Measures

Create New Spawning Habitat Above Crystal Springs Reservoir

Measure 5.5.5-1: The SFPUC will survey the extent and quality of fish spawning habitat that could potentially be lost due to inundation and, if feasible, create new spawning habitat at a higher elevations. The specifics of this mitigation measure will be determined as part of project-level CEQA review for the Lower Crystal Springs Dam Improvements project (PN-4).

Terrestrial Biological Resources (Section 5.5.6)

System Measures

Adaptive Management of Freshwater Marsh and Wetlands at Upper and Lower Crystal Springs Reservoirs

Measure 5.5.6-1a: To offset the loss of wetlands, a qualified professional will develop an adaptive management plan for managing and maintaining freshwater marsh and other wetlands around the periphery of Upper Crystal Springs, and Lower Crystal Springs Reservoirs. This adaptive management plan may include the following:

- Gradually raise the reservoir elevations at appropriate times of year to maintain continuous freshwater marsh and riparian habitat along the shorelines to reduce potentially adverse effects to San Francisco garter snakes and California red-legged frogs.

- Identify feasible measures to help to moderate the effects of reservoir drawdown, increase the extent of reservoir margins with the potential to support freshwater marsh vegetation, and investigate the effectiveness for the management and control of predatory aquatic species such as largemouth bass and bullfrogs.

- Perform monitoring and review to ensure that habitat is sustained at Upper and Lower Crystal Springs Reservoirs and elsewhere, as appropriate, to achieve no net loss of habitat and value for freshwater marsh, wetlands, and special-status species.

- Observe all appropriate protective measures to avoid "take" of San Francisco garter snake. In the event that the mitigation measures above cannot be followed, the SFPUC will prepare a sensitive species relocation plan, which would be approved by both the CDFG and USFWS. Such a plan would detail how underground refugia would be excavated, identify suitable relocation areas, etc.

Compensation for Impacts on Terrestrial Biological Resources

Measure 5.5.6-1b: This measure mitigates for water supply and systemwide operation effects on resources within the Peninsula watershed. These impacts would occur primarily through operation of the Upper and Lower Crystal Springs Reservoir facilitated by the Crystal Springs Dam Improvements project (PN-9).

The SFPUC will compensate for sensitive wetland, riparian and upland habitats and habitats which support key special-status species or other species of concern lost as a result of WSIP system operation. Similar habitat will be identified, protected, restored, enhanced, created and managed off-site[3] to ensure no net loss of habitat extent or function. Similarly, in the event of the loss of large, mature oaks and oak woodland, creation and/or restoration of oak woodland elsewhere will be implemented to compensate for the loss of these common upland habitats. A qualified biologist will quantify the magnitude and extent of impacts to wetlands, sensitive habitats, other upland habitats, and key special-status species and other species of concern, and the SFPUC will develop and implement mitigation and compensation plans that meet the appropriate regulatory requirements and permit

[3] Off-site means the compensatory action is located other than within the project construction footprint, but could be on lands already under SFPUC ownership. Measure 4.6-2 addresses compensatory actions to be taken within the construction footprint.

conditions with respect to compensation ratios, other conservation measures and management requirements to mitigate project impacts to less than significant levels.

The SFPUC will obtain required permits and comply with applicable environmental regulations addressing sensitive habitats and species. Compensatory lands—including those restored or enhanced as well as those acquired or designated as protected as part of program mitigation--will be established in perpetuity with a commitment that such lands will not be used for any purpose that conflicts with the primary purpose of maintaining intact wildlife and plant habitat.

One alternative for implementing such habitat compensation is a Habitat Reserve Program (HRP) currently being developed by the SFPUC. The purpose of the HRP is to provide a comprehensive, coordinated approach to mitigation and related regulatory compliance for WSIP projects and operations. This related SFPUC project is described further in Chapter 3.0, Section 3.11. Under the proposed HRP, the SFPUC would proceed as soon as possible with identifying, securing (through designation, management agreement, conservation easement, or acquisition of fee title) and improving lands to be used for habitat compensation so that mitigation is underway concurrent with habitat loss related to WSIP program activities, further ensuring no net loss of resources. The proposed HRP is scheduled for CEQA environmental review in 2007 and targeted for implementation as soon as possible thereafter. Once the HRP is approved and implemented, the SFPUC will use this as one vehicle or method for implementing the mitigation requirements for individual WSIP projects. Otherwise, where appropriate and necessary, the SFPUC will develop and implement appropriate habitat compensation mitigation for individual WSIP projects and operational effects.

Compensation for Serpentine Seep-Related Special Status Plants

Measure 5.5.6-1c: The SFPUC will develop and implement a plan to protect, create, and restore habitat for plant species adapted to serpentine seeps, particularly fountain thistle, around Upper and Lower Crystal Springs Reservoirs. The plan will also include control of pampas grass and any other invasive plant species within the serpentine seep habitat.

Recreational and Visual Resources (Section 5.5.7)

System Measures

None required.

Westside Groundwater Basin Resources (Section 5.6)

System Measures

Groundwater Monitoring to Determine Basin Safe Yield

Measure 5.6-1: The SFPUC will continue ongoing studies, including the existing groundwater and lake level monitoring programs, to determine the safe yield of the North Westside Groundwater Basin in order to avoid overdraft and associated effects including adverse effects on surface water features and seawater intrusion. Using this data, the SFPUC will develop and implement a plan identifying appropriate pumping patterns to

avoid overdraft and the undesirable effects associated with overdraft. The plan will establish both a regular (average annual) and an intermittent (dry year or emergency) yield as well as a strategy for modifying pumping patterns such that the pumping levels can be sustained as an ongoing reliable water supply without depletion of groundwater storage or degradation of water quality.

Implementation of a Lake Level Management Plan

Measure 5.6-2: The SFPUC will develop and implement a lake level management plan identifying strategies for altering pumping patterns or lake augmentation to maintain Lake Merced water levels within the desired long-term range should monitoring conducted under Measure 5.6-1 indicate the potential for adverse effects on lake levels due to groundwater pumping. The SFPUC will coordinate the implementation of this measure with Measure 5.6-1.

Drinking Water Source Assessments for Groundwater Wells

Measure 5.6-5: As required by the California Department of Health Services and incorporated as part of the WSIP, the SFPUC will prepare drinking water source assessments for groundwater wells constructed under the Local and Regional Groundwater Projects (SF-2) and will update these assessments every five years. If the assessment indicates no potential for contamination, then no mitigation is required. However, for wells that are considered vulnerable to contamination on the basis of the drinking water source assessment, the SFPUC will develop and implement a source water protection program specifying actions and a program to be implemented to prevent contamination of the drinking water source.

The source water protection program could include nonregulatory components such as watershed restoration, stormwater monitoring, groundwater monitoring, and public education to protect drinking water quality. Land use planning, permitting, and possibly more restrictive regulatory methods may also be implemented by the local municipality where a threat to drinking water quality is indicated, and management of potential sources of microbiological or direct chemical contamination to eliminate or reduce the risk of contamination of the water supply may be considered. The SFPUC will encourage public participation in the development of the program and will update the program every five years along with the drinking water source assessments.

Cumulative Projects and Impacts Related to WSIP Water Supply and System Operations (Section 5.7)

Cumulative System Measures

None required.

References

See Chapter 6 for references.

CHAPTER 7
Growth-Inducement Potential and Indirect Effects of Growth

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7.1 Overview and Summary

7.1.1 Approach to Analysis and Chapter Organization

This chapter analyzes the growth inducement potential and associated secondary effects of growth impacts of the San Francisco Public Utilities Commission's (SFPUC's) Water System Improvement Program (WSIP), as required by the California Environmental Quality Act (CEQA). CEQA requirements, other laws and regulations pertinent to land use and water supply planning, and how the project's growth inducing impacts were assessed, are discussed below.

CEQA Requirements

CEQA requires that an environmental impact report (EIR) evaluate the growth-inducing impacts of a proposed project[1]. A growth-inducing impact is defined as follows:

> [T]he ways in which the proposed project could foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment. Included in this are projects which would remove obstacles to population growth…. It must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment.

Regulatory Context for Water Supply and Land Use Planning

The SFPUC does not have authority to make land use decisions in its service area. It cannot approve or deny development proposals; that is the responsibility of the cities and counties to which the SFPUC provides water. However, the SFPUC and its wholesale customers are required, through laws and agreements, to provide water service. Numerous laws are intended to ensure that water supply planning like the WSIP and land use planning (such as the approval of, or establishment of constraints to, development) proceed in an orderly fashion. The laws and agencies described below provide the regulatory and planning context for coordination among water agencies and cities and counties, and yield key documents (e.g., general plans and regional projections) used in this analysis.

- *General Plan Requirements*. Pursuant to state law[2], each city and county is required to adopt a comprehensive, long-term general plan for the physical development of the jurisdiction. The general plan is a statement of development policies and is required to include land use, circulation, housing, conservation, open space, noise, and safety elements. The land use element designates the proposed general distribution, location, and extent of land uses and includes a statement of the standards of population density and building intensity recommended for lands covered by the plan. The city or county is required to prepare the water section of the conservation element in coordination with any countywide water agency and with all districts and/or city agencies that develop, serve, control, or conserve water for that jurisdiction. The water section must include discussion and evaluation of water supply and demand information contained in any applicable urban water management plan that has been submitted to the city or county by a water agency.

- *Urban Water Management Planning Act*. Every urban water supplier is required to prepare an urban water management plan (UWMP) for the purpose of "actively pursu[ing] the efficient use of available supply."[3] In preparing the UWMP, the water supplier is required to coordinate with other appropriate agencies, including other water suppliers that share a common source, water management agencies, and relevant public agencies. When a city or county proposes to adopt or substantially amend a general plan, the water agency is required to provide the planning agency with the current version of the adopted UWMP, the current version of the water agency's capital improvement program or plan, and other information about the system's sources of water supply. The Urban Water Management Planning Act requires urban water suppliers, as part of their long-range planning activities,

1 CEQA Guidelines Section 15126.2(d).
2 California Government Code, Section 65300 *et seq.*
3 California Water Code, Section 10610.2 *et seq.*

to make every effort to ensure the appropriate level of reliability in their water service sufficient to meet the needs of their various categories of customers during normal, dry, and multiple dry water years.

- *Senate Bills 610 and 221*. In 2001, the California legislature adopted two bills pertaining to coordination between land use and water supply planning and decision making:

  – *Senate Bill (SB) 610*. Pursuant to SB 610[4], CEQA review for most large projects[5] is required to include a water supply assessment. The water supply assessments must address whether existing water supplies will suffice to serve the proposed project and other planned development over a 20-year period in average, dry, and multiple-dry year conditions, and must set forth a plan for finding additional supplies necessary to serve the proposed project. Cities and counties can approve projects notwithstanding identified water supply shortfalls provided that they address such shortfalls in their findings.

  – *SB 221*. Pursuant to SB 221[6], land use agencies must require, at the time the subdivision map is considered for approval, that an applicant for a large subdivision[7] demonstrate that sufficient water supply is available to support the development. Proof of available supply must be based on written verification from the applicable public water system and must be supported by substantial evidence (which may include the public water system's UWMP). Water supply verification should require a showing of "real" water as a condition of final subdivision map approval.

The Association of Bay Area Governments

A key regional agency involved in forecasting growth in the SFPUC service area is the Association of Bay Area Governments (ABAG). An advisory organization, ABAG is the official regional planning agency of the San Francisco Bay Region; its mission is to strengthen cooperation and coordination among local governments. Since its inception (1961), ABAG has examined regional issues such as housing, transportation, economic development, and the environment. ABAG members include the nine Bay-Area counties and 99 of 101 cities within the Bay Area, and represent nearly all of the Bay Area's population. ABAG's biennial *Projections* series provides long-term population and economic forecasts through a series of computer models. ABAG's model results are relied on by transportation and air quality agencies, water agencies, local governments, and others. ABAG forecasts are cited by many jurisdictions in their general plans, and were selected by many SFPUC water customers to forecast future water demand.

4 Codified at California Water Code Sections 10631, 10656, 10910, 10911, 10912, and 10915.
5 Large projects include residential developments with more than 500 units; retail uses with more than 500,000 square feet of floor space; office buildings with more than 250,000 square feet of floor space; hotels or motels with more than 500 rooms; industrial uses occupying more than 40 acres or having more than 650,000 square feet of floor area; and mixed-use projects that include any use or combination as large as the above uses.
6 Codified at California Business and Professional Code Section 65867.5 and Government Code Sections 66455.3 and 66473.7.
7 A large subdivision is defined as more than 500 dwelling units.

Approach to Analysis and Chapter Organization

On the basis of the CEQA definition of growth stated above, assessing the growth-inducement potential of the WSIP involves answering the question: *Would construction and/or operation of planned improvements proposed as part of the WSIP directly or indirectly support economic or population growth or residential construction?*

By removing the lack of a reliable water supply and supply system as one potential obstacle to growth within the SFPUC service area, the WSIP would have an indirect growth-inducing effect according to the CEQA definition above.[8] Implementation of the WSIP would improve supply reliability for existing water system customers and meet customer purchase requests through the year 2030, as discussed in Chapter 3. Meeting additional purchase requests would provide water to serve additional residential and business customers in the existing SFPUC service area. A variety of factors influence new development or population growth in the area served by SFPUC water, including economic conditions of the region, adopted growth management policies in the affected communities, and the availability of adequate infrastructure (e.g., water service, sewer service, public schools, and roadways, etc.), with economic factors generally the lead driver. While water service is only one of many factors affecting the growth potential of a community, it is one of the chief public services needed to support urban development, and lack of a reliable water supply as well as a service capacity deficiency could constrain future development.

Pursuant to CEQA, growth *per se* is not assumed to be necessarily beneficial, detrimental, or of little significance to the environment; it is the secondary, or indirect, effects of growth that can cause adverse changes to the physical environment. The indirect effects of population and/or economic growth and accompanying development can include increased demand on community services and public service infrastructure; increased traffic and noise; degradation of air and water quality; and conversion of agricultural land and open space to urban uses. Local land use plans (e.g., general plans and specific plans) of the jurisdictions served by the SFPUC establish land use development patterns and growth policies that are intended to allow for the orderly expansion of urban development supported by adequate public services, including water supply, roadway infrastructure, sewer service, and solid waste service. Local jurisdictions conduct CEQA environmental review on their general and specific plans to assess the secondary effects of their planned growth. A project that would induce growth that is inconsistent with local land use plans and policies could indirectly cause adverse environmental impacts, as well as impacts on public services, that the local land use jurisdictions have not previously addressed in the CEQA review of their land use plans and development proposals.

8 The WSIP would not *directly* induce growth as it does not involve the development of new housing to attract additional population, nor would it indirectly induce growth by establishing substantial permanent or even short-term construction employment opportunities that could stimulate population growth. Construction of the WSIP projects is not expected to involve employment opportunities substantially beyond what would normally be available to construction workers in the area, and workers are expected to be drawn from the local labor pool.

To assess the growth inducement potential of the WSIP and characterize the secondary effects of growth, this chapter also investigates the following questions:

- *What assumptions did the SFPUC and its wholesale customers make regarding growth (population and employment) in projecting future (2030) total water demand and customer purchases from the SFPUC?*

- *Are these assumptions consistent with forecasts prepared and used by local and regional planning agencies (e.g., ABAG, counties and cities) within the service area? What are the growth trends in the Bay Area region?*

- *Are there any notable inconsistencies between the population and employment forecasts used by the SFPUC and the wholesale customers and those of the local and regional planning agencies that suggest that the water supply planning efforts are inconsistent with land use planning efforts?*

- *Is the level of growth projected for 2030 consistent with that identified and planned for in existing adopted general plans?*

- *What are the potential environmental impacts (secondary effects) associated with growth projected to occur in the service area? Have these impacts been evaluated in previous CEQA review documents on existing general and specific plans?*

- *What mitigation measures and findings have the local jurisdictions adopted as part of approving their future growth plans?*

The issues raised in these questions are addressed through the following analyses (the section where the analyses can found is indicated in parentheses); a summary of the chapter's conclusions follows in Section 7.1.2.

- *SFPUC Projections (Section 7.2)*. Accurate demand projections are important in ensuring that future water supplies will be adequate while not surpassing the needs of planned growth. SFPUC and its customers used computer models to forecast future water demand. Section 7.2 presents an overview of the SFPUC water service area, and describes key factors (assumptions, inputs, and methodologies) used in estimating future demand that relate to growth and inform comparisons between water demand and land use planning projections. These factors include baseline population, methodology used to determine existing water usage by land use/account type, the current water supply agreement between the SFPUC and its wholesale customers, and assumptions regarding future land use patterns, water conservation and recycling, and water from other (non-SFPUC) sources through 2030. The demand estimates, in conjunction with estimates of savings from conservation and use of other water sources, provide the basis for the 2030 purchase estimates.

- *Growth Inducement Potential (Section 7.3)*. This section analyzes the WSIP's growth inducement potential: whether the demand to be met by the WSIP would be consistent with local plans and policies or could contribute to growth in the service area beyond that called for in the existing general plan. To gauge the consistency of the WSIP with growth planned in the jurisdictions served by the SFPUC, the analysis compares the growth assumed in the SFPUC projections with growth forecasts (a) developed by ABAG and (b) reflected in adopted land use plans in the service area. With respect to ABAG, this section also

describes ABAG's changing expectations about growth as reflected in its updated projections issued in 2002, 2003 and 2005.

- *Indirect Effects of Growth (Section 7.4)*. Growth (whether planned or unplanned) can cause environmental impacts. Section 7.4 describes the potential impacts of growth that could be supported, in part, by implementation of the WSIP. This section also identifies measures adopted to reduce, eliminate or otherwise mitigate the impacts of planned growth.

7.1.2 Summary of Conclusions

The following bullet items highlight the key findings of this chapter.

Service Area Characteristics, Growth Trends, and Policies

A review of historical growth trends of a selection of jurisdictions in the service area, based primarily on information in general plans and Bay Area Water Supply and Conservation Association (BAWSCA) profiles, shows that:

- Cities in the service area are largely urbanized, most having experienced their most rapid growth in the postwar decades through the 1970s.
- Milpitas and East Palo Alto have experienced high rates of growth more recently.
- San Francisco's population fluctuated somewhat but on average has been essentially stable over the past 50 years.
- Many jurisdictions cannot grow laterally and their general plans include policies to manage growth; many general plans identify strategies consistent with "smart growth" principles, such as encouraging infill development and the redevelopment of previously developed areas, as means to accommodate future growth.
- The SFPUC's wholesale customers vary widely, in a variety of ways: by size, overall demand projected for 2030, the change that the 2030 demand represents in absolute terms and as a percentage of 2001 demand, and the degree to which the customers depend on the SFPUC for their water supply. As such, the WSIP would remove growth obstacles to varying degrees within the service area.

Growth Assumptions Used to Develop 2030 Water Demand and Purchase Requests Compared with ABAG Growth Projections

As discussed in Sections 7.2.2 through 7.3.2, each SFPUC wholesale customer selected a published source for growth projections to use in developing its service area's projections for total water demand in 2030 and subsequently identified its estimated level of water purchase in 2030 from the SFPUC. The majority of customers (about two-thirds) selected the most current ABAG projections available at the time (*Projections 2002*); while the others (about one third) selected other published sources (such as Urban Water Management Plans) for their population growth projections. *Projections 2002* was used by for almost all of the employment growth

projections. These customer-selected growth projections were compared to ABAG's most recent projections series, *Projections 2005*.

- The growth assumptions used to derive the 2030 water demand estimates and subsequently the water customer purchase requests from the SFPUC are generally consistent with the most recent ABAG projections for jurisdictions in the service area. For the most part, the analysis demonstrates that, compared to the forecasts in ABAG's *Projections 2005*, the customer-selected projections used to derive water demand in the wholesale and retail service areas indicate:
  - somewhat less growth in employment and population (fewer added jobs and residents) through 2030, due largely to the expectation of more existing jobs in the area in 2005 than ABAG's *Projections 2005* estimates
  - more total employment in 2030 than ABAG's *Projections 2005* projects by about 5 percent overall
  - less total population in 2025 and 2030 by about 5 percent overall
- The growth that would be supported by the WSIP is generally consistent with current ABAG 2005 projections for jurisdictions in the service area. Because of differences in geographic area covered by most of the water customers and the jurisdictions they serve, they do not match exactly, and a few cannot be reasonably compared.

Growth Assumptions Used to Develop 2030 Water Demand and Purchase Requests Compared with General Plan Growth Assumptions

As discussed in Section 7.3.3, the existing, adopted general plans for cities within the SFPUC wholesale customer service area and for San Francisco were reviewed to compare the level of growth projected in these land use plans with that reflected in the growth assumptions used in the WSIP planning studies. The key findings of this review are:

- The horizon years for projections in the general plans considered in the analysis vary from 2005 to 2025; none of the plans extend out to 2030, which is the WSIP planning horizon. Due to the WSIP's longer planning horizon, in some areas the WSIP could support a degree of growth that has not been addressed in adopted land use plans.
- Comparison of the growth assumed in the development of the WSIP demand projections with growth forecasted in locally adopted land use plans indicates that much of the WSIP-related growth has been addressed in the adopted plans. A comparison of general plan projections with those selected by the water customers shows that:
  - The population growth assumed in the demand projections for most (17 of 20) of the water customers for which comparable general plan projections are available is similar to the growth anticipated in the general plans of the cities served by them.
  - The employment growth assumed in the demand projections for most (11 of 16) of the water customers for which comparable general plan projections are available are

generally consistent with (within 20 percent of) the employment growth anticipated in the general plans of the cities served by them. This general consistency was found despite the extraordinary job growth that occurred as a result of the economic boom in the 1990s, which was substantially reflected in employment projections used for the water demand projections (*Projections 2002)* but was not reflected to the same degree in earlier projections series used for many of the general plan employment estimates.

  - The employment growth assumed for four wholesale customers is substantially greater (between 20 and 70 percent greater) than the growth anticipated in the respective general plans, due to the economic boom that occurred in the 1990s in the Bay Area, which affected various jurisdictions differently. This difference in growth assumptions suggests that a degree of commercial and industrial growth assumed in the demand projections is not fully addressed in the respective general plans.

- The general plans of jurisdictions in the SFPUC service area vary substantially in age, whereas the ABAG projections are updated every two years.

Indirect Effects of Growth

The indirect effects of growth expected in the general plans of jurisdictions in the service area have been identified in the EIRs prepared for those plans. A table of impacts commonly identified as significant and unavoidable and those commonly identified as significant but mitigable is presented in Section 7.4.

- The most commonly identified significant and unavoidable impacts of growth are:
  - Increased traffic congestion
  - Deterioration of air quality
  - Cumulative effects of increased air pollutant emissions and noise
- Mitigation measures have been adopted by local jurisdictions as part of their general plan approval processes to address the secondary effects of planned growth. These measures are summarized in Appendix E.
- Two cities identified increased demand for potable water supply as a significant and unavoidable effect of growth; the WSIP would address this issue in those two cities.
- Overriding considerations commonly adopted by the decision-making bodies in adopting their general plans include the following:
  - Accommodation of growth in an orderly, fiscally sound manner
  - Economic diversification and job generation
  - Creation of housing, furtherance of regional housing share objectives, and provision of affordable housing

  - Improvements of the local jobs/housing balance
  - Increased sales revenue and positive fiscal impact
  - Promotion of alternative modes of travel to reduce reliance on private vehicles
  - Establishment of policies to preserve natural areas and open space lands

- For many cities that receive water from the SFPUC regional system, the supply to be provided under the WSIP supports and is consistent with the planned growth reflected in their existing adopted general plans. For other communities, it appears that the WSIP supply (in combination with other supply sources available to those communities), could serve a level of growth beyond that identified in the existing general plans. In those cases, secondary effects of such growth could include impacts related to increased density and impacts related to development of new land areas.
  - Density related impacts could include, e.g., increased traffic congestion, air pollution, traffic noise, construction noise, and demand on public services.
  - Land area related impacts could include, e.g., loss of open space and agricultural land, loss of wildlife habitat, potential impacts on cultural resources, and interference with groundwater recharge and degradation of water quality due to increases in impervious surface area.

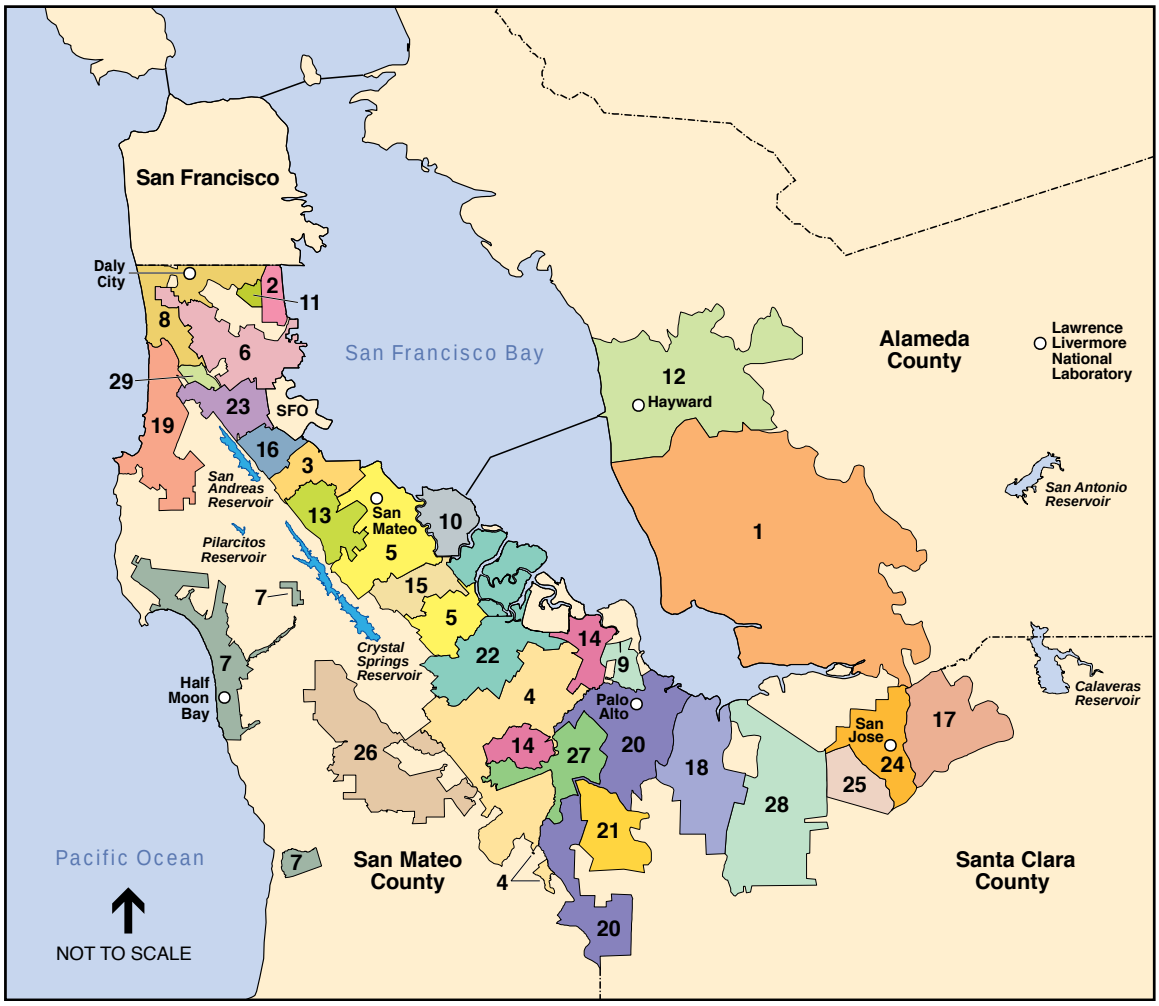
7.2 SFPUC Regional Water System: Customers and Water Demand Projections

7.2.1 SFPUC Service Area

The SFPUC serves retail customers in San Francisco and in Tuolumne County, and primarily wholesale customers in San Mateo, Santa Clara, and Alameda Counties (see Chapter 3, Program Description). **Figure 7.1** shows the SFPUC regional water service area, including the wholesale customers. **Figure 7.2** shows the city and county boundaries of the jurisdictions served by the wholesale customers. **Table 7.1** shows the jurisdictions served by the SFPUC's 27 wholesale customers.[9] Some of the water districts encompass more than one jurisdiction; Table 7.1 shows the percentage of the water district that is located within applicable jurisdictional boundaries. For about half the wholesale customers, the SFPUC is one of several sources of supply.[10]

9 There are 27 wholesale customers, but California Water Service Company (CWS), which is counted as one customer, serves three distinct subgroups—Bear Gulch District, Mid-Peninsula District, and South San Francisco District—which are tracked separately in the SFPUC reports. One former wholesale customer, Los Trancos County Water District, which was purchased by CWS and is now part of the Bear Gulch District, is also tracked separately in most of the SFPUC reports. Therefore, Table 7.1 lists 30 rather than 27 wholesale customer entities.

10 In 2001, the base year used for the demand projections, 14 of the 27 wholesale customers relied on other supply sources for at least some of their water (URS, 2004a).



Legend

(Wholesale customers and members of Bay Area Water Supply and Conservation Agency)

1 Alameda County Water District
2 City of Brisbane
3 City of Burlingame
4 CWS – Bear Gulch
5 CWS – Mid-Peninsula
6 CWS – South San Francisco
7 Coastside County Water District
8 City of Daly City
9 City of East Palo Alto
10 Estero Municipal Improvement District
11 Guadalupe Valley Municipal Improvement District
12 City of Hayward
13 Town of Hillsborough
14 City of Menlo Park
15 Mid-Peninsula Water District
16 City of Millbrae
17 City of Milpitas
18 City of Mountain View
19 North Coast County Water District
20 City of Palo Alto
21 Purissima Hills Water District
22 City of Redwood City
23 City of San Bruno
24 City of San Jose (North)
25 City of Santa Clara
26 Skyline County Water District
27 Stanford University
28 City of Sunnyvale
29 Westborough Water District

NOTE: For the purposes of this PEIR, the California Water Service (CWS) Company is a single wholesale customer with three different water service districts.

SOURCE: BAWSCA, 2006a

SFPUC Water System Improvement Program . 203287

Figure 7.1
SFPUC Water Service Area -
San Francisco and SFPUC Wholesale Customers

SFPUC Water System Improvement Program Program EIR, Case No. 2005.0159E . 203287

SOURCE: US Census Bureau, 2005

Figure 7.2
City/County Jurisdictions Served by SFPUC and Its Wholesale Customers

TABLE 7.1
JURISDICTIONS SERVED BY SFPUC WHOLESALE CUSTOMERS

Wholesale Customer	Jurisdictions Served (Percentage of Wholesale Customer Service Area in Jurisdictional Boundary [each totals 100%[a]])
Alameda County Water District	Fremont (65%) Newark (14%) Union City (21%)
City of Brisbane	Brisbane (100%)
City of Burlingame	Burlingame (98%) Other Unincorporated San Mateo County (2%)
CWS–Bear Gulch District[b]	Atherton (11%) Menlo Park (28%) Portola Valley (6.7%) Woodside (6.6%) Other Unincorporated San Mateo County (47.7%)
CWS–Mid-Peninsula District[b]	San Mateo (77%) San Carlos (23%)
CWS–South San Francisco District[b]	South San Francisco (91%) Colma (2%) Daly City (0.1%) Other Unincorporated San Mateo County (7%)
Coastside County Water District	Half Moon Bay (65%) Half Moon Bay Unincorporated (35%)
City of Daly City	Daly City (100%)
City of East Palo Alto	East Palo Alto (100%)
Estero MID[c]	Foster City (90%) San Mateo (10%)
Guadalupe Valley MID[c]	Brisbane[d] (100%)
City of Hayward	Hayward (100%)
Town of Hillsborough	Hillsborough (100%)
Los Trancos County Water District[e]	Portola Valley (10%) Other Unincorporated Mateo County (90%)
City of Menlo Park	Menlo Park (100%)
Mid-Peninsula Water District	Belmont (95%) Other Unincorporated San Mateo County (4%) San Carlos (1%)
City of Millbrae	Millbrae (100%)
City of Milpitas	Milpitas (100%)
City of Mountain View	Mountain View (100%)
North Coast County Water District	Pacifica (98%) Other Unincorporated San Mateo County (2%)
City of Palo Alto	Palo Alto (100%)
Purissima Hills Water District	Los Altos Hills (96.8%) Other Unincorporated Santa Clara County (3.2%)
City of Redwood City	Redwood City (91%) San Carlos (0.1%) Woodside (5.9%) Other Unincorporated San Mateo County (3.3%)
City of San Bruno	San Bruno (98%) Other Unincorporated San Mateo County (2%)
City of San Jose (North)	San Jose (100%)
City of Santa Clara	Santa Clara (100%)
Skyline County Water District	Woodside (63.6%) Other Unincorporated San Mateo County (36.4%)
Stanford University	Not applicable[f]
City of Sunnyvale	Sunnyvale (100%)
Westborough Water District	South San Francisco (100%)

[a] Due to rounding, totals may not be exactly 100%.
[b] CWS = California Water Service Company.
[c] MID = Municipal Improvement District.
[d] Guadalupe Valley MID is within the city of Brisbane.
[e] Los Trancos County Water District was purchased by CWS and is now part of the CWS–Bear Gulch District. Jurisdictions served are shown here for informational purposes.
[f] The Stanford University water system serves the Stanford campus only, primarily the central campus, rather than any distinct jurisdictions. The central campus is located in unincorporated Santa Clara County adjacent to the city of Palo Alto.

SOURCE: URS, 2004a.

Because water demand is projected to remain constant from 2000 to 2030 for the generally small and discrete retail customers located outside San Francisco (e.g., Lawrence Livermore National Laboratory, the community of Sunol, and the Groveland Community Services District), this analysis assumes that the potential for the WSIP to induce growth in these areas is negligible; therefore, the analysis focuses on the program's growth-inducement potential in the Bay Area in the areas served by the SFPUC's wholesale customers and in San Francisco.

SFPUC Wholesale Customers' Master Sales Agreement

As described in Chapter 2, Existing Regional Water System, the SFPUC holds contractual agreements with its wholesale customers. Wholesale water rates are set in accordance with the 1984 Settlement Agreement and Master Sales Water Contract (Master Sales Agreement) between the City and County of San Francisco and each of the wholesale customers (City and County of San Francisco, et al., 1984). The current master contract expires in 2009. Under the Master Sales Agreement, the City and County of San Francisco is required to supply up to 184 mgd (the "Supply Assurance") on an annual average basis to the wholesale customers collectively, subject to reductions in the event of a drought, water shortage, earthquake, or other natural disaster, and for rehabilitation and maintenance of the system. The agreement requires that wholesale customers employ best efforts to use all sources of water owned or controlled by them, including groundwater. The SFPUC and each of the wholesale customers, except for San Jose and Santa Clara, have negotiated individual supply assurance contracts (individual supply assurances) that cumulatively total 184 mgd. San Jose and Santa Clara do not have supply assurance contracts with the SFPUC.

In general, the individual supply assurances specify the amount of water a customer is entitled to purchase from the SFPUC according to a multi-step formula and multi-step vesting process. The contracts with Hayward and the Estero Municipal Improvement District (Estero MID) are exceptions to this type of contract, as they do not specify a quantified limit on purchases from the SFPUC. A specified amount of the total 184 mgd is set aside for growth in consumption by Hayward and Estero MID.[11] If the combined usage by Hayward and Estero MID exceeds this amount, the Master Sales Agreement provides a method for proportional reduction in the other water customers' supply guarantee (Bay Area Water Users Association [BAWUA], 1993; BAWSCA, 2006b).

The individual supply assurances for the wholesale customers under the current Master Sales Agreement are shown in Appendix E, Section E.1. Of the 23 wholesale customers that have individual supply assurance contracts with a specified quantity, 12 submitted 2030 purchase estimates (discussed in Section 7.2.2, below) that exceed their current individual supply assurance, while 11 submitted purchase estimates that are less than or equal to their current individual supply assurance. Consistent with CEQA requirements, the existing base year (2001) demand, not the supply assurances, is considered the baseline for the analysis presented in this

[11] A 1993 memorandum from BAWSCA (then BAWUA) to its member agencies regarding allocation of the supply assurance indicated that the combined usage for Hayward and Estero MID at the time was 21.782 mgd, and that an additional 6.2 mgd was set aside to allow for growth in Hayward and Estero MID consumption (BAWUA, 1993) for a total of 28 mgd. The current BAWSCA annual survey (BAWSCA, 2006b) shows combined usage in FY 2004/2005 of 24.10 mgd for Hayward and Estero MID and a reserve amount of 3.9 mgd (equaling the same combined amount allocated for Hayward and Estero MID (28 mgd) as in the 1993 memorandum).

chapter. The information on current supply assurances is presented for informational purposes. BAWSCA estimates that, excluding Santa Clara and San Jose (which, as noted, do not have supply assurance contracts), wholesale customer purchases from the SFPUC will approach the current 184 mgd wholesale customer supply assurance by about 2020, and that, including San Jose and Santa Clara, purchases from the SFPUC will approach 184 mgd by about 2008 (BAWSCA, 2006b).

7.2.2 Demand Projections

Future water demand projections for both retail and wholesale customers were developed using end-use demand models that break down total water use, by water service account, to specific end uses such as toilets, faucets, and irrigation. Projections for the wholesale service area were developed in close consultation with the wholesale customers, who provided critical inputs to the demand model – including selection of the source of population and employment projections to be used – and subsequently submitted statements concurring with the demand projections. Most (about two-thirds) of the customers selected ABAG's *Projections 2002* as the source of population projections used in their demand model;[12] other customers selected the BAWSCA annual survey, urban water management plans, or city planning sources for growth projections. Projections for San Francisco were developed based on information provided by the San Francisco Planning Department.

To develop yearly projections to 2030, the population and employment increase for each five- or ten-year increment was divided evenly and applied yearly throughout the five- or ten-year period to form a linear yearly projection between increments. The selected projections were then input into the demand model, which applied the growth rate from the selected projection to growth in the applicable water customer accounts. In general, population projections were used as the source of growth rates for residential, institutional, and other miscellaneous water accounts and employment projections were applied to commercial and industrial accounts.

Table 7.2 shows the 2030 water demand projections for the SFPUC wholesale and retail service area. The 2030 demand projections take into account expected growth in population and employment, the influence of plumbing codes (which include water efficiency requirements), and assumptions about rates of water fixture replacement. Thus, the 2030 demand projections factor in some "passive" water savings due to plumbing code changes, as well as the effects of conservation savings accrued prior to the base year. As part of WSIP planning, the SFPUC also undertook studies to determine the potential for continuation of existing conservation programs as well as additional conservation programs and recycled water projects that could be implemented to offset demand for potable water supplies. These studies, and the wholesale and retail service area demand studies, are described in detail in Appendix E, Section E.2.

[12] Because *Projections 2002* provides forecasts only to 2025, population and employment projections for 2025-2030 were estimated using the 2020-2025 population/employment growth rate, which was applied to the 2025 estimate and carried forward linearly at that rate to 2030.

TABLE 7.2
SUMMARY OF 2030 DEMAND PROJECTIONS, WATER SUPPLY ASSUMPTIONS, AND SFPUC PURCHASE ESTIMATES

Customer	A 2030 Projected Demand (with Plumbing Code Savings) (mgd[a])	B 2030 Projected Conservation Savings (mgd[a])	C 2030 Demand Adjusted for Conservation (mgd[a]) (A - B)	D 2030 Projected Use of Recycled Water (mgd[a])	E 2030 Projected Use of Ground-water Sources (mgd[a])	F 2030 Projected Use of Other Surface Water Sources (mgd[a])	G 2030 Projected Demand Adjusted for Use of Other Sources and Conservation (mgd[a]) (C - D - E - F)	H 2030 Purchase Estimates (mgd[a])	I Percent of Total 2030 Demand (with Plumbing Code Savings) met by SFPUC Purchases (H/A)	J Percent of 2030 Demand Adjusted for Conservation met by SFPUC Purchases (H/C)
Alameda County Water District	59.3	3.16	56.14	1.40	13.98	27.00	13.76	13.76	23%	25%
City of Brisbane	0.93	0.04	0.89				0.89	0.89	96%	100%
City of Burlingame	4.9	0.20	4.7				4.70	4.70	96%	100%
CWS–Bear Gulch District[b,c]	14.06	0.93	13.13			1.37	11.76	11.76	84%	90%
CWS–Mid-Peninsula District[b]	18.1	0.86	17.24				17.24	17.24	95%	100%
CWS–South San Francisco District[b]	9.9	0.56	9.34		1.37		7.97	7.97	81%	85%
Coastside County Water District[d]	3.2	0.18	3.02		0 – 0.30	0 – 0.48	2.24 – 3.02	2.24 – 3.02	70 – 94%	74 – 100%
City of Daly City[e]	9.1	0.44	8.66		1.34 – 3.76		4.90 – 7.32	4.90 – 7.32	54 – 80%	57 – 85%
City of East Palo Alto	4.8	0.16	4.64				4.64	4.64	97%	100%
Estero MID[f]	6.8	0.00 – 0.60	6.2 – 6.8				6.20 – 6.80	6.20 – 6.80	91 – 100%	100%
Guadalupe Valley MID[f]	0.81	0.10	0.71				0.71	0.71	88%	100%
City of Hayward	28.7	0.76	27.95				27.95	27.95	97%	100%
Town of Hillsborough	3.9	0.20	3.7				3.70	3.70	95%	100%
City of Menlo Park	4.7	0.16	4.54				4.54	4.54	97%	100%
Mid-Peninsula Water District	3.8	0.10	3.70				3.70	3.70	97%	100%
City of Millbrae[g]	3.3	0.08 – 0.11	3.19 – 3.27				3.19 – 3.22	3.19	97%	99 – 100%
City of Milpitas	17.7	0.61	17.09	1.77		7.13	8.19	8.20	46%	48%
City of Mountain View	14.8	0.24 – 1.21	13.59 – 14.56		0.05	1.30	12.24 – 13.21	13.20	89%	91 – 97%
North Coast County Water District	3.8	0.00 – 0.19	3.62 – 3.80				3.62 – 3.80	3.61 – 3.80	95 – 100%	100%
City of Palo Alto[h]	14.4	0.60	13.76	0.76			13.00	13.00	91%	94%
Purissima Hills Water District	3.3	0.08	3.22				3.22	3.22	98%	100%
City of Redwood City[i]	13.4	0.59 – 1.02	12.38 – 12.81	0 – 1.00			11.38 – 12.81	11.60 – 12.60	87 – 94%	94 – 98%
City of San Bruno	4.5	0.19	4.32				4.32	4.30	96%	100%
City of San Jose (North)[i]	6.5	0.16	6.34				6.34	6.34	98%	100%
City of Santa Clara	33.9	1.00	32.90	4.00	19.99	4.00	4.91	4.90	14%	15%
Skyline County Water District	0.31	0.01	0.30				0.30	0.30	97%	100%
Stanford University	6.8	0.70	6.10			1.90	4.20	4.20	62%	69%
City of Sunnyvale	26.8	0.70	26.10	1.50	2.60	9.90	12.10	12.10	45%	46%
Westborough Water District[k]	1.03	see note k	1.03				1.03	1.03	100%	100%
Total, Wholesale Service Area	**324**	**13 – 15**	**308 – 311**	**9.4 – 10.4**	**39.3 – 42.1**	**52.6 – 53.1**	**203 – 209**	**204 – 209**	**63 – 65%**	**66 – 67%**
SFPUC Retail Service Area[l]	**93.4**	**0 – 4**	**89.4 – 93.4**	**0 – 4**	**2.5 – 4.5**	**0**	**81 – 91**	**80 – 91**	**86 – 97%**	**89 – 97%**
TOTAL	**417**	**13 – 19**	**398 – 404**	**9.4 – 14.4**	**41.8 – 46.6**	**52.6 – 53.1**	**284 – 300**	**284 – 300**	**68 – 72%**	**71 – 74%**

NOTE: Numbers may not sum due to rounding.

a mgd = million gallons per day.
b CWS = California Water Service Company.
c CWS–Bear Gulch District includes the former Los Trancos County Water District.
d The upper range purchase estimate assumes loss of all local water sources (surface water and groundwater) and the lower range estimate assumes continuation of local sources; both estimates assume Level B water conservation.
e The purchase estimate range reflects a range of potential groundwater usage established under a pilot project, from the sustainable yield (3.76 mgd) to the lowest annual production yield (1.34 mgd), according to Daly City's best estimate of 2030 water purchases (SFPUC, 2004).
f MID = Municipal Improvement District.
g 2030 conservation savings is based on URS 2004c and the City's UWMP as confirmed by the City (Popp, 2007).
h 2030 demand and conservation savings are based on information provided by the City of Palo Alto to the SFPUC (City of Palo Alto, 2005a).
i In November 2005, Redwood City informed the SFPUC that it would be purchasing its low-range estimate of 11.6 mgd due to anticipated implementation of 1 mgd of recycled water in 2030 (City of Redwood City, 2005a). The high-range purchase estimate total of 300 mgd published in URS 2004b remains the SFPUC 2030 purchase estimate total for planning purposes, to be consistent with the previous and ongoing WSIP studies. The purchase estimate range originally submitted apparently reflects the average of the City's estimated conservation savings range plus the originally estimated range of recycled water use.
j Portion of north San Jose only.
k Demand and purchase estimates are based on Westborough Water District's 2005 UWMP, as requested by the District in a letter to the SFPUC (Westborough Water District, 2007). The UWMP discusses ongoing and planned future demand management programs but does not quantify conservation savings in relation to the demand and purchase estimate. The District's original estimate of water purchases indicated conservation savings of 0.020 mgd (SFPUC 2004).
l The low range of the SFPUC retail customer purchase estimate reflects the identified groundwater, recycled water, and conservation programs totaling 10 mgd in San Francisco that are included as part of the WSIP proposed water supply option.

SOURCES: URS, 2004a; URS, 2004b; URS, 2004c; URS, 2006; SFPUC, 2004; SFPUC, 2007; City of Palo Alto, 2005a; Popp, 2007; City of Redwood City, 2005a; Westborough Water District, 2005 ; Westborough Water District 2007.

2030 Purchase Estimates

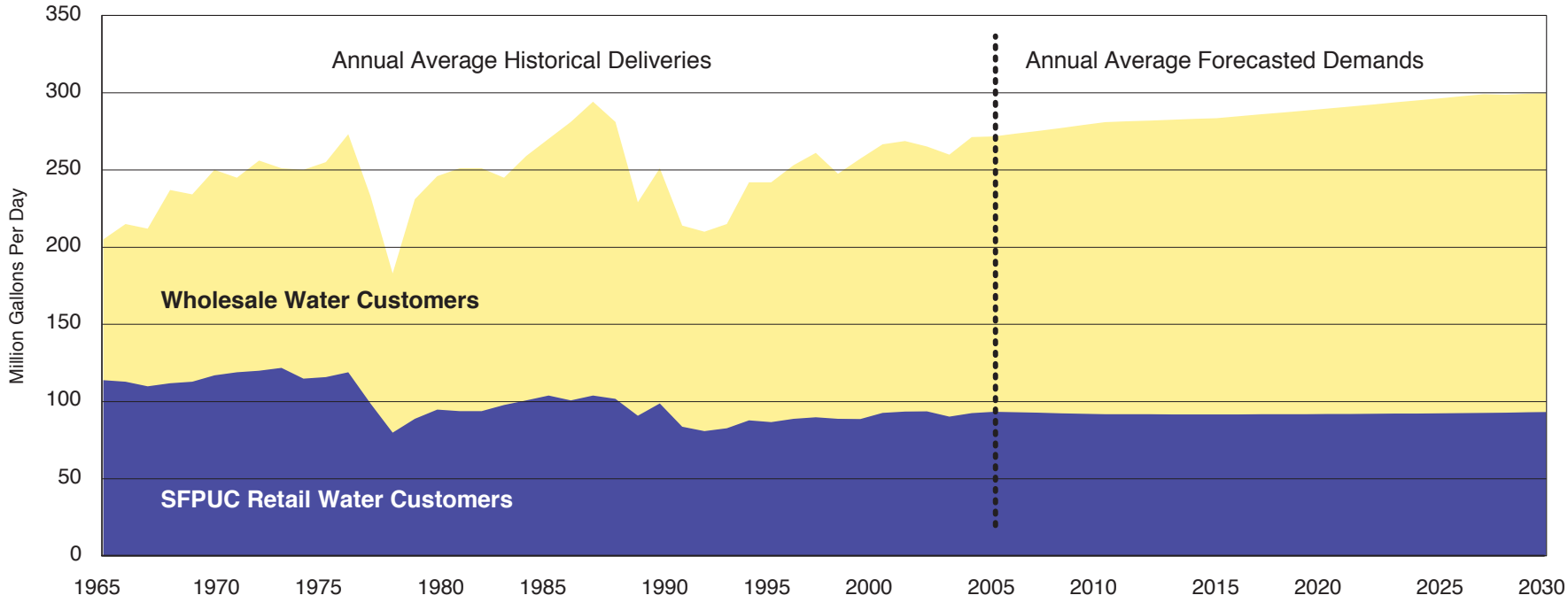
Each wholesale customer is responsible for its own water management planning decisions and for determining the percentage of its future water demand that it desires to meet with SFPUC supplies. Following completion of 2030 demand modeling and the conservation potential and recycled water potential studies, the wholesale customers considered conservation potential and other water supply sources and submitted purchase estimates for SFPUC water for 2030 (URS, 2004b). The purchase estimates include the effects of continuing current conservation programs and additional conservation programs that the SFPUC and/or its wholesale customers plan to implement, as well as the use of recycled water and other supply sources (see Table 7.2). Conservation and demand management programs are an integral component of water suppliers' supply portfolio, as shown in Table 7.2. Table 7.2 shows the percentage of total 2030 demand met by purchases from the SFPUC for each customer and also shows the percentage of all "physical" water supply sources (including recycled water) met by SFPUC purchases (i.e., the percentage of demand after conservation savings are taken into account). As shown, purchases from the SFPUC in 2030 of 300 mgd represent approximately 72 percent of the total SFPUC service area demand (with plumbing code savings) and about 74 percent of demand adjusted for additional conservation.[13] **Figure 7.3** depicts historical water deliveries for the wholesale and retail service areas as well as the projected demand on the SFPUC system (i.e., estimated purchases) to 2030.

Change in Water Demand and Purchases from Base Year

Table 7.3 shows the base-year demand estimates for each wholesale customer and the retail service area (2001 and 2000, respectively), the 2000/2001 purchases from the SFPUC, and the change in demand and purchases forecasted for 2030. The base-year demand estimate is based on actual consumption data (adjusted for unaccounted-for water[14]) and therefore reflects the effects of conservation programs implemented to date. As Table 7.3 shows, overall customer demand (wholesale and retail customers) in the service area is expected to increase by about 51 mgd in 2030 and purchases from the SFPUC regional water system are expected to increase by about 24-39 mgd from the base year 2000/2001. As shown in the table, essentially no change is projected in total demand for the SFPUC retail service area, which is predominantly the City and County of San Francisco. For purposes of planning future 2030 water delivery requirements for the regional system, the SFPUC selected the high range purchase estimates of 300 mgd as the target goal for the average annual water delivery by 2030. This is an increase of approximately 39 mgd from the 2001 deliveries and 35 mgd from the current normal-year average annual demand estimates.

[13] The demand studies also calculated the effects of plumbing codes (which include efficiency requirements) on water savings, and found that a total savings of 35.7 mgd is expected to be achieved in 2030 as a result of plumbing code requirements. Table E.2.4 in Appendix E.2 shows 2030 plumbing code savings for the retail service area and each wholesale customer.

[14] Unaccounted-for water refers to the difference between total water produced in a system and total water billed to customers (i.e., water consumed). Unaccounted-for water includes water delivery system leaks, water not billed or tracked in the system, such as water used for fire fighting and system flushing, and any unauthorized use.



SOURCE: SFPUC, 2005

Figure 7.3
Total SFPUC Water System Demands:
Historical and Projected Water Purchases

TABLE 7.3
SUMMARY OF BASE-YEAR AND PROJECTED 2030 DEMAND AND PURCHASE ESTIMATES

Customer	Base-Year (2001) Demand Estimate (mgd[a])[b]	Fiscal Year 2001/2002 Purchases from the SFPUC (mgd[a])	Percent of 2001 Demand Met by Purchases from the SFPUC[c]	2030 Projected Demand (with Plumbing Code) (mgd[a])	Projected Change in Demand from 2001 (mgd[a])	Projected Percent Change in Demand from 2001	2030 Purchase Estimates (mgd[a])	Change in Water Purchases from the SFPUC 2001–2030 (mgd[a])	Percent Change in Purchases 2001–2030 (mgd[a])
Alameda County Water District	51.1	11.99	24.3%	59.3	8.20	16%	13.76	1.77	15%
City of Brisbane	0.44	0.39	100%	0.93	0.49	111%	0.89	0.50	128%
City of Burlingame	4.8	4.64	100%	4.9	0.12	3%	4.70	0.06	1%
CWS–Bear Gulch District[d]	13.4	11.12	90.6%	13.9	0.48	4%	11.60	0.48	4%
CWS–Mid-Peninsula District[d]	17.2	16.75	100%	18.1	0.94	5%	17.24	0.49	3%
CWS–South San Francisco District[d]	8.9	7.56	88.9%	9.9	1.00	11%	7.97	0.41	5%
Coastside County Water District	2.6	1.8	70.3%	3.2	0.63	25%	2.24 – 3.02	0.44 – 1.22	24 – 68%
City of Daly City	8.7	5.08	63.6%	9.1	0.44	5%	4.90 – 7.32	-0.18 – 2.24	-4 – 44%
City of East Palo Alto	2.5	2.04	100%	4.8	2.30	92%	4.64	2.60	127%
Estero MID[e]	5.8	5.62	100%	6.8	0.98	17%	6.20 – 6.80	0.58 – 1.18	10 – 21%
Guadalupe Valley MID[e]	0.32	0.3	100%	0.81	0.49	153%	0.71	0.41	138%
City of Hayward	19.3	17.61	100%	28.7	9.40	49%	27.95	10.34	59%
Town of Hillsborough	3.7	3.56	100%	3.9	0.20	5%	3.70	0.14	4%
Los Trancos County Water District[f]	0.11	0.11	100%	0.14	0.03	32%	0.16	0.05	45%
City of Menlo Park	4.1	3.57	96%	4.7	0.61	15%	4.54	0.97	27%
Mid-Peninsula Water District	3.7	3.46	100%	3.8	0.15	4%	3.70	0.24	7%
City of Millbrae	3.1	2.47	100%	3.3	0.17	5%	3.19	0.72	29%
City of Milpitas	12.0	6.83	59.3%	17.7	5.74	48%	8.20	1.37	20%
City of Mountain View	13.3	10.97	89.4%	14.8	1.53	12%	13.20	2.23	20%
North Coast County Water District	3.6	3.45	100%	3.8	0.17	5%	3.61 – 3.80	0.16 – 0.35	5 – 10%
City of Palo Alto[g]	14.2	13.19	99.4%	14.4	0.20	1%	13.00	-0.19	-1%
Purissima Hills Water District	2.2	2.2	100%	3.3	1.12	51%	3.22	1.02	46%
City of Redwood City[h]	11.9	11.64	100%	13.4	1.54	13%	11.60 – 12.60	-0.04 - 0.96	0 – 8%
City of San Bruno	4.4	2.7	64.4%	4.5	0.07	2%	4.30	1.60	59%
City of San Jose (North)[i]	5.2	4.42	96%	6.5	1.31	25%	6.34	1.92	43%
City of Santa Clara	25.8	3.84	16.2%	33.9	8.10	31%	4.90	1.06	28%
Skyline County Water District	0.17	0.17	100%	0.31	0.14	82%	0.30	0.13	76%
Stanford University	3.9	2.36	68%	6.8	2.94	76%	4.20	1.84	78%
City of Sunnyvale	24.8	9.69	43.6%	26.8	1.99	8%	12.10	2.41	25%
Westborough Water District[j]	1.02	1.02	100%	1.03	0.01	1%	1.03	0.01	1%
Total, Wholesale Service Area	**272**	**171**	**63%**	**324**	**52**	**19%**	**204 – 209**	**34 – 38**	**20 – 23%**
SFPUC Retail Service Area	**93.6**	**90**	**96%**	**93.4**	**-0.2**	**-0.2%**	**80 – 91**	**-10 – 1**	**-11 – 1%**
TOTAL	**366**	**261**	**71%**	**417**	**51**	**14%**	**284 – 300**	**24 – 39**	**9 – 15%**

NOTE: Numbers may not sum due to rounding.

[a] mgd = million gallons per day.
[b] Demand estimates shown here include unaccounted-for water, which is the difference between total water produced and total water billed to customers (water consumed). Unaccounted-for water includes fire fighting use, maintenance requirements, system flushing, leaks, and any unauthorized use.
[c] Based on URS 2004b.
[d] CWS = California Water Service Company.
[e] MID = Municipal Improvement District.
[f] The former Los Trancos County Water District is now part of CWS–Bear Gulch District; information presented here reflects information in background reports (URS, 2004a, 2004b).
[g] 2030 demand is based on information provided by the City of Palo Alto to the SFPUC (City of Palo Alto, 2005a).
[h] In November 2005, Redwood City informed the SFPUC that it would be purchasing its low range estimate of 11.6 mgd due to anticipated implementation of 1 mgd of recycled water in 2030 (City of Redwood City, 2005a). The high-range purchase estimate total published in URS 2004b of 300 mgd remains the SFPUC 2030 purchase estimate for planning purposes to be consistent with the previous and ongoing WSIP studies.
[i] Portion of north San Jose only.
[j] Demand and purchase estimates are based on Westborough Water District's 2005 UWMP, as requested by the district in a letter to the SFPUC (Westborough Water District, 2007). Base year demand shown here is based on 2001 total water production presented in the UWMP (which is equal to 2001-02 purchases from the SFPUC).

SOURCES: URS, 2004a; URS, 2004b; URS, 2006, City of Palo Alto, 2005a; City of Redwood City, 2005a, Westborough Water District, 2005; Westborough Water District 2007.

7.3 Growth Inducement Analysis

As discussed in the approach to analysis, above, evaluation of the WSIP's growth-inducing impacts involves considering whether the growth that would be supported by implementation of the WSIP is planned growth, anticipated by the land use planning agencies in the areas served by SFPUC water and reflected in their adopted general plans. This section compares the population and employment projections used in the water demand models (referred to herein as customer-selected projections) with the population and employment projections of the regional planning agency, ABAG, and the projections in the general plans (or related land use planning documents) of cities in the service area. The water customers' UWMPs (which have been prepared since the demand studies for the wholesale and retail service areas [URS, 2004a, Hannaford and Hydroconsult, 2004] were completed) are also compared with the population projections used in the demand model. These comparisons establish whether the employment and population growth that the SFPUC and its water customers used as a basis to derive their water demand projections is also forecasted by ABAG and anticipated by local jurisdictions in their general plans. The major conclusions of these comparisons are summarized in Section 7.1, above.

7.3.1 Analysis Assumptions

Use of Demand Model Population and Employment Assumptions

While the 2030 water demand projections are based on projected growth in residential and non-residential water accounts and cannot be directly correlated to demographic projections (because they include various customer-specific model inputs and adjustments), the customer-selected population and employment projections provide a basis of comparison with other growth forecasts for the area. The projections of employment and population selected by the wholesale customers and the SFPUC as the basis for growth in water accounts and future water demand are shown in **Table 7.4** and summarized by county in **Table 7.5**. Wholesale customers are sorted by county to facilitate the analysis of consistency of these projections with ABAG's projections.

Geographic Areas

ABAG projections are published for cities and their planning areas and for unincorporated county areas. The boundaries of most of the water customer service areas are not congruent with city boundaries (as shown in Table 7.1). Therefore, in order to evaluate the consistency of the customer-selected projections with ABAG projections, the ABAG city and county jurisdiction information had to be made to "fit" the wholesale customer service area boundaries. For purposes of comparing population and employment projections this analysis uses the following assumptions about the correspondence between wholesale customers' service areas and "ABAG jurisdictions."[15] Because there is no "perfect fit" between the wholesale customer service area

[15] For this analysis, ABAG's projections for subregional study areas, rather than projections for the cities as defined by their corporate limits, were used. The subregional study areas include the named incorporated city and any adjacent unincorporated area within the city's planning area.

TABLE 7.4
EMPLOYMENT AND POPULATION PROJECTIONS USED FOR WATER DEMAND ESTIMATES[a]

	Employment			Population		
	2001	2030	% Change	2001	2030	% Change
Alameda County						
Alameda County Water District	151,092	221,858	46.8%	316,523	379,931	20.0%
Hayward	87,473	113,843	30.1%	140,439	162,757	15.9%
Santa Clara County						
Milpitas	53,566	76,129	42.1%	62,756	88,841	41.6%
Mountain View	75,629	95,669	26.5%	71,160	81,670	14.8%
Palo Alto	105,432	114,224	8.3%	59,954	69,199	15.4%
Purissima Hills Water District	420	457	8.8%	6,032	6,763	12.1%
San Jose (North)	2,500	3,353	34.1%	11,098	13,686	23.3%
Santa Clara	138,163	177,027	28.1%	104,349	140,698	34.8%
Stanford University	na	na	na	19,738	27,924	41.5%
Sunnyvale	125,476	168,950	34.6%	131,365	151,610	15.4%
San Mateo County						
Brisbane	3,789	19,575	416.6%	3,174	4,606	45.1%
Burlingame	31,205	36,160	15.9%	30,154	34,967	16.0%
CWS – Bear Gulch District[b]	42,899	47,774	11.4%	66,197	73,719	11.4%
CWS – Mid-Peninsula District[b]	79,493	100,568	26.5%	120,856	139,834	15.7%
CWS – South San Francisco District[b]	49,288	62,344	26.5%	49,207	59,584	21.1%
Coastside County Water District	5,402	6,795	25.8%	18,319	24,973	36.3%
Daly City	26,941	33,981	26.1%	106,117	115,651	9.0%
East Palo Alto	3,289	8,673	163.7%	24,395	32,712	34.1%
Estero MID[c]	24,318	31,840	30.9%	34,568	40,096	16.0%
Guadalupe Valley MID[c]	4,442	5,668	27.6%	446	1,558	249.3%
Hillsborough	1,216	1,380	13.5%	11,618	12,708	9.4%
Los Trancos County Water District[d]	na	na	na	740	1,094	47.8%
Menlo Park	10,053	13,287	32.2%	12,153	13,655	12.4%
Mid-Peninsula Water District	14,705	22,221	51.1%	26,443	27,997	5.9%
Millbrae	6,664	8,009	20.2%	21,460	25,174	17.3%
North Coast County Water District	5,797	7,478	29.0%	40,457	47,829	18.2%
Redwood City	66,389	83,678	26.0%	81,888	93,535	14.2%
San Bruno	16,622	25,770	55.0%	40,727	48,229	18.4%
Skyline County Water District	224	224	0.0%	1,210	2,683	121.7%
Westborough Water District[e]	1,610	1,631	1.3%	13,056	14,300	9.5%
Total Wholesale Customers	**1,134,097**	**1,488,566**	**31.3%**	**1,626,599**	**1,937,983**	**19.1%**
San Francisco[f]	**638,840**	**795,400**	**24.5%**	**760,075**	**849,942**	**11.8%**
Total Area Served	**1,772,937**	**2,283,966**	**28.8%**	**2,386,674**	**2,787,925**	**16.8%**

[a] For all customers, a variable annual growth rate for population and employment was established for use in the model, based on annual interpolations from 5 or 10-year incremental demographic projections published by the selected projection sources.
[b] CWS = California Water Service Company.
[c] MID = Municipal Improvement District.
[d] The former Los Trancos County Water District is now part of CWS–Bear Gulch District; information presented here reflects information in background reports.
[e] Population estimates from Westborough Water District's 2005 Urban Water Management Plan.
[f] Estimates for 2001 for San Francisco were interpolated linearly for the PEIR analysis from estimates for 2000 and 2005 presented in the SFPUC technical memorandum (Hannaford and Hydroconsult, 2004).

SOURCE: Hannaford and Hydroconsult, 2004; URS, 2004a; Westborough Water District, 2005; Mundie & Associates, 2006.

TABLE 7.5
EMPLOYMENT AND POPULATION PROJECTIONS USED FOR WATER DEMAND ESTIMATES: SUMMARY BY COUNTY[a]

	Employment			Population		
	2001	2030	% change	2001	2030	% change
Wholesale Customers						
Alameda County	238,565	335,701	41%	456,962	542,688	19%
Santa Clara County	501,186	635,809	27%	466,452	580,391	24%
San Mateo County[b]	394,346	517,056	31%	703,185	814,904	16%
Total Wholesale Customers	1,134,097	1,488,566	21%	1,626,599	1,937,983	19%
Retail Customers						
San Francisco (City and County)[c]	638,840	795,400	25%	760,075	849,942	12%
Total	1,772,937	2,283,966	29%	2,386,674	2,787,925	17%

[a] Figures shown by county are the projections used in demand modeling for the water customers in that county, not the county as a whole. (The SFPUC serves a limited portion of Alameda County and Santa Clara County, which are predominately served by East Bay Municipal Utilities District and Santa Clara Valley Water District, respectively.)
[b] Population estimates for San Mateo County include updated figures for Westborough Water District from its Urban Water Management Plan.
[c] Estimates for 2001 for San Francisco interpolated linearly for the PEIR analysis from estimates for 2000 and 2005 presented in the SFPUC technical memorandum (Hannaford and Hydroconsult, 2004).

SOURCES: Hannaford and Hydroconsult, 2004; URS, 2004a; Westborough Water District, 2005; Mundie & Associates, 2006.

boundaries and the ABAG city and county jurisdiction boundaries, the population and employment projections will differ somewhat simply as a result of this imperfect geographic fit.

- Wholesale customers that serve most or all of one or more cities are assumed to correspond to those cities.
- Wholesale customers that serve most or all of a city plus smaller portions (i.e., less than half) of other cities and any unincorporated county areas are assumed to correspond only to the cities they serve most or all of.
- ABAG does not provide separate or segregable projections for most unincorporated county areas. Therefore, unincorporated areas served by wholesale customers are not captured in the correspondence established for this analysis. (The exception to this is unincorporated Half Moon Bay, for which ABAG provides separate projections and which is assumed, along with the incorporated city, to correspond to the Coastside County Water District service area).[16]

Refer to Appendix E, Section E.3 (Table E.3.A.2 of Attachment E.3.A) for the list of ABAG jurisdictions assumed in this analysis to correspond to respective water customer service areas and vice versa. The same correspondence between service areas and cities is also assumed for the comparison of water customer-selected projections with growth projections in the general plans of jurisdictions in the SFPUC service area.

[16] Because this analysis uses ABAG's subregional study area projections, the projections may include population and employment forecasts for some portion of the unincorporated areas within a wholesale customer's service area. However, it is not known whether, or the degree to which, the unincorporated areas served by a wholesale customer encompass the same geography as the unincorporated areas within the corresponding ABAG subregional study area. With the exception of unincorporated Half Moon Bay, unincorporated areas are identified as "nonsegregable unincorporated areas" in Table E.3.A.1 of Appendix E (Section E.3, Attachment E.3.A) and are assumed not to be captured in the correspondence established for this analysis.

Time Periods

The base year for the wholesale water customers' projections is 2001 and the base year for the retail customer's (i.e., San Francisco's) projections is 2000. Projections for both the wholesale customers and San Francisco extend through 2030. ABAG projections are provided in five-year intervals (for the first year of each decade as well as mid-decade); *Projections 2003* and *Projections 2005* provide forecasts through 2030, but *Projections 2002* extends only through 2025.

To establish a consistent time period for comparison in this PEIR analysis, the customer-selected projections from the respective base years (2000 and 2001) through 2030 presented in the SFPUC's published demand studies were interpolated to establish estimates for 2005 and 2025. An estimate for 2001 was interpolated for the retail service area, from the 2000 base year population and employment estimates, to establish a consistent base year. The years 2005, 2025, and 2030 were then used to evaluate consistency between the customer projections and the ABAG projections. The base year estimates for 2001 and projections for 2005, 2025, and 2030 are shown in Appendix E, Section E.3 (Table E.3.4).

7.3.2 ABAG Projections

Every two years ABAG publishes regional projections of employment and population growth for the nine-county San Francisco Bay Area. These projections are the most comprehensive set of employment and population projections that cover the area served by the SFPUC. *Projections 2002* and *Projections 2003* (ABAG, 2001; ABAG, 2002) were reviewed in preparation of this analysis. ABAG's most recent projections set, *Projections 2005* (ABAG, 2004) is the basis for the comparison presented here. The sidebar reviews the findings of a comparison between ABAG *Projections 2002, 2003,* and *2005*.

ABAG projections are used for various planning purposes by many of the cities in the nine-county area covered by ABAG. Many of the SFPUC wholesale customers selected the ABAG's *Projections 2002* (the projections set that was current at the time) for use in the water demand model. Since that set was published, ABAG has issued two subsequent sets of projections—*Projections 2003* and *Projections 2005.* These two subsequent projections incorporate a fundamental shift in ABAG's projections methodology. Rather than taking existing local land use policy as a given (as had previously been the case), in the projections following *Projections 2002* ABAG assumes that local policy will be amended in the future to adopt "smart growth" principles. Specifically, the projections assume that higher density growth will be focused in urban core areas, and that more housing will be produced in those areas, compared to that previously assumed. The result of these assumptions is to increase the expected population in already developed areas. Most of the SFPUC service area is located in such already developed areas. Another difference reflected in *Projections 2003* and *Projections 2005* is more current and accurate reflection of effects of the dot com recession, especially the estimates of employment in 2005.

To assess whether ABAG's changing assumptions about future growth principals in the region combined with the updated information on current population and employment levels would result in substantially revised estimates of population or employment levels in the areas served by SFPUC water by 2030, an analysis was undertaken to compare the three sets of projections. First *Projections 2002* was compared to *Projections 2003* and then *Projections 2003* was compared to *Projections 2005*.

Based on the improved understanding of the extent of job and population losses that had been sustained in the first part of the decade, employment and population estimates for 2005 in *Projections 2003* are lower than had been projected in *Projections 2002*, and lower still in *Projections 2005*. At the same time, as might be expected from the assumption of more growth occurring in the urban core areas with the adoption and implementation of smart growth principles that ABAG assumes will occur*, Projections 2003* and *Projections 2005* have somewhat steeper growth curves between the present and 2030. Nevertheless, the general trends for the three are similar. The net result of the two principal changes in the later projection sets (that is, lower current population and employment estimates combined with more growth between now and 2030) is that the estimates for the WSIP horizon year of 2030 are similar among all three sets of ABAG projections. (Although *Projections 2002* only extends to 2025, projections for WSIP planning were extrapolated to 2030.) Section 7.3 text includes the key points from the comparison of the projections used in the demand study with ABAG *Projections 2005* projections. More detailed information on the comparison of the three ABAG projection sets is presented in Appendix E, Section E.3. Figures E.3.1 and E.3.2 in Appendix Section E.3 illustrate the differences in forecasted growth rates for the nine Bay Area counties and the four counties of the SFPUC service area reflected in the three projections sets.

Employment Projections

Table 7.6 compares the water customer-selected employment projections to the ABAG *Projections 2005* forecasts for the corresponding geographic areas for the years 2005, 2025, and 2030. The projections selected by the individual water customers (and interpolations for 2005 and 2025 prepared for this analysis) are shown in Table E.3.4 in Appendix E.3; Table 7.6 groups the projections by county. As shown, for the service area as a whole, the customer-selected employment projections forecast about 5 percent more jobs in 2030 than does *Projections 2005*. Thus, on the whole, the projections used in the water demand analysis remain generally consistent with current regional employment growth projections. The table supports the following observations:

- On a countywide basis, customer-selected projections of total employment in 2005 are consistently higher than *Projections 2005* estimates for 2005. The customer-selected projections were prepared a number of years prior to 2005, and therefore these 2005 employment estimates are truly forecasts. The *Projections 2005* estimates for 2005, in contrast, are based on observed data that reflect a more recent understanding of the impact of the "dot com bust" on the Bay Area economy. That is, the higher estimates of the customer-selected projections for 2005 reflect the experience of economic growth experienced by many Bay Area jurisdictions in the 1990s, without the benefit of information about the extent to which a slow down in employment growth occurred in the late 1990s and early 2000s. In contrast, *Projections 2005*, which was prepared a short time before 2005, reflects observed data on the continuing effects of the economic slow down, and shows lower 2005 employment estimates. Nevertheless, because *Projections 2005* also forecasts more growth in employment (i.e., more added jobs) between 2005 and 2030 than do the customer-selected projections, overall employment predicted by *Projections 2005* in 2030 (relying on more accurate 2005 estimates), is within a few percentage points of the overall employment predicted in 2030 by the customer-selected projections (relying on projected 2005 numbers).

- Water customer-selected employment projections for 2030 for Alameda and San Mateo County jurisdictions and San Francisco are generally consistent with (within 10 percent of) *Projections 2005*. Customer-selected projections for Santa Clara County jurisdictions are higher than *Projections 2005*. Customer-selected projections for 2025 are also generally consistent with *Projections 2005* for Alameda County jurisdictions and San Francisco.

- In each county, the numbers of new jobs expected in the customer-selected projections between 2005 and 2030 are smaller than the numbers forecasted in *Projections 2005*. The additional new job growth in *Projections 2005* reflects an increased understanding of the job loss that occurred between 2000 and 2005 combined with the expectation that, over the long term, the losses will be recovered and new jobs will be attracted to the area (but not enough new jobs to attain the totals that were predicted in *Projections 2002*).

- In each county, the customer-selected projection sources show employment growing at a slower rate during the 2005-2030 period as compared to the average rate of change

TABLE 7.6
COMPARISON OF EMPLOYMENT PROJECTIONS:
SFPUC CUSTOMERS AND ABAG *PROJECTIONS 2005* (SUMMARY BY COUNTY)[a,b]

	2005	2025	2030	Change 2005–2030
SFPUC Customer-selected Projections				
Alameda County	251,963	318,953	335,701	83,738
Santa Clara County	519,755	612,598	635,809	116,054
San Mateo County	411,273	495,898	517,056	105,783
Total Wholesale Customers	1,182,991	1,427,449	1,488,566	305,575
San Francisco (City and County)	656,480	770,500	795,400	138,920
Total	1,839,471	2,197,949	2,283,966	444,495
ABAG *Projections 2005*				
Alameda County	212,560	308,120	329,800	117,240
Santa Clara County	393,700	512,830	544,610	150,910
San Mateo County	309,470	435,600	469,900	160,430
Total Wholesale Customers	915,730	1,256,550	1,344,310	438,580
San Francisco (City and County)	575,800	776,100	829,090	253,290
Total	1,491,530	2,032,650	2,173,400	681,870
Customer-selected Projections as a Percentage of ABAG *Projections 2005*				
Alameda County	119%	104%	102%	71%
Santa Clara County	132%	119%	117%	77%
San Mateo County	133%	114%	110%	66%
Total Wholesale Customers	129%	114%	111%	70%
San Francisco (City and County)	114%	99%	96%	55%
Total	123%	108%	105%	65%

[a] Includes only those portions of each county served by SFPUC wholesale water customers or served directly by the SFPUC (i.e., San Francisco); see Appendix E, Section E.3 (Table E.3.A.2 of Attachment E.3.A) for correspondence assumed between ABAG jurisdictions and water customer service areas. (The SFPUC serves a limited portion of Alameda County and Santa Clara County, which are predominately served by East Bay Municipal Utilities District and Santa Clara Valley Water District, respectively.)

[b] Wholesale customer-selected projections for 2005 and 2025 interpolated linearly for the PEIR from estimates for 2001 and 2030 presented in the Wholesale Customer Demand Projections Technical Report (URS, 2004a).

SOURCES: Hannaford and Hydroconsult, 2004; URS, 2004a; ABAG, 2004; Mundie & Associates, 2006

predicted in *Projections 2005* for the same period.[17] The growth rate in the customer-selected projection sources (e.g., *Projections 2002*) is what was used in the model to help forecast future water demand. (Note that the estimates of employment in 2005 provided in *Projections 2005* are noticeably lower than the customers' estimates of employment for that same year. This accounts for the fact that even though the average rate of change is faster in *Projections 2005*, as compared to the customer-selected projection sources, the number of jobs in 2030 in the customer-selected projections is higher than those in *Projections 2005*. (See Tables E.3.37 and E.3.38 in Appendix E, Section E.3, for employment and population growth rates in *Projection 2005* and the water customer projections, respectively.)

[17] This comparison refers to the average rate of change over the 25-year period (2005-2030) reflected in Table 7.6. To predict non residential water use, the change in base year and projected employment through 2030 was used to develop annual growth rates for each customer. The demand model applied this annual growth rate to base year non-residential water use to estimate future water use.

- For Santa Clara County the customer-selected projections predicted 17 percent more jobs in 2030 than are currently forecasted by ABAG in *Projections 2005*. Similar to the other counties, customer-selected projections expect fewer *new* jobs through 2030 than are forecasted in *Projections 2005*; however, because the number of jobs estimated for 2005 was more than 30 percent higher than the number estimated in *Projections 2005*, the expectations of future total employment remain higher than the ABAG forecast. Similarly, for San Mateo County, the customer-selected projections predicted 14 percent more jobs in 2025 than are forecasted by ABAG in *Projections 2005*. As in the other counties, the customer-selected projections expect fewer new jobs through 2025 than are forecasted in *Projections 2005*. However, because the number of jobs estimated for 2005 was more than 30 percent higher than the number estimated in *Projections 2005*, the expectations of future total employment remain higher than estimated in *Projections 2005*. By 2030, because of the faster rate of job growth reflected in *Projections 2005* (compared with the customer-selected projections), the difference in expected jobs is narrowed to 10 percent.

- Overall, the job projections selected by the wholesale customers are about 11 percent higher in 2030 than those of *Projections 2005*, and projections selected by San Francisco are about 4 percent lower than those of *Projections 2005*. With less than 10 percent variation for the service area as a whole, the employment projections used in the water demand studies remain consistent with ABAG's current long-term projections for job growth within the regional service area.

Population

Table 7.7 compares the population projections used by the SFPUC and its wholesale customers to develop future water demand projections to the ABAG *Projections 2005* forecasts for the corresponding geographic areas, for 2005, 2025, and 2030. The projections selected by the individual water customers (and the interpolations for 2005 and 2025 done for this analysis) are shown in Table E.3 4 in Appendix E, Section E.3; Table 7.7 groups the projections by county. As shown, for the service area as a whole, the customer-selected projections forecast about 5 percent less population in 2030 than does *Projections 2005*. Thus, on the whole, the projections used in the water demand analysis remain consistent with current regional population projections. Table 7.7 supports the following conclusions:

- On a countywide basis, water customer projections of total population in 2005 are about the same as (within 5 percent of) *Projections 2005* estimates for 2005.

- *Projections 2005* population estimates for 2025 and 2030 are also similar to, although consistently higher (by 4 percent and 5 percent, respectively) than, the customer-selected projections in those years. The difference is likely attributable in large part to the extent of ABAG's smart growth assumptions, which would locate approximately 150,000 additional households (compared to *Projections 2002*) in the more urban communities of the Bay Area between 2010 and 2030.

- The numbers of new residents expected in the customer-selected projections between 2005 and 2030 are smaller in all counties than the numbers expected by *Projections 2005*.

TABLE 7.7
COMPARISON OF POPULATION PROJECTIONS:
SFPUC CUSTOMERS AND ABAG *PROJECTIONS 2005* (SUMMARY BY COUNTY)[a,b]

	2005	2025	2030	Change 2005–2030
SFPUC Customer-selected Projections				
Alameda County	468,786	527,908	542,688	73,902
Santa Clara County	482,168	560,746	580,391	98,223
San Mateo County[c]	718,517	795,642	814,904	96,387
Total Wholesale Customers	1,669,471	1,884,296	1,937,983	268,512
San Francisco (City and County)	772,470	834,448	849,942	77,472
Total	2,441,941	2,718,744	2,787,925	345,984
ABAG *Projections 2005*				
Alameda County	473,900	552,700	576,200	102,300
Santa Clara County	463,100	561,700	585,100	122,000
San Mateo County	716,100	818,800	840,900	124,800
Total Wholesale Customers	1,653,100	1,933,200	2,002,200	349,100
San Francisco (City and County)	798,000	890,400	924,600	126,600
Total	2,451,100	2,823,600	2,926,800	475,700
Customer-selected Projections as a Percentage of ABAG *Projections 2005*				
Alameda County	99%	96%	94%	72%
Santa Clara County	104%	100%	99%	81%
San Mateo County	100%	97%	97%	77%
Total Wholesale Customers	101%	97%	97%	77%
San Francisco (City and County)	97%	94%	92%	61%
Total	99%	96%	95%	73%

[a] Includes only those portions of each county served by SFPUC wholesale water customers or served directly by the SFPUC (i.e., San Francisco); see Appendix E, Section E.3 (Table E.3.A.2 of Attachment E.3.A) for the correspondence assumed between ABAG jurisdictions and water customer service areas.
[b] Wholesale customer-selected projections for 2005 and 2025 interpolated linearly for the PEIR analysis from estimates for 2001 and 2030 presented in the Wholesale Customer Demand Projections Technical Report (URS, 2004a).
[c] Estimates for San Mateo County include updated figures for the Westborough Water District from its Urban Water Management Plan.

SOURCES: Hannaford and Hydroconsult, 2004; URS, 2004a; ABAG, 2004; Westborough Water District, 2005; Mundie & Associates, 2006.

- On a countywide basis, the customer-selected projection sources show population growing at a slower rate during the 2005-2030 period as compared to the average rate of change predicted in *Projections 2005* for the same period.[18] The growth rate in the customer-selected projection sources (e.g., *Projections 2002*) is what was used in the model to help forecast future water demand. (See Tables E.3.37 and E.3.38 in Appendix E, Section E.3, for employment and population growth rates in *Projection 2005* and the water customer projections, respectively.)

[18] This comparison refers to the average rate of change over the 25-year period (2005-2030) reflected in Table 7.7. To predict residential water use, the change in base year and projected population through 2030 was used to develop annual growth rates for each customer. The demand model applied this annual growth rate to base year residential water use (and other non-industrial and non-commercial water use) to estimate future water use.

7.3.3 General Plan Projections

Comparison of General Plan and Demand Study Projections

A comparison for consistency between the growth projections used as the basis for water demand and purchase requests estimates in the WSIP planning studies and the growth projections presented in the general plans of jurisdictions in the SFPUC service area helps determine whether the growth that would be supported by implementation of the WSIP would be planned growth reflected in adopted general plans, or is somehow more than or different from what is called for in current general plans (in terms of amount and/or location). The general plans of 22 cities that are served in whole or part by SFPUC and its wholesale customers have population projections that are generally comparable to the water customer-selected population projections.[19,20]

Table 7.8 presents a comparison of the population projections selected by the water customers for use in the WSIP demand models with the population projected in the general plan for the respective cities. The table shows the difference (in number and percentage) in projected population from these two sources. Because the general plans vary considerably in age and have a range of projection years, none of which extends to 2030, ABAG's *Projections 2005* forecasts for 2030 are also included in the table for reference. The population projections assumed in the water customers' UWMPs, which were prepared more recently than the demand forecasts, also are included for reference. The comparison indicates the following:

- The population projections used for three of the wholesale customers (East Palo Alto, Milpitas, and Sunnyvale) in the water demand studies are less than (from 2 to 6 percent less) the projections assumed in the general plans of the jurisdictions served by them.

- The population projections assumed for 14 of the water customers (ACWD, CWS-South San Francisco in combination with Westborough Water District, Daly City, Hayward, Hillsborough, Mid-Peninsula Water District, Millbrae, Mountain View, Palo Alto, Redwood City, San Bruno, San Francisco, and Santa Clara) are higher but within 1 to 10 percent of the projections presented in the respective general plans.

- Based on the two summary points above, the population growth assumed in the demand models for most of the water customers (17 of 20), for which comparable general plan projections are available, is similar to the growth anticipated in the general plans of the cities served by them. That is, the growth assumed in the demand models would be planned growth that is reflected in currently adopted general plans.

[19] General plans with projection years earlier than 2005 were not considered comparable to the 2030 population and employment projections used in the water demand studies. In addition, a few general plans did not include population or employment estimates in a form that could be compared to the customer-selected projections (e.g., where population growth is considered in terms of needed new housing units without information on assumed household size from which population estimates could be derived). Several wholesale customers' service areas do not correspond to jurisdictional boundaries closely enough to allow meaningful comparisons; refer to the discussion of correspondence between water customers and jurisdictions in Appendix E.3 and the correspondence assumptions shown in Table E.3.A.2 of Attachment E.3.A, Appendix E.3. The 22 cities, served by 20 water customers, represent approximately two-thirds of 32 cities served by the SFPUC regional system

[20] The 22 cities are served by 19 wholesale customers and the SFPUC (for the retail service area), referred to collectively here as 20 water customers.

TABLE 7.8
COMPARSION OF WATER DEMAND POPULATION ESTIMATES AND GENERAL PLAN POPULATION ESTIMATES

Customer	UWMP Population in 2030	*Projections 2005* Population in 2030	Water Customer-Selected Population Projection for 2030	General Plan Population Projection for General Plan Projection Year[a]	General Plan Projection Year[a]	Difference: Water Customer Population and General Plan Population	% Difference (Water Customer Population and General Plan Population)
Customer-selected projection less than or equal to general plan projection							
City of East Palo Alto	32,712	43,600	32,712	34,600	2020	-1,888	-5.5%
City of Milpitas[b]	91,400	91,400	88,841	94,400	2020	5,559	-5.9%
City of Sunnyvale[c]	159,100	159,100	151,610	154,600	2020	-2,990	-1.9%
Customer-selected projection 1–10% greater than general plan projection							
Alameda County Water District	405,900	404,700	379,931	359,113		20,818	5.8%
Fremont	*257,100*	*257,200*		*229,213*	2020		
Newark	*53,500*	*53,400*		*49,800*	2020		
Union City	*95,300*	*94,100*		*80,100*	2020		
CWS–South San Francisco District and Westborough Water District[d,e]	83,450	73,660	73,884	68,685	2020	5,199	7.6%
City of Daly City	115,651	127,200	115,651	113,000	2020	2,651	2.3%
City of Hayward	162,800	171,500	162,757	160,300	2025	2,457	1.5%
Town of Hillsborough		11,800	12,708	11,800	2025	908	7.7%
Mid-Peninsula Water District[f]	28,930	28,800	27,997	27,800	2010	197	0.7%
City of Millbrae	24,200	24,500	25,174	24,860	2015	314	1.3%
City of Mountain View	81,700	89,600	81,670	75,200	2010	6,470	8.6%
City of Palo Alto	69,199	92,200	69,199	62,880	2010	6,319	10.0%
City of Redwood City	93,329	122,300	93,535	87,100	2020	6,435	7.4%
City of San Bruno	See note g	50,700	48,229	46,400	2020	1829	3.9%
City and County of San Francisco[h]	849,942	903,300	849,942	811,100	2020	38,842	4.8%
City of Santa Clara	140,698	142,100	140,698	129,900	2010	10,798	8.3%
Customer-selected projection more than 10% greater than general plan projection							
City of Burlingame[hi]	31,900	31,900	34,967	31,500	2010	3,467	11.0%
Coastside County Water District[j]	24,973	27,100	24,973	21,065	2020	3,908	18.6%
Estero Municipal Improvement District (MID)[j,k]	40,866	32,500	40,096	30,803	2010	9,293	30.2%

NOTE: Most wholesale customer service areas are not contiguous with city limits (or with the city and its planning area), and therefore the population projections from the jurisdictions' general plans and ABAG should be considered as general comparisons only. The following are not included, because the water service area and jurisdictional boundaries are not comparable or the general plan of the corresponding jurisdiction does not provide a comparable population projection: Brisbane, CWS–Bear Gulch, CWS–Mid-Peninsula, Menlo Park, North Coast County Water District, Purissima Hills Water District, San Jose North, Skyline County Water District, and Stanford University.

a The general plan population projection and projection year are the most distant population projection and the year of the most distant population projection available in the general plan or general plan element.
b The general plan population is based on the population shown in the general plan (77,100) plus the additional population accommodated by the Milpitas Midtown Specific Plan, as advised by Milpitas Planning Department staff (Carrington, 2006), to account for 5,000 additional units with an assumed density of 3.46 persons per unit (i.e., an added population of 17,300). The City has amended to general plan to incorporate the specific plan.
c The service area of Sunnyvale's water district is contiguous with the city limits; however, another water utility (CWS) serves several small areas within the city.
d CWS = California Water Service Company.
e CWS–South San Francisco serves South San Francisco, Colma, a small portion of Daly City, and the unincorporated area of Broadmoor. The water customer estimate for the Westborough Water District is from the district's Urban Water Management Plan. The general plan figure is the combined total projected population in the South San Francisco and Colma general plans (67,400 and 1,285 respectively); the general plan projection year shown (2020) is for South San Francisco, the projection year for Colma is 2005. The *Projections 2005* figure is for South San Francisco and Colma (71,800 and 1,860, respectively).
f The Mid-Peninsula Water District serves Belmont, portions of San Carlos, and unincorporated areas of San Mateo County. The general plan figure is for the city of Belmont, from the 2002 housing element.
g The San Bruno UWMP (City of San Bruno,2007) shows two population projections for 2030: 50,700, based on ABAG's *Projections 2005*, and 48,229, based on the City's Adjusted Draft General Plan.
h UWMP and *Projections 2005* figures are for household population, since the customer-selected figure is for household population.
i Burlingame's water system also serves portions of unincorporated Burlingame and a few properties in the city of San Mateo and town of Hillsborough.
j The general plan figure is for the city of Half Moon Bay only, from the 1993 Half Moon Bay Local Coastal Program Land Use Plan (Table 9.3, Chapter 9, page 189). In addition to incorporated Half Moon Bay, the Coastside County Water District serves unincorporated areas of Half Moon Bay and the unincorporated communities of El Granada, Miramar, and Princeton by the Sea.
k Estero MID serves Foster City and a portion of the city of San Mateo. The general plan figure is for Foster City.

SOURCES: ABAG, 2004; ACWD, 2005; CWS-South San Francisco, 2006; Carrington, 2006; City and County of San Francisco, 2004; City of Belmont, 2002a; City of Burlingame, 2002a; City of Burlingame, 2005; City of Daly City, 2004a; City of Daly City, 2005; City of East Palo Alto, 1999a; City of East Palo Alto, 2006; City of Foster City, 2001a; City of Fremont, 2003a; City of Half Moon Bay, 1993; City of Hayward, 2002a; City of Hayward, 2005; City of Millbrae, 1998a; City of Millbrae, 2005; City of Milpitas, 2002a, City of Milpitas, 2005; City of Mountain View, 2002a; City of Mountain View, 2005; City of Newark, 2002a; City of Palo Alto, 1998a; City of Palo Alto, 2005b; City of Redwood City, 2005b; City of Redwood City, 2007a; City of San Bruno, 2003a; City of San Bruno, 2007; City of Santa Clara, 2002a; City of Santa Clara, 2005; City of South San Francisco, 2002a; City of Sunnyvale, 2002a; City of Sunnyvale, 2005; City of Union City, 2002a; Coastside County Water District, 2005; Estero MID, 2005; Hannaford and Hydroconsult, 2004; Mid-Peninsula Water District, 2006; SFPUC, 2005; Town of Colma, 1999a; Town of Hillsborough, 2002a; URS, 2004a, Westborough Water District, 2005.

- The population projections assumed by three of the water customers (Burlingame, Coastside County Water District, and Estero Municipal Improvement District) appear to be more than 10 percent greater than the projections assumed in the respective general plans. The difference in these projections results from the longer 2030 planning horizon used for water planning and differences in the geographic area covered by the two sets of projections. Based on the difference in projections, however, the growth assumed in the demand models of these wholesale customers does not appear to be fully addressed in the general plans of the cities served by these customers.

- Two of the three customers assuming greater population growth than is reflected in the respective general plan also show somewhat greater growth than is forecasted in *Projections 2005*. Both of these customers (Burlingame and Estero MID) serve unincorporated areas outside the city's jurisdictional boundaries and ABAG subregional areas. In addition, Estero MID serves a non-segrable part of the City of San Mateo that is not included with the *Projections 2005* forecast for Foster City used in this comparison. The other customer (Coastside County Water District) assumes less growth than is forecasted in *Projections 2005* for 2030.

Compared to the population forecasts, fewer general plans (or general plan elements) prepared by jurisdictions served by the wholesale customers include comparable employment forecasts. The general plans of 18 cities that are served in whole or part by 16 SFPUC water customers have employment projections that are generally comparable to the water customer-selected employment projections.[21] **Table 7.9** presents a comparison of the employment projections selected by the water customers for use in the WSIP demand models with the employment projected in the general plan for the respective cities. The table shows the difference (in number and percentage) in employment estimates in these two sources. Because the general plans vary considerably in age and have a range of projection years, ABAG's *Projections 2005* forecasts for 2030 are included in the table for reference. The comparison indicates the following:

- The employment projections assumed for four wholesale customers are lower than the projections in their respective general plans. The projection for Millbrae is substantially less (33 percent); the combined projection for CWS-South San Francisco and Westborough Water District is about 10 percent less, and the projection for Daly City is slightly less (1 percent).

- The employment growth assumed for eight water customers is greater than but within 20 percent of the growth assumed in the respective general plans. The water customer-selected employment projections of two wholesale customers (Hayward, and Hillsborough) and of San Francisco are within 10 percent of the projections assumed in their respective general plans, and the customer-selected projections of five wholesale customers (Milpitas, Mountain View, Palo Alto, Santa Clara, and Sunnyvale) are 10 to 20 percent greater than the projections assumed in the respective general plan.

[21] General plans with projection years earlier than 2005 were not considered comparable to the employment projections used in the demand studies. A few general plans did not include population or employment estimates in a form that could dependably be compared to the customer-selected projections (e.g., where employment growth [additional jobs] is discussed without the baseline employment levels being provided). Several wholesale customers have service areas that do not correspond to jurisdictional boundaries closely enough to allow meaningful comparisons with the general plan projections. Table E.3.A.2 of Attachment E.3.A, Appendix E.3, shows the jurisdictions that are assumed to correspond to wholesale customers for purpose of comparing population and employment projections

TABLE 7.9
COMPARISON OF WATER DEMAND EMPLOYMENT ESTIMATES AND GENERAL PLAN EMPLOYMENT ESTIMATES

Customer	*Projections 2005* Employment in 2030	Water Customer Selected Employment Projection for 2030	General Plan Employment Projection for General Plan Projection Year[a]	General Plan Projection Year[a]	Difference: Water Customer Employment and General Plan Employment	% Difference (Water Customer Employment and General Plan Employment)
Customer-selected projection less than or equal to general plan projection						
City of Daly City	29,830	33,981	34,260	2020	-279	-1%
City of Millbrae	9,960	8,009	12,006	2015	-3,997	-33%
CWS–South San Francisco District and Westborough Water District[b,c]	56,080	63,975	71,400	2020	-7,425	-10%
Customer-selected projection 1–20% greater than general plan projection						
City of Hayward	100,430	113,843	108,830	2025	5,013	5%
Town of Hillsborough	2,030	1,380	1,360	2025	20	1%
City of Milpitas	68,940	76,129	65,200	2010	10,929	17%
City of Mountain View	81,110	95,669	84,810	2010	10,859	13%
City of Palo Alto	117,090	114,224	98,500	see note d	15,724	16%
City and County of San Francisco	829,090	795,400	745,600	2020	49,800	7%
City of Santa Clara	152,670	177,027	151,280	2010	25,747	17%
City of Sunnyvale[e]	123,020	168,950	152,730	2020	16,220	11 %
Customer-selected projection more than 20% greater than general plan projection						
Alameda County Water District	229,370	221,858	177,800		44,058	25%
Fremont	*160,410*		*130,530*	2020		
Newark	*24,960*		*26,560*	2020		
Union City	*44,000*		*20,710*	2020		
Subtotal: Fremont, Newark, Union City	*229,370*		*177,800*			
City of East Palo Alto	6,110	8,673	5,940	2010	2,733	46%
Estero Municipal Improvement District (MID)[f]	21,110	31,840	18,760	2010	13,080	70%
City of San Bruno	28,400	25,770	19,180	2020	6,590	34%

NOTE: Most wholesale customer service areas are not contiguous with city limits (or with the city and its planning area), and therefore the employment projections from the jurisdictions' general plans and ABAG should be considered as general comparisons only. The following are not included, because the water service area and jurisdictional boundaries are not comparable or the general plan of the corresponding jurisdiction does not provide a comparable employment projection: Brisbane, Burlingame, CWS–Bear Gulch, CWS–Mid-Peninsula, Coastside County Water District, Daly City, East Palo Alto, Guadalupe Valley MID, Menlo Park, Mid-Peninsula Water District, North Coast County Water District, Purissima Hills Water District, Redwood City, San Jose North, Skyline County Water District, and Stanford University.

a The general plan projection and projection year are the most distant employment projection and the year of the most distant employment projection available in the general plan or general plan element.
b CWS = California Water Service Company.
c CWS–South San Francisco serves South San Francisco, Colma, a small portion of Daly City, and the unincorporated area of Broadmoor.
d Employment estimate for Palo Alto is based on the Housing Element 1999-2006 (City of Palo Alto 2002) estimate that the city will "eventually contain 98,000 to 99,000 jobs within the next several years if the economy recovers in the near term."
e The service area of Sunnyvale's water district is contiguous with the city limits; however, another water utility (CWS) serves several small areas within the city.
f Estero MID serves Foster City and a portion of the city of San Mateo. The general plan figure is for Foster City.

SOURCES: City and County of San Francisco, 2004;City of Daly City, 2004a; City of East Palo Alto, 2001a; City of Foster City, 2001a; City of Fremont, 2003a; City of Hayward, 2002a; City of Millbrae, 1998a; City of Milpitas, 2002b; City of Mountain View, 2002a; City of Newark, 2002a; City of Palo Alto, 2002; City of San Bruno, 2003a; City of Santa Clara, 2002a; City of South San Francisco, 2002a; City of Sunnyvale, 2002a; City of Union City, 2002a; Hannaford and Hydroconsult, 2004; Town of Hillsborough, 2002a; URS, 2004a.

- The employment growth assumed for the remaining four water customers (ACWD, East Palo Alto, Estero Municipal Improvement District, and San Bruno) are between 25 and 70 percent greater than the projections assumed in the respective general plans. The difference in these projections results primarily from the longer 2030 planning horizon used for water planning and, for Estero MID, differences in the geographic area covered by the two sets of projections. Based on the difference in projections, however, the employment growth assumed in the demand models of these wholesale customers does not appear to be fully addressed in the general plans of the cities served by these customers.

These observations, in turn, suggest the following:

- The employment growth assumed in the demand models of most (12 of 16) of the water customers for which comparable general plan projections are available is greater than the growth anticipated in the general plans of the cities served by them. For all but four, however, the difference in projection is less than 20 percent. The reasons for differences between general plan and demand study employment projections included the following:

  – *Differences in horizon years*. For the employment projections surveyed, none of the general plan's horizon years extend to 2030; five of the general plan horizon years are 2010.

  – *Differences in base years.* In almost all cases the demand study projections were prepared after the general plans projections. As a result, the demand study projections reflect to a greater extent the economic boom of the 1990s than do the projections in the general plans. That is, the projections vary as a result of when they were prepared, especially with respect to the economic growth that occurred in the 1990s. For the most part, general plans were prepared before the extent of the economic boom in the 1990s was fully appreciated, and have not been updated to reflect the economic growth that occurred during that period. In two cases (Palo Alto and Estero MID), the demand study's 2001 estimate is greater than the general plan's estimate for 2010. The region subsequently experienced substantial job losses from the "dot com bust" in the first part of this decade; therefore, demand study projections prepared before the "bust" was fully understood somewhat over projected 2005 job levels, compared with ABAG's *Projections 2005*. *Projections 200*5 forecasts substantial recovery over time, however, and by 2030 the employment projections selected for use in the demand study are fairly consistent with those of *Projections 2005* for most jurisdictions.

  – *Differences in the extent to which certain jurisdictions were impacted by the economic boom and subsequent recession.* The three series of ABAG projections reviewed for this analysis reflect evolving information about the extent of job gains and losses in bay area jurisdictions in the late 1990s and early 2000s. Some jurisdictions have sustained successive and substantial job losses whereas others experienced fewer losses or losses have been offset by a degree of economic recovery. The net effect of the two cycles has been that over the WSIP planning horizon, employment expectations, as reflected in projections selected by the water customers, are for the most part generally consistent with the projections presented in jurisdictions' general plans. The projections selected by four wholesale customers, however, are 25 to 70 percent greater than the projections of the respective general plans. Although the relationship between water use and non-residential development depends upon the type of commercial or industrial development that occurs, given the difference in employment assumptions, it is likely that the impacts of employment growth assumed in the WSIP demand forecasts in the jurisdictions served by these wholesale customers has not been fully analyzed in the respective general plan impact analyses.

7.3.4 Growth in Water Demand Compared with Growth in Population and Employment

The relationship between the growth in water demand and growth in population and employment within a water service area is not linear. Because of differences in water use rates for a water agency's different retail customers, depending on such factors as types and sizes of residences, types of businesses, and a range of other variables that can affect consumption rates, a direct per capita or per job relationship is not expected between water demand and the population and employment within a service area.[22] As such, growth in water demand by 2030 would not be expected to track directly with population and employment growth. In addition, differences would be expected between the different wholesale water customers as a result of additional variables including climate and housing density. In general, water demand within the SFPUC service area as a whole would be expected to grow somewhat more slowly than population and employment due to the increasing efficiency of water fixtures expected from plumbing code requirements.

A comparison of the percent change in the SFPUC wholesale customers' water demand projected for 2030 (from Table 7.3) and percent change in population and employment (from Table 7.4) is shown in **Table 7.10** for each wholesale customer and the retail service area. The data presented reflect considerable variability between the water customers; for most the increase in projected water demand is smaller than the increase in projected population or job growth. The exceptions to this are noted and discussed in the customer summaries in Section 7.3.6.

7.3.5 Growth Trends in the Service Area

As part of the review of general plans for the comparisons presented above, a selection of general plans from cities in each of the counties in the SFPUC service area were reviewed in greater depth to ascertain a better understanding of historical growth trends in the service area. The general plans of the following cities were reviewed: East Palo Alto, Fremont, Hayward, Milpitas, Newark, Redwood City, San Francisco, San Mateo, Santa Clara, South San Francisco, Sunnyvale, Union City. These jurisdictions represent a range of sizes and include some of the larger cities and some of the cities projecting relatively substantial increases in water demand by 2030. Information provided in BAWSCA profiles of its member agencies supplemented the review, which is described in more detail in Appendix E, Section E.4 of this PEIR.

The results of this review indicate the following population growth trends in the region:

- Cities in the service area are largely urbanized, most having experienced their most rapid growth in the postwar decades through the 1970s.
- Milpitas and East Palo Alto have experienced high rates of growth more recently.
- San Francisco's population has fluctuated somewhat but on average has been essentially stable over the past 50 years

[22] As described in Section 7.2.2 and in more detail in Appendix E, Section E.2, the SFPUC expressly did not take a per capita approach to projecting 2030 demand, but rather undertook a detailed demand study utilizing actual account data in end-use demand models, which broke down total water use, by water service account, to specific end uses in each wholesale customer service area and San Francisco.

TABLE 7.10
PERCENT CHANGE IN POPULATION, EMPLOYMENT, AND WATER DEMAND 2001 – 2030

Customer	Customer's Demand as Percentage of Total 2030 Demand (%)	Percent Change in		
		Employment (%)	Population (%)	Water Demand (%)
Alameda County Water District	14.2	47	20	16
City of Brisbane	0.2	417	45	111
City of Burlingame	1.2	16	16	3
CWS–Bear Gulch District[a]	3.3	11	11	4
CWS–Mid-Peninsula District[a]	4.3	27	16	5
CWS–South San Francisco District[a]	2.4	27	21	11
Coastside County Water District	0.8	26	36	25
City of Daly City	2.2	26	9	5
City of East Palo Alto	1.2	164	34	92
Estero MID[b]	1.6	31	16	17
Guadalupe Valley MID[b]	0.2	28	249	153
City of Hayward	6.9	30	16	49
Town of Hillsborough	0.9	14	9	5
Los Trancos County Water District[c]	0.0	NA	48	32
City of Menlo Park	1.1	32	12	15
Mid-Peninsula Water District	0.9	51	6	4
City of Millbrae	0.8	20	17	5
City of Milpitas	4.2	42	42	48
City of Mountain View	3.5	27	15	12
North Coast County Water District	0.9	29	18	5
City of Palo Alto	3.4	8	15	1
Purissima Hills Water District	0.8	9	12	51
City of Redwood City	3.2	26	14	13
City of San Bruno	1.1	55	18	2
City of San Jose (North)	1.6	34	23	25
City of Santa Clara	8.1	28	35	31
Skyline County Water District	0.1	0	122	82
Stanford University	1.6	NA	42	76
City of Sunnyvale	6.4	35	15	8
Westborough Water District	0.2	1	10	1
Total, Wholesale Service Area	**78**	**31**	**19**	**19**
SFPUC Retail Service Area	**22**	**25**	**12**	**-0.2**
TOTAL	**100**	**29**	**17**	**14**

NA = Not applicable; the former Los Trancos County Water District had only residential accounts and Stanford University used other parameters, such as increase in building square footage, to forecast growth in non-residential accounts.

[a] CWS = California Water Service Company
[b] MID = Municipal Improvement District
[c] The former Los Trancos County Water District is now part of CWS–Bear Gulch District; information presented here reflects information in background reports.

SOURCES: URS, 2004a; Hannaford and Hydroconsult, 2004; City of Palo Alto, 2005a; Westborough Water District, 2005.

General plans include policies to manage growth, and many identify strategies consistent with "smart growth" principles, such as encouraging infill development and the redevelopment of previously developed areas, as means to accommodate future growth.

7.3.6 Customer-Specific Summaries

This section summarizes for each wholesale customer and San Francisco the following key information regarding both (1) their water demand and the growth projections used in forecasting that demand, and (2) the consistency between the growth called for in the adopted general plans and that which could be supported by the WSIP.

Summary of Customer-Specific Review

The combined total 2030 water demand for San Francisco and the wholesale customers, taking into account projected plumbing code savings, is 417 mgd. To meet the customer purchase requests, the SFPUC regional water system would provide 284 – 300 mgd,[23] or about 68 – 72 percent of this total 417 mgd service area demand and about 71 – 74 percent of remaining demand after planned conservation programs have been implemented. SFPUC water would supplement other supply sources used by some of its water customers of groundwater, other surface water supplies, and recycled water, as well as conservation savings (refer to Table 7.2).

Overall, the estimated water demand from the SFPUC regional water system through 2030 is about 14 percent higher than 2001 levels. As the summaries by water customer presented below indicate, the increased water that would be available as a result of the WSIP would enable growth to varying degrees in the SFPUC service area. As the summaries and information presented in this chapter indicate, the water customers vary in size, their overall projected demand for 2030, the change the 2030 demand represents in absolute terms (i.e., in mgd) and as a percentage of 2001 demand, and the degree to which they depend on the SFPUC for their water supply. Not surprisingly, considering the different jurisdictions within the service area, expectations about future growth and growth-related constraints and opportunities also vary somewhat. However, the jurisdictions have much in common with respect to growth and growth management. The SFPUC service area is largely urbanized; many of the jurisdictions served cannot grow laterally (because they are bordered by other cities, the bay, and/or protected areas) and have identified infill development, redevelopment, and increasing densities as approaches to accommodating future growth. Such growth is consistent with ABAG principles of smart growth and is, in general, the kind of growth that the WSIP would have the potential to induce or support.

As discussed below, the growth that would be supported by the SFPUC regional water system under the WSIP is generally consistent with ABAG projections for jurisdictions in the service area. Because of differences in the geographic area covered by most of the water customers and the jurisdictions they serve, the population projections of ABAG, general plans, and the SFPUC wholesale and retail demand studies are not expected to match exactly. However, the comparisons presented below do show reasonably consistent expectations in most areas.

[23] As previously noted and discussed in more detail in Chapter 3 of this PEIR, for planning purposes the high range purchase estimate of 300 mgd was selected as the target goal for the average annual water delivery by 2030.

The age of the jurisdictions' general plans vary considerably, as previously noted. Due to the WSIP's longer planning horizon (especially considering the age of some of the local general plans), the WSIP would support a degree of growth that has not been addressed in adopted general plans. The effects of planned growth and growth that is not addressed in adopted land use plans of jurisdictions in the SFPUC service area are discussed in Section 7.4, below.

Customer Summaries

Each customer summary provides the following:

- Total 2030 demand
- Change in demand from 2001 (mgd and percent)
- Percent of projected demand that would be met by the SFPUC
- Customer's 2030 purchase estimate
- Change in purchases from the SFPUC from 2001 (mgd and percent)
- Customer's current supply assurance
- How projected growth in population and employment compares with growth in water demand
- Consistency of population and employment (for general plans that present employment projection data) assumed in developing water demand with projected growth contained in general plans.

The discussion of individual customers presented in this section indicates that different ABAG series result in markedly different projections for some jurisdictions. For an illustration of the differences in growth rates forecasted for the nine Bay Area counties and the four counties of the SFPUC service reflected in ABAG's last three projections sets, see Figures E.3.1 and E.3.2 in Appendix E, Section E.3.2.

Unless otherwise specified, the ABAG projections referenced in this section are from *Projections 2005* (ABAG, 2004). The demand study referenced is the *SFPUC Wholesale Customer Water Demand Projections Technical Report* (URS, 2004a), except for the discussion of the SFPUC retail service area. The source of retail service area demand information is the report entitled *City and County of San Francisco Retail Water Demands and Conservation Potential* (Hannaford and Hydroconsult, 2004).

ACWD

The ACWD's total 2030 water demand, based on the demand study and taking into account plumbing code savings, is 59.3 mgd. This represents a 16 percent increase in total service area demand over the 2001 base-year demand estimate. ACWD uses multiple supply sources to meet its water demand. In 2030, ACWD projects it will purchase about 23 percent of its water demand and about 25 percent of remaining demand from the SFPUC after conservation has been implemented. The SFPUC portion of ACWD's supply would supplement ACWD's projected conservation savings and use of groundwater, other surface water supplies, and recycled water

(refer to Table 7.2) to meet future demand increases. ACWD's 2030 estimated purchase of 13.76 mgd from the SFPUC represents a 1.77 mgd, or 15 percent, increase over its 2001 purchases. ACWD's current water supply assurance is 13.76 mgd.

Population projections used in the demand study are generally consistent with the growth cited in the general plans of the three cities served by ACWD (Fremont, Newark, and Union City) and the growth projected for the three cities by ABAG. The population projections used in the demand study for 2030 are approximately 6 percent higher than those presented in the cities' general plans (combined), which is likely attributable to the longer planning horizon of the WSIP (2030 compared to 2020 for the general plans). The population estimate in the demand study is approximately 6 percent less than is projected in ABAG's *Projections 2005* for the three cities in 2030.

The employment projection used in the demand study is about 25 percent higher than the (combined) employment projections cited in the cities' general plans, but is generally consistent with (about 3 percent less than) the combined ABAG *Projections 2005* employment projection for the three cities. This may be partially attributable to the longer planning horizon of the WSIP (and ABAG). The projections in Table 7.9 indicate that the ABAG projections for Fremont are 23 percent higher than the general plan projection; the ABAG projection for Newark is about 6 percent less than the general plan projection; and the ABAG projection for Union City is more than double that of the general plan. Business and industrial demand accounts for approximately 20 percent of ACWD's projected 2030 demand (SFPUC, 2006).

City of Brisbane

Brisbane's total 2030 water demand, taking into account plumbing code savings, is 0.93 mgd. This represents a 111 percent increase in total service area demand over the 2001 base-year demand estimate. The SFPUC is Brisbane's only source of potable water supply. In 2030, Brisbane projects it will purchase 96 percent of its total water demand from the SFPUC and 100 percent of demand after conservation has been implemented, based on Brisbane's purchase estimate (refer to Table 7.2). Brisbane's 2030 estimated purchase of 0.89 mgd from the SFPUC represents a 0.50 mgd, or 128 percent, increase over its 2001 purchases. Brisbane's current water supply assurance is 0.46 mgd.

The projected 111 percent increase in service area demand for Brisbane is apparently primarily due to the city's expectation of substantial job growth in the 2001- 2030 planning period. The demographic projections used in the demand model, which were provided by the City of Brisbane, assume a 45 percent increase in population and a 417 percent increase in employment by 2030.

Both the City of Brisbane water district and Guadalupe Valley MID provide water to the city of Brisbane; therefore, this discussion combines the 2030 projections used in the demand study for both customers to allow a comparison with projections developed for the city. The 2030 population assumed for Brisbane in the demand study is 4,606. The combined population projection used in the demand study for 2030 for the two districts is 6,164, which is 18 percent

higher than the population projected by ABAG for Brisbane of 5,240 (ABAG, 2004). The Brisbane General Plan, adopted in 1994, does not have a comparable population projection. The 1999–2006 housing element cites an ABAG estimate of 4,010 for 2005, but does not project beyond that year.

The combined employment projection for the two water customers is about 24 percent higher than ABAG's *Projections 2005* forecast for Brisbane in 2030. The combined projections for the two water districts represent a 139 percent increase in jobs from 2005[24] to 2030. This projected increase, while substantial, is slightly lower than the 149 percent increase predicted for Brisbane by *Projections 2005* for the same period.

Both water districts are operated by the City of Brisbane and both used city population and employment projections as the source of projections in the water demand study. If a water customer selected a projection source other than ABAG for the demand study, they were asked to provide the source and the reason the source was more appropriate for them than ABAG.[25] Brisbane noted that ABAG projections do not divide the city's population into the two separate water districts. The selected population projections were based on the number of available units in each district under the zoning ordinance and population density assumptions (persons per unit) using information from the Brisbane Building and Planning Department and the housing element, and an additional population estimate based on the 2000 U.S. Census data. The city identified 1,366 additional units for the two districts (660 in the Brisbane service area and 706 in the Guadalupe Valley service area) with an assumed density factor of 2.2 persons per unit, for a projected additional population of 3,005 above the initial population of 3,159. Thus, the projection used appears to be consistent with existing planning and zoning within the City.

City of Burlingame

Burlingame's total 2030 water demand, taking into account plumbing code savings, is 4.9 mgd. This represents a 3 percent increase in total service area demand over the 2001 base-year demand estimate. The SFPUC is Burlingame's only source of potable water supply. In 2030, Burlingame estimates it will purchase 96 percent of its total water demand from the SFPUC and 100 percent of demand after conservation has been implemented, based on Burlingame's purchase estimate (refer to Table 7.2). Burlingame's 2030 estimated purchase of 4.70 mgd from the SFPUC represents a 0.06 mgd, or 1 percent, increase over its 2001 purchases. Burlingame's current water supply assurance is 5.23 mgd.

Burlingame's water demand projections assumes 16 percent growth in population and 16 percent growth in employment by 2030. The population projection used for Burlingame in the demand study is about 11 percent higher than the growth cited in the 2002 general plan housing element for 2010, and 10 percent higher than the 2030 population estimated in ABAG's *Projections 2005* for the city and its sphere of influence. Because the housing element projection only extends to

[24] The 2005 estimates were interpolated from the employment figures in the SFPUC demand study for this analysis, as shown in Table E.3.4 of Appendix E, Section E.3.

[25] The request for projection source information was part of the SFPUC Capital Improvement Project Wholesale Customer Demand Projections/DSS Modeling Wholesale Customer Population Projection Selection Form submitted by each wholesale customer.

2010, it would be expected to be less than the population for 2030 used to derive water demand projections. The difference between the customer-selected projections used in the demand study and ABAG projections apparently stems from ABAG's lowered expectations about population growth in Burlingame. The demand study cites as its source ABAG *Projections 2002*, which expected more growth in the city than does *Projections 2005*. For example, *Projections 2002* forecasted a 2025 population of 33,600, and *Projections 2005* forecasts a 2025 population of 31,700, and the population now expected in *Projections 2005* in 2030 was expected in 2015 in *Projections 2002*. (*Projections 2002* does not provide 2030 estimates for a direct comparison of projections for 2030.) Burlingame's UWMP, published in 2005, cites *Projections 2005* as the projection source and uses the lower 2030 population estimate of 31,900. In addition, 2 percent of Burlingame's water service area is unincorporated San Mateo County, for which segregable ABAG and San Mateo County General Plan projections are not available.

Given the moderate expectations for growth assumed in the demand model (16 percent over 29 years), the revisions to ABAG's expectations of growth for the region, and the much shorter planning horizon contained in the city's housing element, the growth assumed in the demand model is generally consistent with the local and regional planning agencies.

CWS–Bear Gulch District

The total 2030 water demand estimated for the CWS–Bear Gulch District, taking into account plumbing code savings, is 14.06 mgd. This estimate includes the projected 2030 demand of 0.14 mgd of the former Los Trancos County Water District, which is now part of CWS–Bear Gulch, and represents a 4 percent increase in total service area demand over the 2001 base-year demand estimate. CWS–Bear Gulch District uses multiple services to meet its water demand. In 2030, CWS–Bear Gulch estimates it will purchase about 84 percent of the district's total water demand from the SFPUC and about 90 percent of remaining demand after conservation has been implemented, based on CWS–Bear Gulch District's purchase estimate (refer to Table 7.2). CWS–Bear Gulch District's 2030 estimated purchase of 11.76 mgd (including the former Los Trancos district) from the SFPUC represents a 0.53 mgd, or 5 percent, increase over the combined CWS–Bear Gulch and Los Trancos County Water District 2001 purchases. The current water supply assurance for the three CWS districts combined (i.e., including CWS-Mid Peninsula and CWS–South San Francisco) is 35.5 mgd.

Because the CWS–Bear Gulch District serves many communities, including Atherton, Menlo Park, Portola Valley, part of Woodside, and areas of unincorporated San Mateo County (i.e., the communities of West Menlo Park, Ladera, North Fair Oaks, and Menlo Oaks), its population projections are not comparable to those of ABAG or the respective jurisdictions' general plans.

The CWS–Bear Gulch District's UWMP, published in December 2005, shows a much lower 2030 population estimate (59,220) than the customer-selected estimate shown in the demand study (73,719). The UWMP's estimate of the district's 2004 population, 54,350, is also substantially lower than the 2001 base-year population of 66,197 used in the demand study. The differences appear to result from the different methods used to estimate the population of the service area, which, as noted, serves parts of a number of incorporated cites and unincorporated

parts of the county. The UWMP states that the population estimates are different because "initial conditions for the DSS model hav[e] changed since the DSS model was first created and when [the UWMP] was written." The UWMP notes that, although the "initial conditions" for the two estimates changed, the rates of growth of both projections are similar. A comparison of expected growth from 2004 to 2030 in the UWMP, based on the estimates cited above, shows the population is expected to grow by about 9 percent, and the expected growth from 2001 to 2030 in the wholesale demand study is about 11 percent. Based on a comparison of the SFPUC's share of the UWMP's planned 2030 water supply and the 2030 purchase estimate, no change is expected in water demand. The UWMP estimates 14,708 acre-feet per year, or about 11.76 mgd, from the SFPUC. This is equivalent to the combined 2030 purchase estimates of CWS–Bear Gulch (11.6 mgd) and the former Los Trancos County Water District.

CWS–Mid-Peninsula District

The total 2030 water demand estimated for the CWS–Mid-Peninsula District, taking into account plumbing code savings, is 18.1 mgd. This represents a 5 percent increase in total service area demand over the 2001 base-year demand estimate. The SFPUC is CWS-Mid Peninsula's only source of potable water supply. In 2030, CWS–Mid-Peninsula District estimates it will purchase about 95 percent of its total water demand from the SFPUC and 100 percent of demand remaining after conservation has been implemented, based on CWS-Mid-Peninsula District's purchase estimate (refer to Table 7.2). CWS–Mid-Peninsula District's 2030 estimated purchase of 17.24 mgd from the SFPUC represents a 0.49 mgd, or 3 percent, increase over its 2001 purchases. The current combined water supply assurance for the three CWS districts is 35.5 mgd.

Because the CWS–Mid-Peninsula District serves portions of San Carlos and San Mateo and adjacent unincorporated areas of San Mateo County, including the Highlands and Palomar Park, its population and employment projections are not comparable to those of ABAG or the respective jurisdiction's general plans since they cover different geographic areas.

CWS–South San Francisco District

The CWS–South San Francisco District's 2030 water demand, taking into account plumbing code savings, is 9.9 mgd. This represents an 11 percent increase in total service area demand over the 2001 base-year demand estimate. CWS–South San Francisco District's uses multiple supply sources to meet its water demand. In 2030, CWS–South San Francisco estimates it will purchase about 81 percent of its total demand from the SFPUC and about 85 percent of the district's remaining demand after conservation has been implemented, based on CWS–South San Francisco's purchase estimate (refer to Table 7.2). CWS–South San Francisco District's 2030 estimated purchase of 7.97 mgd from the SFPUC represents a 0.41 mgd, or 5 percent, increase over its 2001 purchases. The current combined water supply assurance for the three CWS districts is 35.5 mgd.

Both CWS–South San Francisco and Westborough County Water District provide water to South San Francisco; therefore, this discussion combines the 2030 population projections for the two water customers to allow a comparison with the city's general plan and ABAG projections

for the city. (The 2030 customer-selected projection for CWS-South San Francisco [59,584] is based on the 2004 demand study. The 2030 projection for Westborough [14,300] is from Westborough's 2005 UWMP, based on a letter from the water district to the SFPUC [Westborough Water District, 2007] indicating that the population estimates in the UWMP more accurately reflect the district's service area than did the population estimates used in the demand study.) The combined estimated 2030 population to be served by the two wholesale customers (73,884) is about 8 percent higher than that projected in the general plan and about the same as (0.3 percent higher than) ABAG's 2030 projections for the city.

The combined employment projection for the two water customers in the demand study is about 10 percent lower than the employment projection cited in the city's general plan, and about 14 percent higher than ABAG's *Projections 2005* 2030 projections.

Coastside County Water District

The Coastside County Water District's (Coastside CWD) total 2030 water demand, taking into account plumbing code savings, is 3.2 mgd. This represents a 25 percent increase in total service area demand over the 2001 base-year demand estimate. Coastside CWD uses multiple sources to meet its water demand. In 2030, Coastside CWD estimates it will purchase 70 to 94 percent of its total water demand from the SFPUC and 74 to 100 percent of remaining demand after conservation has been implemented, based on Coastside CWD's purchase estimate (refer to Table 7.2). Coastside CWD's 2030 estimated purchase of 2.24 – 3.02 mgd from the SFPUC represents a 0.44 – 1.22 mgd, or 24 – 68 percent, increase over its 2001 purchases. The high-end of its purchase estimate range assumes loss of all local water sources (i.e., groundwater and other surface water). Coastside CWD's current water supply assurance is 2.18 mgd.

The customer-selected population projection used for Coastside CWD in the demand study is 19 percent higher than the population of 21,065 for 2020 cited in Half Moon Bay's 1993 Local Coastal Program Land Use Plan (which serves as the general plan), and about 8 percent lower than the 2030 ABAG projections for Half Moon Bay and unincorporated Half Moon Bay. In addition to the city itself, Coastside CWD serves unincorporated areas of Half Moon Bay and the unincorporated communities of El Granada, Miramar, and Princeton by the Sea. The difference in geographic area covered by the land use plan and the water district may account for the differences in the population projections. In addition, some of the district's increase in SFPUC water purchase is needed to replace existing local supplies that, because of water quality concerns, are no longer suitable for use.

The 2030 employment projection used for Coastside CWD in the demand study is about 20 percent less than the combined *Projections 2005* employment forecasts for Half Moon Bay and unincorporated Half Moon Bay for 2030 (8,490). The 1993 Local Coastal Program Land Use Plan does not have a comparable employment projection.

Half Moon Bay currently is in the process of updating its general plan. According to information about the public review draft available on the city's website, the updated general plan will incorporate provisions of Measure D, a growth control measure adopted by voters in 1999.

Measure D limits residential growth in the city to 1 percent per year, with an optional 50 percent additional growth (i.e., 1.5 percent) allowed in the downtown area (City of Half Moon Bay, 2005a). A 1991 growth control measure, Measure A, was incorporated into the adopted 1993 Land Use Plan; however, Measure D further restricts residential growth (City of Half Moon Bay, 2005b). The Draft Local Coastal Program Amendment posted on the city's website states that ABAG's *Projections 2005* expects 820 new households for Half Moon Bay by 2025, reflecting a 1.1 percent annual growth rate, and another 200 units in the unincorporated coastside area. The draft plan states that ABAG's projection for Half Moon Bay and unincorporated Half Moon Bay shows a combined population of about 26,500 in 2025 (City of Half Moon Bay, 2005c).

City of Daly City

Daly City's total 2030 water demand, taking into account plumbing code savings, is 9.1 mgd. This represents a 5 percent increase in total service area demand over the 2001 base-year demand estimate. Daly City uses multiple supply sources to meet its water demand. In 2030, Daly City estimates it will purchase 54 to 80 percent of its total water demand from the SFPUC and 57 to 85 percent of remaining demand after conservation has been implemented, based on Daly City's purchase estimate (refer to Table 7.2). Daly City's 2030 estimated purchase of 4.90 – 7.32 mgd from the SFPUC represents a -0.18 – 2.24 mgd, or -4 – 44 percent, change from its 2001 purchases. The purchase estimate range reflects a range of potential groundwater usage established under a pilot project, from the sustainable yield (3.76 mgd) to the lowest annual production yield (1.34 mgd). Daly City's current water supply assurance is 4.29 mgd.

The customer-selected population projection used for Daly City in the demand study is about the same as (2 percent higher than) the buildout population cited in the city's general plan, and 9 percent lower than the 2030 population projected by ABAG.

The employment projection for Daly City in the demand study is about the same as (1 percent less than) the employment projection cited in the city's general plan, and about 14 percent higher than the ABAG *Projections 2005* employment projection.

City of East Palo Alto

East Palo Alto's total 2030 water demand, taking into account plumbing code savings, is 4.8 mgd. This represents a 92 percent increase in total service area demand over the 2001 base-year demand estimate. The SFPUC is East Palo Alto's only source of potable water supply. In 2030, East Palo Alto estimates it will purchase 97 percent of its total water demand from the SFPUC and 100 percent of remaining demand after conservation has been implemented, based on East Palo Alto's purchase estimate (refer to Table 7.2). East Palo Alto's 2030 estimated purchase of 4.64 mgd from the SFPUC represents a 2.60 mgd, or 127 percent, increase over its 2001 purchases. East Palo Alto's current water supply assurance is 1.96 mgd.

East Palo Alto's customer-selected projections used to derive water demand assume 34 percent growth in population and 164 percent growth in employment by 2030. Besides the projected population and employment growth assumed in the demand model, the projected 92 percent

increase in demand reflects expected new commercial and residential development having higher per-account water use rates than existing accounts. To accommodate this new development, two new account categories were created for the demand model, as follows:

- a new commercial account category was created to represent additional water demand of 1.2 mgd from new commercial uses, which are assumed to have a use rate of 5,000 gallons per account per day, in the Ravenswood Business District

- a new residential account category was created to represent additional water demand of 0.3 mgd from new single-family residences in the Ravenswood Business District

In more general terms the East Palo Alto's Urban Water Management Plan attributes the near doubling of demand by 2030 to a shift in development density in the city. The UWMP states that the city is shifting from traditional single family dwelling units to higher density multiple-family units that is expected to substantially increase water demand without a commensurate increase in the number of water connections.

The population projection used for East Palo Alto in the demand study is about 6 percent less than the growth expected by 2020 in the city's general plan and 25 percent less than that projected by ABAG's *Projections 2005* for East Palo Alto in 2030. This substantial difference is likely due to adjustments made to the demand study projections to account for the portion of residential customers in East Palo Alto that are served by two other water districts (which are not BAWSCA members and do not receive SFPUC water): the Palo Alto Mutual Water Company and the O'Connor Tract Mutual Cooperative Water Company. According to the demand study, the single- and multi-family residential accounts served by these two water companies were subtracted from the total population served by East Palo Alto (URS, 2004a).

The customer-selected employment projection for East Palo Alto used in the demand study is substantially higher (about 46 percent) than the employment projection cited in the city's general plan (and about 42 percent higher than the ABAG *Projections 2005* employment projection). A combination of the following factors likely accounts for the difference:

- The Ravenswood Business District, a proposal to amend the general plan and zoning ordinance to redevelop 146 acres in the northeast section of East Palo Alto, is not reflected in the general plan projections but is reflected in the WSIP projections. The city began preparing an environmental impact report on the Ravenswood Business District in 2002; as then envisioned, the development would have resulted in an estimated 1,800 jobs above general plan employment projections.[26] Economic changes have likely slowed the pace at which revitalization can occur in East Palo Alto, and the Ravenswood Business District is currently being redefined.

- The difference is partially attributable to the longer planning horizon of the WSIP (2030 versus 2010) and changing expectations about employment growth as reflected in different

[26] The Ravenswood Business District area identified in the administrative draft EIR for the project consists of about 146 acres of land, exclusive of streets. Existing land uses within the area include a variety of industrial, commercial, residential, and agricultural uses; approximately 45 acres are vacant and undeveloped.

ABAG projections series. The customer-selected projection is consistent with (about 6 percent less than) *Projections 2002* employment forecasts for 2030.

- The base year employment projection identified in the general plan is 2,760 for year 2000; the base year employment estimate in the demand study is 3,289 for year 2001. The latter estimate may more accurately reflect the substantial increases in job growth that occurred in the late 1990s.

Commercial and industrial demand accounts for approximately 41 percent of East Palo Alto's projected 2030 demand (SFPUC, 2006).

Estero MID

The Estero MID service area includes Foster City and a part of the City of San Mateo. Estero's total 2030 water demand, taking into account plumbing code savings, is 6.8 mgd. This represents a 17 percent increase in total service area demand over the 2001 base-year demand estimate. The SFPUC is Estero MID's only source of potable water supply. In 2030, Estero MID estimates it will purchase 91 – 100 percent of its total water demand from the SFPUC and 100 percent of remaining demand after conservation has been implemented, based on Estero MID's purchase estimate (refer to Table 7.2). Estero MID's 2030 estimated purchase of 6.20 – 6.80 mgd from the SFPUC represents a 0.58 – 1.18 mgd, or 10 – 21 percent, increase over its 2001 purchases. Estero MID's water supply assurance contract does not specify a limit on purchase.

The customer-selected 2030 population projection used for Estero MID in the demand study is 30 percent higher than the population projection in the Foster City General Plan housing element (adopted in 2001),[27] and about 23 percent higher than the 2030 Foster City population estimated by ABAG in *Projections 2005*. The difference between the demand study and general plan projections is probably due both to the general plan's horizon year of 2010 and the fact that Estero MID serves more than Foster City. (According to the wholesale customer demand study, about 10 percent of the water district is within the city of San Mateo and 90 percent is within Foster City. However, a comparison of the population estimates used for the demand study with the 2000 census for Foster City and ABAG's near term and 2030 projections indicates a population difference of about 20 percent between the water district and Foster City, as discussed below.)

A comparison of Estero's 2001 base-year population (34,568) with the 2000 census population for Foster City (28,756) (U.S. Census Bureau, 2000) shows that the population of the Estero MID service area was roughly 20 percent higher than Foster City's for the base year. A comparison of the population estimates used for Estero in the demand study with *Projections 2005* estimates for Foster City shows that the district's 2001 base-year population is about 20 percent higher than the 2000 population,[28] 16 percent higher than the projection for 2005, and, as noted, about 23 percent higher than ABAG's projection for 2030. This fairly consistent relationship between Foster City

[27] The General Plan land use element (amended in 1999) also includes population and employment projections. The land use element projects a 2005 population of 31,471, slightly higher than the later housing element projection for 2010, and 27 percent less than the 2030 population forecast used in the demand study.

[28] *Projections 2005* shows the 2000 census figure for Foster City.

and Estero population estimates suggests that the difference between the demand study and ABAG projections for 2030 is due to the difference in geographic area covered by the two sets of projections. Similarly, this difference in geographic area partially accounts for the difference between the water customer's projected 2030 population and the Foster City General Plan population at buildout. As noted, another important difference is in the shorter-term planning horizon (2010) used in the General Plan projection. Residential demand accounts for a little more than half (52 percent) of Estero's 2030 demand (SFPUC, 2006).

The customer-selected employment projection for Estero MID in the demand study is substantially higher (about 70 percent) than the employment projection cited in Foster City's 2001 housing element[29] and the ABAG *Projections 2005* employment projection (about 51 percent higher). As with the population projections, the difference is due to the difference in the geographic area covered by the sets of projections and, for the general plan, the longer planning horizon of the WSIP (2030 versus 2010). An additional factor contributing to the difference between employment projections is the more dynamic nature of employment in the area (compared to population) in the late 1990s and early 2000s. The Foster City housing element employment projection is based on ABAG's *Projections 2000* (ABAG, 1999), whereas the demand study used the employment projections in *Projections 2002*. A comparison of these two ABAG projections sets show that *Projections 2002* expected continued strong job growth in Foster City into the future (15 to 18 percent more jobs in 2005, 2010, 2015, and 2020 than were projected for those years in *Projections 2000*). The influence of the economic boom on *Projections 2002* thus contributed to some of the difference between the general plan and water demand study projections.

Projections 2005, by contrast, reflects improving information about the effects of dramatic job losses that were incurred in the area, with job forecasts for Foster City 23 to 33 percent lower than those of *Projections 2002* for the years that can be compared (2005, 2010, 2015, 2020, and 2025). *Projections 2005* employment forecasts for San Mateo also are 15 to 30 percent lower than those in *Projections 2002*, for the years that can be compared. This would account for the greater difference between customer-selected and ABAG employment projections than would be expected due to differences in geographic area covered by the two projections. As discussed in Section 7.3.2, above, *Projections 2005* forecasts a greater increase in jobs over time than was forecasted in *Projections 2002*, so that by 2025 (the last year the two sets can be compared) there is less difference between projections than there is in the near-term.

Commercial/institutional and industrial demand accounts for approximately 12 percent of Estero's projected 2030 demand (SFPUC, 2006).

[29] The General Plan land use element (amended in 1999) also includes employment projections. The land use element projects a 2010 employment projection of 21,460, somewhat higher than the later housing element projection, and about 48 percent less than the 2030 employment forecast used in the demand study.

Guadalupe Valley MID

Guadalupe Valley MID serves part of the City of Brisbane. The district's total 2030 water demand, taking into account plumbing code savings, is 0.81 mgd. This represents a 153 percent increase in total service area demand over the 2001 base-year demand estimate. The SFPUC is Guadalupe Valley MID's only source of potable water supply. In 2030, Guadalupe Valley MID estimates it will purchase 88 percent of its total water demand from the SFPUC and 100 percent of remaining demand after conservation has been implemented, based on Guadalupe Valley's purchase estimate (refer to Table 7.2). Guadalupe Valley MID's 2030 estimated purchase of 0.71 mgd from the SFPUC represents a 0.41 mgd, or 138 percent, increase over its 2001 purchases. Guadalupe Valley MID's current water supply assurance is 0.52 mgd.

The projected 153 percent increase in service area demand for Guadalupe Valley MID is apparently due to the City of Brisbane's expectation of substantial population growth in the 2001-2030 in the area served by this water district. The demographic projections used in the demand model, which were provided by Brisbane, assume a 249 percent increase in population and a 28 percent increase in employment by 2030.

The customer-selected projections used for Guadalupe Valley MID in the demand study assume a population of 1,558 in 2030 and 5,668 jobs. Since Guadalupe Valley MID serves only part of Brisbane, the population and employment projections used in the demand study are not comparable to the city as a whole. Refer to the discussion under Brisbane for a comparison of combined water district projections with general plan and ABAG projections.

City of Hayward

Hayward's total 2030 water demand, based on the demand study and taking into account plumbing code savings, is 28.7 mgd. This represents a 49 percent increase in total service area demand over the 2001 base-year demand estimate. The SFPUC is Hayward's only source of potable water supply. In 2030, Hayward estimates it will purchase 97 percent of its total water demand from the SFPUC and 100 percent of remaining demand after conservation has been implemented, based on Hayward's purchase estimate (refer to Table 7.2). Hayward's 2030 estimated purchase of 27.95 mgd from the SFPUC represents a 10.34 mgd, or 59 percent, increase over its 2001 purchases. Hayward's water supply assurance contract does not specify a limit on purchases.

The percentage increase in water demand for Hayward projected for 2030 (49 percent) is considerably greater than the projected growth in both population and employment assumed in the demand model (16 percent and 30 percent, respectively). Given both the substantial increase in total demand projected for Hayward (9.4 mgd) and the substantial difference in the expected demand and population and employment growth rates, this discrepancy warrants additional discussion.

Hayward residents have among the lowest rates of per capita water use compared with residents in other communities served by the SFPUC. This is a consequence of past development patterns

that have included high density development with little or no landscaping. The general plan states that during development surges that occurred from the 1950's to mid 1980's, because few development standards existed, "some apartment buildings were poorly designed with as many units as possible loaded on the site… and there was little or no play space for children…" (City of Hayward, 2002a). In addition, single family homes typically were located on smaller lots compared with other parts of the Bay Area and many had minimal, if any, landscaping. The city currently expects that new housing developed in the city will have higher water use rates due to comparatively larger lots with more landscaping. The city is also encouraging renovation efforts that include landscaping common areas within neighborhoods and assisting homeowners with rehabilitating their private properties. As a result, per capita water use rates are expected to increase somewhat (City of Hayward, 2005). According to the general plan, city planners also are encouraging development consistent with smart growth principles, including infill development and higher densities in urban core areas. Because of the city's experience with poorly planned, designed, and constructed high density development in the past, the city has met with some resistance regarding higher densities. However, successful transit oriented developments have demonstrated that well planned development can accommodate higher densities without diminishing quality of life for resident.

The demand model incorporated adjustments in recognition of these factors. The higher water demand projected for 2030 results from adjustments made to account for expected changes in water usage for new and existing residential accounts, as well as changes expected in some industrial accounts. To accommodate the anticipated changes, in response to input from the city, the demand model was adjusted to include several new account categories, as follows:

- A new category of residential account was created to accommodate the addition of more than 2,000 new homes the city expects to be developed. These new residences are expected to be on larger lots than existing housing, include more landscaping, and have a higher per capita water use rate.

- A new account category was created for newly renovated single family homes, which have more landscaping than previously and use more water.

- Based on the city's general plan, which indicates that the city expects to attract high technology manufacturing industries, a new account category was added for higher-demand commercial and industrial uses. The higher water demand expected from this new industrialization was incorporated into the model.

Hayward's demand model also was adjusted to increase the expected percentage of unaccounted-for water in its system. The five-year average for the Hayward water system was 7.2 percent. A 9 percent unaccounted-for water was used in the demand study because Hayward's unaccounted-for water includes water used for hydrant flushing and other maintenance purposes. Although many agencies categorize these uses as "other," Hayward does not. Because these types of uses are difficult to anticipate, Hayward adjusted its unaccounted-for water to 9 percent, consistent with its 2001 UWMP (URS, 2004a). The SFPUC reviewed each of the requests for adjustments against current billing records and other documentation, including the city's Water Master Plan and general plan, before making a determination that the requested adjustments were reasonable.

The customer-selected population projection used for Hayward in the demand study is generally consistent with the growth cited in the city's general plan and the growth expected by ABAG. The 2030 Hayward population used in the demand study is approximately 2 percent higher than the population identified in the city's general plan and about 5 percent lower than projected by ABAG.

The employment projection for Hayward in the demand study is generally consistent with (about 5 percent higher than) the employment projection cited in the city's general plan and about 13 percent higher than ABAG's *Projections 2005* 2030 projections.

Town of Hillsborough

Hillsborough's total 2030 water demand, taking into account plumbing code savings, is 3.9 mgd. This represents a 5 percent increase in total service area demand over the 2001 base-year demand estimate. The SFPUC is Hillsborough's only source of potable water supply. In 2030, Hillsborough estimates it will purchase 95 percent of its total water demand from the SFPUC and 100 percent of remaining demand after conservation has been implemented, based on Hillsborough's purchase estimate (refer to Table 7.2). Hillsborough's 2030 estimated purchase of 3.70 mgd from the SFPUC represents a 0.14 mgd, or 4 percent, increase over its 2001 purchases. Hillsborough's current water supply assurance is 4.09 mgd.

The customer-selected population projection used for Hillsborough in the demand study is generally consistent with the growth identified in the city's general plan and the growth expected by ABAG. The 2030 Hillsborough population used in the demand study is approximately 8 percent higher than both the population identified in the city's general plan (for 2025) and that projected for 2030 by ABAG. The difference between the demand study and ABAG 2030 projections is probably due to the fact that the Hillsborough's water service area includes a portion of unincorporated San Mateo County, in addition to the town itself. A comparison of Hillsborough's 2001 base-year population for the water demand projections with ABAG projections for 2000 and 2005 show that the difference in ABAG and Hillsborough projections is about the same in the base year as in 2030: Hillsborough's 2001 population is about 7 percent higher than ABAG's 2000 population and 6 percent higher than ABAG's 2005 population. This suggests that the difference between the projections may be due to differences in the geographic area covered.

The employment projection for Hillsborough used in the demand study is about the same as (1 percent more than) the projection for 2025 in the town's general plan. The projection is considerably less (32 percent) than ABAG's projection for 2030.

City of Menlo Park

The City of Menlo Park, represented by the Menlo Park Municipal Water District estimates a total 2030 water demand, taking into account plumbing code savings, of 4.7 mgd. This represents a 15 percent increase in total service area demand over the 2001 base-year demand estimate. The SFPUC is Menlo Park's only source of potable water supply. In 2030, Menlo Park estimates it will purchase 97 percent of the water district's total water demand from the SFPUC and

100 percent of remaining demand after conservation has been implemented, based on Menlo Park's purchase estimate (refer to Table 7.2). Menlo Park's 2030 estimated purchase of 4.54 mgd from the SFPUC represents a 0.97 mgd, or 27 percent, increase over its 2001 purchases. Menlo Park's current water supply assurance is 4.46 mgd.

Because the water district serves less than half of the city, the population projection used for Menlo Park in the demand study is not directly comparable to general plan or ABAG projections for the city. Nevertheless, the 2030 water demand population projection is consistent with growth identified in the city's general plan, assuming the district would serve the same percentage of the city's population. In 2001, the water district served 12,153—or 39 percent—of the city's more than 30,785[30] residences. The customer-selected population used in the demand study for 2030 (13,655) is 39 percent of the general plan buildout population (35,285, projected for 2010). ABAG projects a population for Menlo Park of 41,100 in 2030, 16 percent more than the population projected at general plan buildout. (The CWS–Bear Gulch District, discussed above, and O'Connor Water District, which is not an SFPUC customer, serve the remaining portions of Menlo Park.)

Mid-Peninsula Water District

The Mid-Peninsula Water District primarily serves the City of Belmont, although it also serves a small part of unincorporated San Mateo County and the City of San Carlos. Mid-Peninsula's total 2030 water demand, taking into account plumbing code savings, is 3.8 mgd. This represents a 4 percent increase in total service area demand over the 2001 base-year demand estimate. The SFPUC is the Mid-Peninsula Water District's only source of potable water supply. In 2030, the District estimates it will purchase 97 percent of its total water demand from the SFPUC and 100 percent of remaining demand after conservation has been implemented, based on Mid-Peninsula's purchase estimate (refer to Table 7.2). Mid-Peninsula Water District's 2030 estimated purchase of 3.70 mgd from the SFPUC represents a 0.24 mgd, or 7 percent, increase over its 2001 purchases. Mid-Peninsula Water District's current water supply assurance is 3.89 mgd.

The customer-selected population projection used for the Mid-Peninsula Water District in the demand study is about the same as (approximately 1 percent higher than) the projection cited in the 2002 Belmont housing element for 2010, and 3 percent lower than the 2030 population projected by ABAG for Belmont.

The employment projection for Mid-Peninsula Water District in the demand study is substantially higher (about 58 percent) than ABAG's *Projections 2005* projections for Belmont in 2030. The difference is due to the lower number of jobs estimated for Belmont in the near term in *Projections 2005*, compared with the customer-selected projections used in the demand study, as a consequence of the substantial job losses sustained in the area in the first part of this decade. The projections used in the demand study expected almost twice as many jobs in 2005 as are estimated in *Projections 2005* (15,742 compared to 8,190).[31] Because *Projections 2005* forecasts

[30] This was the city's population in 2000 according to the U.S. Census.
[31] The demand study estimate for 2005 was interpolated for this PEIR analysis from the employment figures in the SFPUC demand study; refer to Table E.3.4 of Appendix E, Section E.3.

a higher rate of subsequent job growth (a 72 percent increase in jobs compared to a 41 percent increase assumed in the demand study projections), by 2030 the difference in total jobs forecasted by the two projections is less than in the near term.

City of Millbrae

Millbrae's total 2030 water demand, taking into account plumbing code savings, is 3.3 mgd. This represents a 5 percent increase in total service area demand over the 2001 base-year demand estimate. The SFPUC is Millbrae's only source of potable water supply. In 2030, Millbrae estimates it will purchase 97 percent of its total water demand from the SFPUC and 99 – 100 percent of remaining demand after conservation has been implemented, based on Millbrae's purchase estimate (refer to Table 7.2). Millbrae's 2030 estimated purchase of 3.19 mgd from the SFPUC represents a 0.72 mgd, or 29 percent, increase over its 2001 purchases. Millbrae's current water supply assurance is 3.15 mgd.

The population projection used for Millbrae in the demand study is generally consistent with the growth identified in the city's general plan and the 2030 population projected by ABAG. The 2030 Millbrae population used in the demand study is approximately 1.3 percent higher than the population cited in the city's general plan, and 3 percent higher than the 2030 Millbrae population projected by ABAG.

The employment projection for Millbrae in the demand study is about 33 percent lower than the employment projection cited in the city's general plan and about 20 percent lower than ABAG's *Projections 2005* employment projection.

City of Milpitas

Milpitas' total 2030 water demand, taking into account plumbing code savings, is 17.7 mgd. This represents a 48 percent increase in total service area demand over the 2001 base-year demand estimate. Milpitas uses multiple supply sources to meet its water demand. In 2030, Milpitas estimates it will purchase about 46 percent of its total 2030 water demand from the SFPUC and about 48 percent of remaining demand after conservation has been implemented, based on Milpitas' purchase estimate. The SFPUC portion of Milpitas' supply would supplement the city's use of recycled water and other surface water supplies in addition to the conservation savings (refer to Table 7.2). Milpitas' 2030 estimated purchase of 8.20 mgd from the SFPUC represents a 1.37 mgd, or 20 percent, increase over its 2001 purchases. Milpitas' current water supply assurance is 9.23 mgd.

The projected percentage increase in water demand for Milpitas in 2030 (48 percent) is somewhat greater than the projected growth in both population and employment assumed in the demand models (42 percent growth projected for each category). Given the relatively substantial increase in total service area demand for Milpitas (5.74 mgd) this discrepancy in demand and demographic growth rates warrants additional discussion. Several new billing account categories were created in the demand model for Milpitas to reflect observed changes in land use and water consumption rates. All new single family residential accounts (above those existing in 2001) were placed into a

new single family residential category that assumes larger homes with higher outdoor water usage. It was assumed that these accounts use approximately 50 percent more water than existing accounts; all of the additional water usage was allocated to outdoor use. In addition, based on information in the city's Water Master Plan and conversations with the wholesale customer, the model also included a new commercial category, which was assumed to have higher water usage than existing accounts. All new commercial accounts (above those existing in 2001) were placed in this category. Therefore, the differences in rates of increase (in demand compared with population and employment) do not indicate inconsistencies between the city's water supply and land use planning efforts. The city's estimated 2030 purchase from the SFPUC (which, as noted in the preceding paragraph, is 20 percent above 2001 purchases) does not reflect the growth in total demand.

The customer-selected population projection used for Milpitas in the demand study is generally consistent with the growth identified in the city's general plan and the growth projected by ABAG. The 2030 Milpitas population presented in the demand study is approximately 6 percent less than that cited in the city's general plan, as amended by the Midtown Milpitas Specific Plan, and about 3 percent less than projected by ABAG.

The employment projection for Milpitas in the demand study is about 17 percent higher than the employment projection cited in the city's general plan, and about 10 percent higher than the ABAG *Projections 2005* employment projection.

City of Mountain View

Mountain View's total 2030 water demand, taking into account plumbing code savings, is 14.8 mgd. This represents a 12 percent increase in total service area demand over the 2001 base-year demand estimate. Mountain View uses multiple supply sources to meet its water demand. In 2030, Mountain View estimates it will purchase 89 percent of its total water demand from the SFPUC and 91 – 97 percent of remaining demand after conservation has been implemented, based on Mountain View's purchase estimate (refer to Table 7.2). Mountain View's 2030 estimated purchase of 13.20 mgd from the SFPUC represents a 2.23 mgd, or 20 percent, increase over its 2001 purchases. Mountain View's current water supply assurance is 13.46 mgd.

The customer-selected population projection used for Mountain View in the demand study is 9 percent higher than the buildout population identified in the city's general plan, and 9 percent lower than the 2030 population projected by ABAG. The difference between the demand study and general plan projections may be attributable to the general plan's horizon year of 2010.

The employment projection for Mountain View in the demand study is about 13 percent higher than the employment projection cited in the city's general plan, and about 18 percent higher than the ABAG employment projection.

North Coast County Water District

The North Coast County Water District primarily serves the city of Pacifica; a small part of its service area encompasses a portion of unincorporated San Mateo County. North Coast County's total 2030 water demand, taking into account plumbing code savings, is 3.8 mgd. This represents a5 percent increase in total service area demand over the 2001 base-year demand estimate. The SFPUC is North Coast's only source of potable water supply. In 2030, the District estimates it will purchase 95-100 percent of its total water demand from the SFPUC and remaining 100 percent of demand after conservation has been implemented, based on North Coast's purchase estimate (refer to Table 7.2). North Coast County's 2030 estimated purchase of 3.61 – 3.80 mgd from the SFPUC represents a 0.16 – 0.35 mgd, or 5 – 10 percent, increase over its 2001 purchases. North Coast County's current water supply assurance is 3.84 mgd.

The customer-selected population projection used for North Coast County Water District in the demand study (47,829) is 13 percent higher than the 2030 Pacifica population projected by ABAG (42,200). The difference in the projections is apparently due to ABAG's lowered expectations of population growth in Pacifica. The demand study cites as its source ABAG *Projections 2002*, which expected more growth in Pacifica than does *Projections 2005*. (For example, *Projections 2002* estimated a population of 44,300 in 2025, whereas *Projections 2005* estimates a 2025 population of 41,700. North Coast County's UWMP, published in December 2005, uses a 2030 population estimate of 42,100, which is similar to ABAG's. The UWMP also forecasts somewhat lower water demand in 2030 than did the wholesale customer demand study (3.46 compared to 3.80 mgd). According to the UWMP, the "source of the discrepancy appears to be differing data for the District's base year, and differences in ABAG *Projections 2002* and *Projections 2005*" (North Coast County Water District, 2005). The Pacifica General Plan (which appears to date from 1980, except for a 1992 housing element) does not provide a comparable population projection.

The employment projection for North Coast in the demand study is 12 percent less than the ABAG *Projections 2005* employment projection for Pacifica.

City of Palo Alto

Palo Alto's total 2030 water demand, taking into account plumbing code savings, is 14.36 mgd based on the City's 2005 UWMP, as requested by the City in a letter to the SFPUC (City of Palo Alto, 2005). This represents a 1 percent increase in total service area demand over the 2001 base-year demand estimate. The SFPUC is Palo Alto's only source of potable water supply. In 2030, Palo Alto estimates it will purchase 91 percent of its total water demand from the SFPUC, and 94 percent of remaining demand after conservation has been implemented, based on the city's purchase estimate. The SFPUC portion of Palo Alto's supply would supplement the city's projected conservation savings and use of recycled water (refer to Table 7.2). Palo Alto's 2030 estimated purchase of 13.00 mgd from the SFPUC represents a -0.19 mgd, or 1 percent, decrease from its 2001 purchases. Palo Alto's current water supply assurance is 17.07 mgd.

The customer-selected population projection used for Palo Alto in the demand study is 10 percent higher than the buildout population identified in the city's general plan; the projection is not comparable to ABAG's projections for Palo Alto, since the wholesale demand projection does not include Stanford University (a distinct SFPUC wholesale customer), whereas ABAG does include the university. The difference between the demand study and general plan projections may be attributable to the general plan's horizon year of 2010.

The employment projection for Palo Alto in the demand study is about 16 percent higher than the employment projection cited in the city's general plan, but slightly lower than (by about 2 percent) than the ABAG employment projection for 2030.

Purissima Hills Water District

The Purissima Hills Water District serves about two-thirds of the Town of Los Altos Hills and a small part of adjacent unincorporated Santa Clara County. The total 2030 water demand estimated for the water district, taking into account plumbing code savings, is 3.3 mgd. This represents a 51 percent increase in total service area demand over the 2001 base-year demand estimate. The SFPUC is Purissima Hills Water District's only source of potable water supply. In 2030, the District estimates it will purchase 98 percent of its total water demand from the SFPUC and 100 percent of remaining demand after conservation has been implemented, based on Purissima Hills' purchase estimate (see Table 7.2). Purissima Hills' 2030 estimated purchase of 3.22 mgd from the SFPUC represents a 1.02 mgd, or 46 percent, increase over its 2001 purchases. Purissima Hills' current water supply assurance is 1.62 mgd.

Because the Purissima Hills Water District serves only part of the town's residences and some unincorporated county areas, the population projection used for the district in the demand study is not comparable to general plan or ABAG projections for the town. Nevertheless, the 2030 water demand population projection for the water district is consistent with growth identified in the town's 2002 Housing Element (Town of Los Altos Hills, 2002), assuming the district would serve the same percentage of the town's population. In 2001, the Purissima Hills Water District served 6,032—or 64 percent—of the approximately 94,555 residences estimated for the town and its sphere of influence in 2000. The customer-selected population projection used in the demand study (6,763) is 64 percent of the projection shown in the Housing Element (10,500 projected for 2025). Both the demand study and Housing Element projections reflect an annual population growth rate of approximately 0.4 percent. ABAG projects a population for Los Altos Hills of 10,700 in 2030, 2 percent more than the Housing Element population projection for 2025. The Housing Element cites ABAG projections for employed residences (and indicates some reservations about these ABAG projections) but does not provide projections for jobs with which to compare the demand study employment (job) projections.

Although the water district projects a 51 percent increase in water demand, that increase is not reflected in expected population and employment growth. The population and employment estimates used in the demand model indicate a 12 percent increase in population and a 9 percent increase in employment from 2001 to 2030. The demand model for the Purissima Hills Water District includes a "new/renovated single family residential" account category that has a much

higher water use rate (1,605 gallons per day per account), than does the "old single family residential" category (716 gallons per day per account), which accounts for the substantial increase in water demand compared to projected population and employment growth.

City of Redwood City

The City of Redwood City provides water to Redwood City as well as to part of San Carlos, part of Woodside, and part of unincorporated San Mateo County. Redwood City's total 2030 water demand, taking into account plumbing code savings, is 13.4 mgd. This represents a 13 percent increase in total service area demand over the 2001 base-year demand estimate. The SFPUC is Redwood City's only source of potable water supply.

In 2030, Redwood City estimates it will purchase 87 percent of its total water demand from the SFPUC, and 92 percent of remaining demand after conservation has been implemented, based on Redwood City's purchase estimate and subsequent communication with the SFPUC. Redwood City's 2030 estimated purchase of 11.60 mgd from the SFPUC represents essentially no change (-0.04 mgd) from its 2001 purchases. In the purchase estimate originally submitted to the SFPUC in 2004, Redwood City estimated it would purchase 11.60 – 12.60 mgd, which corresponds to 87 – 94 percent of its total 2030 demand and 94 – 98 percent of remaining demand after conservation has been implemented. The estimated purchases of 11.60 – 12.60 mgd from the SFPUC represent a -0.04 – 0.96 mgd change from the City's 2001 purchases (refer to Table 7.2). Subsequently, in 2005, Redwood City informed the SFPUC that it would be purchasing its low range estimate (11.6 mgd) due to the estimated use of 1 mgd of recycled water in 2030. Redwood City's current water supply assurance is 10.93 mgd.

The customer-selected population projection used for Redwood City in the demand study is generally consistent with the buildout population identified in the city's general plan (which has a 2020 planning horizon), and 24 percent lower than ABAG's 2030 population projection of 122,300 for the city and its sphere of influence. The 2030 Redwood City population used in the demand study is approximately 7 percent more than the 2020 projection shown in the city's *Downtown Precise Plan* (a recent amendment of the general plan), which cites ABAG's *Projections 2005* forecast for 2020 for the city within its jurisdictional boundary. The city's water service area includes only a portion of the city's sphere of influence (Bonte, 2006), which probably accounts for the difference between the ABAG projection for the city and its sphere of influence and that assumed in the demand study. ABAG's 2030 projection of 94,300 for Redwood City within the city limits only is within 1 percent of the demand study projection.

The employment projection for Redwood City in the demand study is about 9 percent higher than the *Projections 2005* employment projection for 2030. The City's general plan does not have a comparable employment projection.

City of San Bruno

San Bruno's total 2030 water demand, taking into account plumbing code savings, is 4.5 mgd. This represents a 2 percent increase in total service area demand over the 2001 base-year demand estimate. In 2030, the SFPUC will be San Bruno's only source of potable supply, although in the past the City has used other sources of water supply. In 2030, San Bruno estimates it will purchase 96 percent of its total water demand from the SFPUC and 100 percent of remaining demand after conservation has been implemented, based on San Bruno's purchase estimate (refer to Table 7.2). San Bruno's 2030 estimated purchase of 4.30 mgd from the SFPUC represents a 1.60 mgd, or 59 percent, increase over its 2001 purchases. San Bruno's current water supply assurance is 3.25 mgd.

The customer-selected population projection used for San Bruno in the demand study is about 4 percent higher than the projection for 2020 cited in the city's 2003 general plan housing element and 5 percent lower than the 2030 population projected by ABAG. The general plan, adopted in 1984, does not include comparable projections; the City of San Bruno is currently working on a general plan update.

The employment projection used for San Bruno in the demand study is about 34 percent higher than the projection for 2020 cited in the city's 2003 general plan housing element, but about 9 percent lower than the 2030 ABAG employment projection. The demand study employment projection is based on the city's 2001 draft general plan. The draft general plan had not been adopted at the time of Draft PEIR publication, so the housing element provides the city's published employment projections. Base year employment estimates in the 2003 housing element and 2001 draft general plan are similar (16,500 and 16,600, respectively). The sources of the job estimates for the housing element and draft general plan are ABAG *Projections 2000* and *Projections 2002*, respectively. The housing element indicates an expected annual growth rate for the period 2000-2020 of 0.8 percent, whereas the draft general plan indicates an expected annual growth rate for the period 2000-2020 of 1.7 percent. (This average annual growth rate for the 2000–2020 period was applied to the 2020 to 2030 period for the WSIP forecasts). Consequently, the differences in the forecasts are a direct reflection of the shifting expectations in the two ABAG Projections series, with *Projections 2002* forecasts reflecting more of the economic boom that occurred in the late 1990s and early part of the 2000s in the Bay Area, as well as the 10-year difference in the horizon year. Commercial demand accounts for approximately 20 percent of San Bruno's projected 2030 demand (SFPUC 2006b).

City of San Jose (North)

The San Jose Municipal Water District–North (San Jose North) serves part of the northern San Jose/Alviso area of the city. The district's total 2030 water demand, taking into account plumbing code savings, is 6.5 mgd. This represents a 25 percent increase in total service area demand over the 2001 base-year demand estimate. In 2030, the SFPUC will be San Jose's only source of potable supply, although in the past the City has used other sources of water supply. In 2030, the District estimates it will purchase 98 percent of its total water demand from the SFUPC and 100 percent of remaining demand after conservation has been implemented, based on

San Jose North's purchase estimate (refer to Table 7.2). San Jose's 2030 estimated purchase of 6.34 mgd from the SFPUC represents a 1.92 mgd, or 43 percent, increase over its 2001 purchases. San Jose does not have a water supply assurance contract with the SFPUC.

The customer-selected projections used in the demand study for San Jose assume 23 percent growth in population and 34 percent growth in employment by 2030. Because this water district only serves part of the northern section of San Jose, the population projection used for San Jose North in the demand study is not comparable to projections contained in the city's general plan or ABAG projections for San Jose.

City of Santa Clara

Santa Clara's total 2030 water demand, taking into account plumbing code savings, is 33.9 mgd. This represents a 31 percent increase in total service area demand over the 2001 base-year demand estimate. Santa Clara uses multiple supply sources to meet its water demand. In 2030, Santa Clara estimates it will purchase about 14 percent of its total 2030 water demand from the SFPUC and about 15 percent of remaining demand after conservation has been implemented, based on the City's purchase estimate. The SFPUC portion of Santa Clara's supply would supplement the city's conservation savings and use of recycled water, groundwater, and other surface water supplies (refer to Table 7.2). Santa Clara's 2030 estimated purchase of 4.90 mgd from the SFPUC represents a 1.06 mgd, or 28 percent, increase over its 2001 purchases. Santa Clara does not have a water supply assurance contract with the SFPUC.

The customer-selected population projection used for Santa Clara in the demand study is generally consistent with the growth cited in the city's general plan and the growth projected by ABAG. The 2030 population estimated in the demand study is approximately 8 percent higher than that cited in the city's general plan, which may be attributable to the longer planning horizon of the WSIP (2030 compared to 2010 for the general plan). The 2030 Santa Clara population estimated in the demand study is about 1 percent less than the population projected by ABAG.

The employment projection used for Santa Clara in the demand study is 17 percent higher than the projection in the City's general plan (for 2010) and 16 percent higher than the ABAG 2030 employment projection.

Skyline County Water District

Skyline County Water District serves part of the town of Woodside and part of unincorporated San Mateo County along Highway 35 (Skyline Boulevard), from Highway 84 to Highway 92. Skyline County's total 2030 water demand, taking into account plumbing code savings, is 0.31 mgd. This represents an 82 percent increase in total service area demand over the 2001 base-year demand estimate. The SFPUC is Skyline County's only source of potable water supply. In 2030, Skyline estimates it will purchase about 97 percent of the district's total water demand from the SFPUC and 100 percent of remaining demand after conservation has been implemented, based on Skyline's purchase estimate (see Table 7.2). Skyline's 2030 estimated purchase of

0.30 mgd from the SFPUC represents a 0.13 mgd, or 76 percent, increase over its 2001 purchases. Skyline's current water supply assurance is 0.18 mgd.

Because Skyline County Water District serves part of Woodside and a portion of unincorporated San Mateo County, the population projection used for the district in the demand study is not comparable to either general plan or ABAG projections. The water district selected historical data—the BAWSCA annual survey—as its source for population projections. The district stated that, because of the limited development potential in the district—much of which is owned by the Mid-Peninsula Regional Open Space Authority and San Mateo County Parks and Recreation Department—it expected less growth than was projected for the greater San Francisco Bay Area. Nevertheless, the demand model estimates show a district population in 2030 that is more than twice that in 2001 (an increase from 1,210 to 2,683, or 122 percent). This substantial increase (in contrast to the stated low expectations of growth) is apparently due to the possibility that three other water districts—the Kings Mountain Water Company, the Skylonda Mutual Water Company, and the Cuesta La Honda Water Company—may become part of Skyline County Water District. The Skyline County Water District notes that growth in the areas served by these water companies is also constrained by publicly owned open space lands (Skyline County Water District, 2003). No change is projected in the number of jobs in the district.

Stanford University

Stanford University's total 2030 water demand, taking into account plumbing code savings, is 6.8 mgd. This represents a 76 percent increase in total service area demand over the 2001 base-year demand estimate. Stanford uses multiple supply sources to meet its water demand. In 2030, Stanford estimates it will purchase about 62 percent of its total 2030 water demand from the SFPUC and about 69 percent of remaining demand after conservation has been implemented, based on Stanford's purchase estimate. The SFPUC portion of Stanford's supply would supplement the university's use of other surface water supplies in addition to the conservation savings (refer to Table 7.2). Stanford's 2030 estimated purchase of 4.20 mgd from the SFPUC represents a 1.84 mgd, or 78 percent, increase over its 2001 purchases. Stanford's current water supply assurance is 3.03 mgd.

The customer-selected population projection used for Stanford in the demand study assumes 42 percent growth in population; the demand projections for Stanford did not include assumptions about employment growth. Stanford has special water account categories to reflect that it is a university rather than a city or water district. Besides residential categories (i.e., student and faculty housing), account categories include construction projections and medical school, commercial space, and academic occupants. The demand model added a special "lake water" billing category account in order to include lake water that is used for irrigation of the campus in order to more accurately reflect the actual total demand on campus. According to the demand study the effect of this specific change was to increase total demand. The Stanford Community Plan (adopted in 2000) includes an Academic Growth Boundary (AGB) which limits development on the campus. The AGB, which applies the concept of urban growth boundaries promoted in the Santa Clara County General Plan to the campus setting, limits development to the

area within the AGB. The AGB is established for 25 years, during which time it may only be modified by a fourth-fifths vote of all members of the county board of supervisors.

City of Sunnyvale

Sunnyvale's total 2030 water demand, taking into account plumbing code savings, is 26.8 mgd. This represents an 8 percent increase in total service area demand over the 2001 base-year demand estimate. Sunnyvale uses multiple supply sources to meet its water demand. In 2030, Sunnyvale estimates it will purchase about 45 percent of its total 2030 water demand from the SFPUC and about 46 percent of remaining demand after conservation has been implemented, based on Sunnyvale's purchase estimate. The SFPUC portion of Sunnyvale's supply would supplement the city's conservation savings and use of recycled water, groundwater, and other surface water supplies (refer to Table 7.2). Sunnyvale's 2030 estimated purchase of 12.10 mgd from the SFPUC represents a 2.41 mgd, or 25 percent, increase over its 2001 purchases. Sunnyvale's current water supply assurance is 12.58 mgd.

The customer-selected population projection used for Sunnyvale in the demand study is generally consistent with the growth cited in the city's general plan and the growth projected by ABAG. The 2030 Sunnyvale population estimated in the demand study is approximately 2 percent less than that cited in the general plan and about 5 percent less than projected by ABAG.

The employment projection for Sunnyvale in the demand study is about 11 percent higher than the employment projection cited in the city's general plan, and about 37 percent higher than the ABAG *Projections 2005* employment projection.

Westborough Water District

The Westborough Water District's total 2030 water demand and 2030 purchase estimate are based on the district's 2005 UWMP, as requested by the district and described below in this summary (Westborough Water District, 2005; Westborough Water District, 2007). Based on the UWMP, the district's 2030 water demand, taking into account plumbing code savings, is 1.03 mgd. This represents a 1 percent increase (0.01 mgd) in total service area demand over the 2001 base-year demand estimate. The SFPUC is Westborough's only source of potable water supply. In 2030, Westborough estimates it will purchase 100 percent of its total water demand from the SFPUC. Westborough's 2030 purchase estimate of 1.03 mgd is 1 percent higher (0.01 mgd) than its 2001 purchases. Although this purchase estimate does not explicitly include quantified conservation savings, the UWMP describes demand management programs that the district is currently implementing, those it plans to continue, and two new programs it plans to start during the 2006-2010 UWMP planning period. The purchase estimate originally submitted by the district indicated conservation savings of 0.02 mgd. Westborough's current water supply assurance is 1.32 mgd.

The district's total 2030 water demand, taking into account plumbing code savings, was calculated in the demand study to be 0.88 mgd. This represented an 11 percent decrease in total service area demand over the 2001 base-year demand estimate. In 2004, following completion of

the demand, conservation, and other related studies, Westborough submitted a purchase estimate of 1.2 mgd, an 18 percent increase over 2001 purchases, and 36 percent greater than the demand study's projected demand. Demand estimates in Westborough's UWMP, which was published in December 2005, differ from these demand study projections. In February 2007 Westborough Water District formally submitted a request to the SFPUC (Westborough Water District, 2007) that the district's calculation of future water demands in 2030 of 1.03 mgd, as cited in the UWMP, be used in SFPUC planning efforts.

The updated UWMP projection of 1.03 mgd demand and purchases in 2030 is 17 percent higher than was projected in the SFPUC demand study and 17 percent lower than the purchase estimate originally submitted by the district. The UWMP attributes the difference between its projected 2030 demand and the demand developed in the DSS model to "differing assumptions about the District's base year, and projected population" (Westborough Water District, 2005). The UWMP base year population estimates for 1990 and 2000 are from U.S. Census data for Census Tracts 6025 and 6026. The 2000 population is 13,033 and the projected 2030 population is 14,300 (a 10 percent increase) compared with the estimated 2001 base year population of 10,017 and 2030 projected population of 10,146 (a 1 percent increase) used in the demand study. (The BAWSCA [then BAWUA] annual survey was the source of population projections selected by Westborough Water District for the modeling exercise [URS, 2004a].)

Based on the information presented in the UWMP and the February 2007 letter from the Westborough Water District to the SFPUC, this PEIR uses the demand, purchase, and population estimates presented in the UWMP. To be consistent with previous and ongoing WSIP studies, the high-range purchase estimate total published in URS 2004b of 300 mgd, based on the previously submitted purchase estimates of Westborough and the other water customers, remains the SFPUC's 2030 purchase estimate for planning purposes.

Since the Westborough Water District serves only part of South San Francisco, the population projection used in the demand study is not comparable to that of the city as a whole. Refer to the discussion under CWS–South San Francisco for a comparison of combined water district projections with those of the city's general plan and ABAG.

SFPUC Retail Service Area

The total 2030 water demand for San Francisco and the rest of the retail service area, taking into account plumbing code savings, is approximately 93.4 mgd. This represents a 0.2 percent decrease in total service area demand from the 2001 base-year estimate. The SFPUC regional water system is currently the only source of potable water supply for San Francisco and for the SFPUC's other major retail customers. In 2030, the SFPUC regional water system would provide about 86– 97 percent of total SFPUC retail service area water demand and 89 – 97 percent after conservation has been implemented. San Francisco's 2030 estimated purchase of 80 – 91 mgd from the regional water system represents a 10 percent decrease to 1 percent increase compared to 2001 SFPUC regional water system purchases. The low range of the purchase estimate would be supplemented by identified groundwater, recycled water and conservation programs totaling

10 mgd in San Francisco that are included as part of the WSIP proposed water supply option (refer to Table 7.2).

San Francisco's water demand projections are based on demographic projections that assume 12 percent growth in population and 25 percent growth in employment by 2030. The population projection used for San Francisco in the retail demand study is generally consistent with the growth cited in the city's general plan, and somewhat less consistent with the growth projected by ABAG. The 2030 population for San Francisco estimated in the demand study is approximately 5 percent more than indicated in the city's general plan and about 8 percent less than projected by ABAG in *Projections 2005* for 2030. At the time ABAG's draft *Projections 2005* was distributed to jurisdictions for review in 2004, the CCSF informed ABAG that San Francisco expects less growth by 2030 than is forecasted in *Projections 2005* and cited the estimates in the CCSF's 2002 Land Use Allocation as more realistic (Macris, 2004). The 2030 household population shown in SFPUC's UWMP, which were linearly extrapolated from City Planning estimates for 2000 and 2025, are the same as the population projection used in the demand study (849,942) (SFPUC, 2005).

The employment projection used for San Francisco in the retail demand study is about 7 percent higher than the employment projection citied in the city's general plan for 2020, and about 4 percent lower than the ABAG *Projections 2005* employment projection.

7.4 Indirect Effects of Growth

The WSIP would support planned growth and growth that is projected to occur in the service area by ABAG. Most of the projected population growth and much of the employment growth that would be supported by the SFPUC regional water system under the WSIP has been addressed in the adopted general plans of jurisdictions within the service area. The impacts of planned growth are identified and evaluated in the EIRs and other CEQA documents prepared by the jurisdictions for their general plans and related land use plans (such as general plan elements and specific plans that general plans are subsequently amended to incorporate). This section presents a summary of the impacts associated with planned growth in the service area and the mitigation measures adopted by the jurisdictions to reduce or eliminate those impacts. It includes a summary of the impacts commonly found to be mitigable and those commonly found not to be mitigable to a less-than-significant level. It also includes a summary of overriding considerations that were commonly identified by city councils in adopting land use plans despite the plans' unavoidable significant impacts. The WSIP would also support a degree of growth that, while consistent with the projections of the regional planning agency (ABAG), is not covered in adopted land use plans because the WSIP projections reflect more recent employment trends (i.e., the substantial job growth that occurred in the Bay Area in the latter part of the 1990s) than do most of the general plans and the WSIP planning horizon is longer than the planning horizon of the general plans. Therefore, this section also qualitatively describes the impacts that could result from growth supported by the WSIP beyond what has already been evaluated in the CEQA review of the adopted land use plans. Finally, as a means of gauging whether the impacts of projects developed in the planning area subsequent to adoption of the current general plans are being mitigated as

prescribed in the general plan EIRs, a review of the EIRs for several large projects was undertaken and is summarized in this section.

7.4.1 Impacts

Significance Criteria

The EIRs prepared for the local general plans and related planning documents of the jurisdictions in the SFPUC service area evaluated the environmental effects associated with growth projected in the respective general plans. The impact findings identified in these environmental documents are incorporated by reference into this PEIR pursuant to CEQA Guidelines Section 15150 and are summarized here. Please see Section 1.3.5 in PEIR Chapter 1, Introduction, for a list of locations where documents incorporated by reference are available for public review.

Approach to Analysis

This section provides a summary overview of the potential indirect effects of growth that could result from implementation of approved land use plans of the jurisdictions served by SFPUC water. In addition, this section reviews the role of the SFPUC and the jurisdictions in the wholesale service area in addressing these effects; provides a discussion of the key regional growth issues in the SFPUC service area; and reviews recent examples of environmental analyses conducted at the project level within the SFPUC service area.

Impact 7-1: The WSIP would support planned growth in the SFPUC service area, although it appears that some growth would occur irrespective of the WSIP due to increased water delivery efficiencies (e.g., plumbing code changes), conservation, and other water supply sources. Planned growth would in turn result in indirect effects. In most cases, the effects of planned population and employment growth have been identified and addressed in the EIRs for the general plans and associated area plans and specific plans adopted by the jurisdictions in the service area. Some of the identified indirect effects of growth are significant and unavoidable; others are significant but can be mitigated.

In some areas the WSIP could support a degree of population and/or employment above that planned for in jurisdictions' adopted general plans, as indicated by a comparison of the levels of growth assumed in WSIP demand studies and general plan documents. In some jurisdictions (Foster City, Half Moon Bay, and Burlingame), the WSIP could support more population growth than is forecasted in adopted general plans. In some jurisdictions (East Palo Alto, Foster City, San Bruno, Fremont, Newark and Union City), the WSIP could support more employment growth than is forecasted in adopted general plans of the respective jurisdictions. To the extent that growth supported by the WSIP has not been fully analyzed in EIRs for the general plans and related land use plans of the jurisdictions served by SFPUC water, due to the WSIP's longer planning horizon, the WSIP would have impacts that are similar to, but potentially more severe than, the impacts identified in local general plan CEQA documents. To the extent the WSIP would support employment growth not fully anticipated in the general plans of jurisdictions in the service area because the general plans were prepared before the extent of the economic boom was realized, the WSIP would have impacts associated with economic development and higher numbers of

employees within the service area that are potentially new or more severe than impacts previously identified. These impacts would include traffic, air quality, noise, and demands on public services resulting from an influx of commuters from out of the area to jobs within the service area, and impacts resulting from increased demand for housing and other services within the service area to better accommodate the workforce. In addition, although the general plan EIRs reviewed for this PEIR were prepared prior to the passage of the California Global Warming Solutions Act of 2006 and do not include assessments of impacts from greenhouse gas emissions, it is expected that planned growth in the area could result in a significant and unavoidable contribution to increases in greenhouse gas emissions (e.g., from increased fossil fuel use for transportation and construction, increased industrial and commercial activities, residential energy use, operation of power plants, and oil refining).

Potentially significant unavoidable impacts as a result of planned growth in the SFPUC service area have been identified in the following areas: traffic congestion, air pollution, traffic noise, construction noise, increased demand for public schools and other public services, loss of recreational opportunities and impacts on visual quality resulting from the loss of open space, cumulative effects on overutilized parks, loss of wildlife habitat and wetlands, cumulative impacts on cultural resources, increased flooding potential, increased urban runoff pollutants, seismic hazards, induced population growth, failure to meet housing demand for projected population growth, exposure of new development to contaminated soil or groundwater, insufficient water supply, insufficient wastewater disposal capacity, loss of agricultural resources, land use conflicts, conflicts with existing land use plans or policies, and changes in density, scale, and character of an area.

Impacts from growth in years beyond that evaluated in the EIRs for adopted land use plans would occur due to an increased density of development or the use of additional land area. Impacts from increased density could include additional traffic congestion, air pollution, noise, and demand on public services; land area (or "footprint") impacts could include the loss of agricultural resources and open space, impacts on wildlife habitat and other biological resources, disturbance of cultural resources, increased soil erosion, and water quality impacts from increased urban runoff. In addition, to the extent that a water supply shortage is identified as a future impact, the WSIP would address the need for additional water supply.

The program would support much of the planned growth in the jurisdictions served by SFPUC water. In general, development planned and approved through the general plan process in the SFPUC service area would have environmental impacts. The environmental consequences of this planned growth have been largely addressed in local plans and the associated CEQA review as well as in other, project-specific documentation. In a number of jurisdictions, negative declarations or mitigated negative declarations were prepared for general plans and related planning documents that were found not to have significant environmental effects. The analysis presented in this section focuses on the significant effects of growth identified in general plan, area plan, and specific plan EIRs. These EIRs substantially address the impacts and mitigation measures identified in the mitigated negative declarations.

The planning documents and associated environmental documents listed below were reviewed for this analysis. The EIRs and City Council and Board of Supervisor findings resolutions are summarized in this PEIR (in this chapter and Appendix E, Section E.5) and are incorporated by reference pursuant to CEQA Guidelines Section 15150. Please see Section 1.3.5 in PEIR Chapter 1, Introduction, for a list of locations where documents incorporated by reference are available for public review. In addition to listed planning documents and EIRs, statements of overriding considerations adopted in conjunction with adoption of the general plans were also reviewed.

- Town of Atherton General Plan Revisions (2002a, 2002b, 2002c)
- City of Belmont General Plan (1982), San Juan Hills Area Plan EIR (1988a, 1988b), Western Hills Area Plan EIR (1990a, 1990b), Downtown Specific Plan (1995), Peninsula Corridor Specific Plan (2003), Housing Element, (2002a, 2002b, 2002c)
- City of Brisbane General Plan and EIR (1994a, 1994b, 1994c, 1994d), Housing Element (2002)
- City of Burlingame General Plan (1969, amended through 2002), Housing Element and Negative Declaration (2002a, 2002b, 2002c), Bayfront Specific Plan and Mitigated Negative Declaration (2004a, 2004b, 2004c), North Burlingame / Rollins Road Specific Plan and Negative Declaration (2004d, 2004e, 2004f)
- Town of Colma General Plan and Negative Declaration (1999a, 1999b, 1999c, 1999d)
- City of Daly City General Plan Land Use and Circulation Elements (1987a, 1987b), Housing Element and Negative Declaration (2004a, 2004b)
- City of East Palo Alto General Plan and EIR (1999a, 1999b, 1999c), Housing Element (2001a, 2001b)
- City of Foster City General Plan (1993, amended through 2001) and EIR (1993a, 1993b, 1993c, 1993d), Housing Element and Mitigated Negative Declaration (2001a, 2001b, 2001c)
- City of Fremont General Plan (1991, amended through September 1996) and EIR (1991a, 1991b, 1991c), Housing Element, Land Use Element Revisions, and Negative Declaration (2003a, 2003b, 2003c)
- City of Half Moon Bay Local Coastal Program Land Use Plan (1993)
- City of Hayward General Plan and EIR (2002a, 2002b, 2002c)
- Town of Hillsborough General Plan (2005) and Negative Declaration (2004), Housing Element and Negative Declaration (2002a, 2002b)
- Town of Los Altos Hills General Plan (1975), General Plan Path Element (1996), 2002 Housing Element (2002), Circulation Element (1999), Land Use, Open Space, and Recreation Elements (n.d.)
- City of Menlo Park General Plan Policy Document and Background Report and EIR (1994a, 1994b)

- City of Millbrae General Plan and EIR (1998a, 1998b), Millbrae Station Area Specific Plan and EIR (1998c, 1998d)
- City of Milpitas, 1994 General Plan and Negative Declaration (1994a, 1994b), 2002 Update of the 1994 General Plan, Housing Element, and Negative Declaration (2002a, 2002b, 2002c. 2002d); Midtown Milpitas Specific Plan EIR (2002e, 2002f, 2002g, 2002h)
- City of Mountain View General Plan (1992a, 1992b, 1992c), Housing Element and Initial Study (2002a, 2002b), Residential Neighborhood Chapter (2002c)
- City of Newark General Plan Update Project 2007 and EIR (1992a, 1992b, 1992c, 1992d, 1992e), Housing Element (2002a), Housing Element Negative Declaration and Negative Declaration Addendum (2002b)
- City of Pacifica General Plan (2001)
- City of Palo Alto Comprehensive Plan 1998–2010 and EIR (1998a, 1998b, 1998c), Housing Element (2002)
- Town of Portola Valley General Plan (1998, except for Housing Element, which appears to be 1990)
- City of Redwood City General Plan (1990a, 1990b), Downtown Precise Plan and EIR (2007a, 2007b, 2007c, 2007d)
- City of San Bruno General Plan and EIR (1984a, 1984b), Housing Element and Resolutions approving Housing Element and its Negative Declaration (2003a, 2003b, 2003c)
- City of San Carlos General Plan (1992); Housing Element, Draft Negative Declaration, and Resolution adopting Housing Element (2001a, 2001b, 2001c);Circulation Element and Negative Declaration (2005a, 2005b).
- City and County of San Francisco General Plan (1998), Housing Element (2004)
- City of San Jose 2020 General Plan (amended to May 2005) and EIR (1994a, 1994b), Housing Element (2003)
- City of San Mateo General Plan and EIR (1990a, 1990b, 1990c), Housing Element (2001) and Negative Declaration, (n.d.), and Circulation Element (2005) and Negative Declaration (n.d.)
- County of San Mateo General Plan and Board of Supervisors Resolution Adopting Findings Pursuant to the Final EIR (1986a, 1986b)
- City of Santa Clara General Plan 1990-2005 and City Council Resolution and Related Findings Certifying the Final EIR (1992a, 1992b, 1992c, 1992d, 1992e), General Plan 2000-2010 (including amendments since 1992) and City Council Resolution Adopting a Negative Declaration and General Plan Amendment (2002a, 2002b)
- County of Santa Clara General Plan and EIR (1994a, 1994b, 1994c), Housing Element (2003)

- City of South San Francisco General Plan (1999a, 1999b, 1999c) and Housing Element (2002a, 2002b)

- Stanford University Community Plan and EIR (County of Santa Clara, 2000a, 2000b, 2000c, 2000d, 2000e)

- City of Sunnyvale General Plan Elements: Housing and Community Revitalization Sub-element of the General Plan (2002a, 2002b), Land Use and Transportation Element of the General Plan (1997a, 1997b), Water Resources Sub-element of the General Plan (1996a, 1996b)

- City of Union City General Plan, Housing Element, and EIR (2002a, 2002b, 2002c, 2002d, 2002e, 2002f)

- Town of Woodside General Plan and Negative Declaration (1988a, 1988b), Housing Element (2002, 2003)

Table 7.11 summarizes the environmental effects associated with planned growth in the program area, as identified in the general plan, area plan, and specific plan EIRs for the jurisdictions in the SFPUC wholesale customer and retail service areas. Because the table reflects the determinations of multiple jurisdictions, some impacts are listed as both significant and unavoidable and significant but mitigable, reflecting differences in the jurisdictions in the service area. Appendix E, Section E.5, Table E.5.1 presents a more detailed summary of the relevant growth impacts and mitigation measures identified in the EIRs for these local land use plans. These environmental impacts are the indirect effects of growth supported by the WSIP.[32]

Significant and Unavoidable Impacts

The environmental effects of growth most commonly identified as significant and unavoidable in the service area are increased traffic, cumulative traffic impacts, deterioration of air quality, the cumulative effects of increased air pollutant emissions, and noise impacts, primarily as a result of increased traffic. Traffic and air quality effects are discussed in greater detail below under "Key Regional Effects of Growth."

The WSIP would address a significant unavoidable impact that was identified by two cities: increased demand for potable water supply. The WSIP provides for increased supply and related water treatment facility and storage upgrades to reliably meet projected demand (i.e., projected retail demand and projected wholesale customer purchase requests) to 2030. The SFPUC's role in addressing this indirect effect of growth is discussed at the end of this subsection.

[32] To assess whether mitigation measures identified in general plan EIRs to reduce growth-related impacts are in fact being applied at the project level, a review of the EIRs of several current major projects in the service area was undertaken. The review indicated that the mitigation measures identified in general plan EIRs to reduce the adverse impacts of growth are being applied at the project level. Information on the review of the project EIRs is presented in Appendix E.6.

TABLE 7.11
SIGNIFICANT IMPACTS ASSOCIATED WITH PLANNED GROWTH IN THE PROGRAM AREA

Significant and Unavoidable Impacts

- Impacts due to the loss of open space (to development) on visual quality
- Alteration of the visual setting or degradation of existing views, and cumulative visual quality impacts
- Conversion of agricultural land to nonagricultural uses
- Cumulative loss of agricultural land
- Increases in air pollutant emissions and/or ozone precursors or violation of air quality standards
- Cumulative air quality impacts
- Impacts on natural habitat, including individual or cumulative loss of wetlands
- Cumulative impacts on cultural resources
- Exposure to seismic or geologic hazards
- Cumulative impacts on soil resources
- Exposure to soil or groundwater contamination
- Cumulative effects from increased exposure to man-made hazards
- Increases in impervious surfaces and/or alterations to drainage resulting in exposure to flood hazards and/or the need for new drainage facilities
- Water pollution from stormwater runoff
- Land use impacts
- Cumulative impacts from the depletion of nonrenewable resources and the alteration of landforms
- Noise impacts, including increases in traffic noise, exposure to construction noise, and exposure to aircraft noise
- Impacts related to population growth (directly or indirectly induced) and jobs/housing balance
- Increased demand for schools and/or other public facilities
- Loss of recreational open space
- Cumulative impacts on recreational facilities
- Local and regional traffic impacts
- Cumulative traffic impacts
- Impacts on landfill capacity
- Increases in water demand
- Large and wasteful increase in energy consumption and cumulative energy-related impacts

Significant but Mitigable Impacts

- Impacts on scenic resources, including resources within a scenic highway
- Creation of new source(s) of light and glare
- Alteration of visual setting or degradation of existing views
- Conversion of agricultural land to nonagricultural uses
- Conflicts between agricultural uses and adjacent land uses
- Construction-related air quality impacts
- Exposure of new sensitive land uses to toxic air contaminants and/or odor emissions sources
- Increases in air pollutant emissions
- Conflicts with, or obstruction of, the implementation of an applicable air quality attainment plan or related plan
- Impacts on/loss of special-status species
- Impacts on biological resources due to individual or cumulative impacts on wetlands, riparian habitat, or other sensitive habitat
- Conflicts with local policies or ordinances protecting biological resources
- Disruption of wildlife migration or travel corridors
- Cumulative impacts on biological resources
- Individual or cumulative impacts on historical, archaeological, and/or paleontological resources
- Disturbance of human remains

TABLE 7.11 (Continued)
SIGNIFICANT IMPACTS ASSOCIATED WITH PLANNED GROWTH IN THE PROGRAM AREA

Significant but Mitigable Impacts (continued)

- Exposure to seismic, geological, or soils-related hazards
- Exposure to flooding due to levee or dam failure
- Increased risk of wildland fires
- Release of or exposure to hazardous materials
- Increased risk of structural fires and degree of damage from industrial chemical fires
- Impacts related to emergency response
- Degradation of surface water and/or groundwater quality
- Construction impacts on water quality
- Increased surface runoff and flood hazard
- Incompatible and/or inappropriate land uses; conflicts between adjacent land uses
- Loss of agricultural land or premature urbanization of rural areas
- Inefficient land use patterns
- Intensification of land uses
- Exposure to excessive noise levels or groundborne vibration
- Permanent or substantial temporary or periodic increases in ambient noise levels
- Construction noise impacts
- Increased traffic noise
- Increased demand for housing and related impacts on housing affordability
- Increased demand for special housing needs
- Substantial population and/or job growth
- Jobs/housing imbalances, oversupply of jobs
- Increased demand for and/or impacts on public services and facilities, including increased need for new fire and police facilities, schools, parks, and other public facilities
- Increased demand for new or expanded recreational facilities
- Loss or degradation of recreational open space
- Local and regional traffic impacts
- Congestion impacts on transit service and bicyclists
- Construction traffic impacts
- Increased traffic safety concerns
- Impacts on landfill capacity or demand for solid waste services
- Increased demand for new or expanded water and wastewater facilities
- Need for new or expanded stormwater drainage facilities
- Increased demand on water supply
- Increased demand for public utilities
- Increased demand for energy

SOURCES: City of Belmont, 1988a; 1990a; City of Brisbane, 1994b; City of East Palo Alto, 1999a; City of Foster City, 1993b; City of Fremont, 1991b; City of Fremont 1991c; City of Hayward, 2002b; City of Menlo Park, 1994b; City of Millbrae, 1998b; City of Millbrae, 1998d; City of Milpitas, 2002e; City of Mountain View, 1992b; City of Newark, 1992b; City of Palo Alto, 1998b; City of Redwood City, 2007a; City of San Bruno, 1984a; City of San Jose, 1994b; City of San Mateo, 1990b; City of Santa Clara, 1992b; City of Union City, 2002c; County of San Mateo, 1986b; County of Santa Clara, 1994b; County of Santa Clara, 2000b.

Measures to partially mitigate traffic impacts identified in the EIRs include participation in regional transportation planning, implementation of local and regional transit/transportation plans, promotion of alternative modes of transportation, implementation of roadway- and intersection-specific improvements (e.g., adding various combinations of turn lanes and through lanes and expanding intersection capacity), and encouragement of higher density development and supportive uses around transit stations. Measures to partially mitigate air quality impacts identified in the EIRs include participation in regional planning efforts to improve air quality, requiring measures to reduce construction emissions (both equipment emissions and dust), and implementation of many of the same (or similar) measures adopted to improve traffic impacts, such as encouraging alternative forms of transportation, improving roadways to maintain efficient vehicular movement, and encouraging higher density infill development and mixed uses. Measures to partially mitigate noise impacts identified in the EIRs include adoption and enforcement of noise ordinances, requiring the use of construction practices to protect sensitive receptors, and requiring project-specific review of noise impacts and project mitigation measures such as setbacks, buffering, and insulation. (Refer to Appendix E, Section E.5 for a more detailed summary of the mitigation measures.)

Overriding Considerations

Jurisdictions may approve land use plans that would result in significant unavoidable impacts by adopting statements of overriding considerations pursuant to CEQA; these statements provide the rationale for approving a plan despite its significant unavoidable impacts. In the SFPUC service area, some jurisdictions have determined that certain social, economic, and/or other considerations outweigh the adverse environmental effects. These considerations are summarized in **Table 7.12**. Of the key overriding considerations identified in the table, the following considerations were commonly identified by the local jurisdictions in the region:

- Accommodation of growth in an orderly, fiscally sound manner
- Economic diversification and job generation
- Creation of housing, furtherance of regional housing share objectives, and provision of affordable housing
- Improvement of the local jobs/housing balance
- Increased sales revenue and positive fiscal impact
- Promotion of alternative modes of travel to private vehicles; reduction in reliance on private vehicles
- Establishment of policies to preserve natural areas and open space lands

Impacts Commonly Identified as Significant but Mitigable

Impacts commonly identified as significant but mitigable by jurisdictions in the service area include obstruction of views or alteration of the visual setting; construction-related air quality impacts; adverse impacts on habitat and wetlands; impacts on historical, archaeological, or paleontological resources, including potential disturbance of unknown cultural resources; exposure to seismic and geologic hazards; creation of a hazard related to the use or transport of

TABLE 7.12
KEY OVERRIDING CONSIDERATIONS FOR SIGNIFICANT UNAVOIDABLE IMPACTS OF PLANNED GROWTH AND DEVELOPMENT

- Compliance with legal mandates to adopt and maintain a comprehensive long-term plan
- Provision of a database and statement of policies to guide decision-making
- Policies that assure adequate mitigation of land use impacts
- Realization of a comprehensively planned community that provides for a logical extension of services, including law enforcement, fire protection, parks, and public utilities
- Provision of coordinated guidance in addressing the impacts of new development and redevelopment within the urban area while not substantially increasing traffic, noise, and seismic impacts compared to existing trends
- Policies and strategies to alleviate some environmental effects that are not otherwise addressed in routine land use planning or through the existing general plan elements
- Strengthened community and neighborhoods, protection of neighborhoods from commercial encroachment, and encouragement of participation in community and governmental activities
- Facilitation of public participation and the continuation of the city's desire to provide leadership on issues of regional interest
- Protection of community character
- Enhanced public facilities and programs
- Improvement of infrastructure
- Expanded opportunities for economic activities and development; increased economic vitality
- Economic growth that supplies jobs for existing and future residents while protecting environmental resources and prudently managing traffic capacity
- Economic benefits, including increases in new jobs, sales tax revenues, and property tax revenues
- Creation of new sources of employment and income to the city
- Increased diversity of employment opportunities
- Provision of a wide range of new employment opportunities and shopping opportunities
- Improvement of jobs/housing balance and provision of more opportunities for revenue-generating uses
- Balance of residential and commercial interests
- Increased housing opportunities
- Increased diversity of housing types, including affordable housing
- Achievement of affordable housing goals and maintenance of social diversity while protecting environmental resources
- Targeting of state-mandated "fair share" requirements for new housing units as a goal, including creation of affordable housing to help maintain the city's economic base without incurring even greater adverse impacts on the area's air quality due to greater commute distances required for local employees
- Increase in the amount of affordable housing and the ability of the city to contribute its fair share of regional housing opportunities
- Alternatives to residential infill within existing residential neighborhoods that are affected by airport noise would create more adverse impacts than new residential infill
- Encouragement and support of school districts to take specific mitigatory action(s), where appropriate
- Improved transportation and circulation systems
- Reduction of reliance on the automobile
- Enhanced transit-oriented development at transit hubs
- Improved local and regional transit connections through development of intermodal facility and high-density office and residential uses in transit station area
- Long-term preservation and maintenance of sensitive ecosystems, open space, and aquatic resources
- Policies, programs, and land use designations that enhance the preservation of natural resources
- Installation of open space, park, recreation, and resource protection amenities
- Environmental benefits resulting from incorporation of innovative and extensive environmental mitigation
- Designation of new areas and retention of substantial existing areas of land for open space, and provision of neighborhood and community parks for a variety of open space and recreational opportunities for the city and region
- Providing for recreational needs of the existing and future population
- Impacts that cannot feasibly be mitigated to a less-than-significant level would occur whether or not the general plan or any feasible alternative were adopted
- Policies that direct future urban development into the cities
- Policies that minimize the potential loss of rural open space surrounding urban areas within the county
- Providing for planned urban expansion, in contrast to urban sprawl, thereby decreasing demand for government revenues for public infrastructure and services
- Enhanced cultural, recreational, and educational facilities and a modern government center, enabling the city to provide more efficient service in an inviting setting

SOURCES: City of Belmont, 1988b; City of Belmont,1990b; City of Brisbane, 1994d; City of East Palo Alto, 1999c; City of Foster City, 1993d; City of Fremont, 1991c; City of Hayward, 2002c; City of Menlo Park, 1994b; City of Milpitas, 2002f; City of Mountain View, 1992c; City of Newark, 1992c; City of Palo Alto, 1998c; City of Redwood City, 2007c; City of San Bruno, 1984b; City of San Mateo, 1990c; City of Santa Clara, 1992b; City of Union City, 2002e; County of Santa Clara, 1994c; County of Santa Clara, 2000e;.

hazardous materials; exposure of people and property to flooding; water quality impacts; land use incompatibilities; increased noise, including ambient noise levels and short-term construction noise; increased housing demand; increased demand for public services, including fire and police protection, schools, recreational facilities, and other public services; and increased need for new or expanded water or wastewater treatment facilities. Appendix E, Section E.5, Table E.5.1 summarizes these impacts. The WSIP addresses water supply needs reflected in the retail demand studies and wholesale customer purchase estimates (discussed further in the following section).

Impacts of Planned Growth to 2030

As discussed above (and in Chapter 3, Program Description), the WSIP would meet the SFPUC's regional water system purchase requests in the wholesale and retail service areas to the year 2030. The demand projections for the retail service area and each wholesale customer service area were developed using a detailed end-use model that employed ABAG's population and employment projections or the projections of a limited number of other local agencies. Thus, the projections reflect the future growth expectations of the regional planning agency or other agencies with knowledge of the service area.

In most cases, the levels of population growth reflected in the 2030 water customer-selected population projections are generally consistent with the population growth projected in the respected general plans, as indicated by the general plans' projected population (see Table 7.8). That growth, therefore, has been addressed in the adopted general plans, and the growth-related impacts have been analyzed in the general plans' impact analyses. The additional availability of water and improved water supply reliability through the WSIP would support a portion of this growth. In a few cases, the general plans do not project population growth into the future to the degree assumed in the WSIP. In these cases, the WSIP would support a degree of population growth beyond the level that is projected in the adopted general plans.

For the most part, the employment growth reflected in the 2030 water customer-selected population projections also is generally consistent with the employment growth projected in the respected general plans, as indicated by the general plans' projected employment shown in Table 7.9. However, there has been much more recent employment growth, and greater fluctuations in employment levels, in the region compared with populations. As a consequence, not all of the employment growth reflected in water customer-selected projections is reflected in the general plans of respective jurisdictions. Therefore, while much of the employment growth expected in the area has been addressed in the adopted general plans, the WSIP would support a degree of employment growth that has not been addressed in the jurisdictions' general plans nor have the impacts associated with such growth been fully analyzed in the CEQA documents prepared for the planning documents.

Two principal factors account for the discrepancy between WSIP population projections and those of general plans in the service area. One is the WSIP's 2030 planning horizon, which extends farther into the future than the general plan horizons of jurisdictions served by SFPUC

water.[33] The other is the age of some jurisdictions' general plans, several of which were adopted more than 10 years ago.

The above two factors, and a third, are the principal factors that account for the discrepancy between WSIP employment projections and those of general plans in the service area. The third factor is the economic boom and recession that occurred in the Bay Area in the 1990s and first half of the current decade. Phenomenal job growth occurred during the "dot com boom" was not captured in projections prepared prior to this boom, while the extent of job losses in early 2000s was not fully capture in projections prepared in the early 2000s. As the comparison of the last three ABAG projections sets suggest, although there are differences between the individual projections, by 2030 a similar level of employment is expected for the area as a whole.

The impact discussion in the previous section describes the indirect effects of planned growth in the service area; these effects were identified and evaluated in the EIRs produced for the general plans and related land use planning documents that guide the nature and extent of development in the service area. As noted above, however, the effects of greenhouse gas emissions were not addressed in these prior EIRs. Given that the WSIP projections extend beyond the projections of many adopted general plans, especially in terms of expected employment growth, this analysis also considers the potential impacts of growth that could occur beyond the projections indicated in local general plans and related land use plans. In contemplating the potential impacts of growth beyond the previously evaluated growth, it is important to consider the following:

- Most of the service area is urbanized; many of the jurisdictions experienced peak growth periods in previous decades, with slowing growth rates in more recent decades. Urban areas provide less opportunity for substantial growth beyond existing city limits or spheres of influence. Thus, these communities are subject to certain physical constraints (such as neighboring jurisdictions) that would preclude major changes from current planning policies and growth trends.

- Various jurisdictions have identified increased densities and infill development as important means to accommodate future development. In addition to constraints on available land and fewer options to grow laterally, more compact development is being adopted by some jurisdictions in recognition of its value in supporting public transit systems. The promotion of public transit, in turn, is increasingly recognized as a way to alleviate traffic problems in the region. Infill development is generally consistent with ABAG assumptions about smart growth. Given such trends in current planning documents and the promotion of smart growth principles by the regional planning agency, it is reasonable to assume that as general plans are updated to guide future growth (i.e., through the 2030 WSIP buildout), city planners will continue to seek solutions to planning issues that minimize the extent of adverse environmental effects.

- Notwithstanding the constraints to lateral expansion that exist for many jurisdictions, some jurisdictions abut less-developed unincorporated county lands; therefore, at least some jurisdictions could conceivably annex portions of adjacent unincorporated areas to accommodate the jurisdiction's anticipated development.

[33] As discussed in Section 7.2, water agencies typically have a longer planning horizon than do local land use planning agencies because of the time required to plan, permit, and construct water supply infrastructure.

Based on the above considerations, the growth supported by the WSIP beyond the level evaluated in adopted land use plans would likely have impacts related to increased density or the development of new land areas, potentially resulting in impacts that are more severe than those identified in the EIRs of adopted land use plans and plan elements.

- Impacts from increased density of development include increased traffic congestion, air pollution, traffic noise, construction noise, and increased demand on public services. On the other hand, it should be noted that accommodating growth by increasing the density of development can help offset some of these identified impacts if it provides sufficient density to support development of public transit or neighborhood retail businesses that help reduce dependency on the use of private vehicles.

- Land area impacts include the loss of open space and agricultural land, loss of wildlife habitat and related impacts on biological resources, potential impacts on cultural resources, and increased impervious surface area, resulting in interference with groundwater recharge and the degradation of surface water quality from polluted runoff.

- Because the WSIP impacts would be similar in kind to those identified in jurisdictions' general plan and plan element EIRs, albeit potentially more severe, the mitigation measures identified in the general plan EIRs (summarized in Appendix E, Section E.5) should apply to such impacts and would serve to reduce them.

- Impacts from employment growth beyond that evaluated in jurisdictions' general plans include increased traffic, especially if workers would be commuting from outside the bay area to new jobs forecasted to occur by 2030; air quality and noise impacts as a result of the increased traffic, and impacts on various public services.

Project-Level Impacts of Growth

As part of this PEIR analysis a selection of EIRs of major projects currently being undertaken in the SFPUC service area were reviewed. The purpose of the review was to assess whether, at least for the small selection of EIRs reviewed, the mitigation measures identified in general plan EIRs were being implemented at the project level. The specific impacts of a project necessarily depend on its particular circumstances, such as the location and nature of the project. Nevertheless, the review indicated that in these instances mitigation measures are being identified to reduce the impacts of growth consistent with measures identified in the general plan EIRs. A summary of the project review and table of impacts and mitigation measures associated with each is included in Appendix E, Section E.6, of this PEIR.

WSIP Role in Addressing the Indirect Effects of Growth

Three jurisdictions in the SFPUC service area identified demand on existing water supply as a significant or significant unavoidable impact. This section summarizes the water supply impacts and mitigation measures identified by these jurisdictions in their general plans and associated EIRs. However, the demand projections in these general plan EIRs are somewhat outdated in that their horizon years are 2000 and 2005, and actual demand (according to 2001 records) has proven to be somewhat different from the EIR projections. The WSIP would help to meet the future demand of these jurisdictions to 2030 (as currently projected by the water agencies that serve them).

The Foster City *General Plan Revision* EIR (1993b) identified increased water demand resulting from future development as a significant and unavoidable cumulative impact. Estero MID, which provides water service to Foster City, obtains all of its water from the SFPUC. The EIR projected that cumulative water demands on the SFPUC system would exceed the system's capacity. As mitigation, the EIR identified a measure requiring new projects to pay fair share contributions to infrastructure improvements, and a measure requiring water conservation in existing and new development; however, the EIR concluded that the impact could not be fully mitigated through these measures. The WSIP would help meet increased demand projected by Estero MID, thus alleviating an impact related to insufficient supply. However, the timeline and current demand estimates have been substantially revised since the general plan EIR was published. The 1993 EIR projected water demand requirements to the year 2000 and estimated that average daily demand that year would be about 7.2 mgd. By contrast, the SFPUC's wholesale demand study cites an Estero MID 2001 demand of 5.8 mgd, and projects its 2030 demand at 6.8 mgd—less than was estimated in the General Plan than for 2000.

The *City of San Mateo Proposed General Plan Revisions EIR* (1990b) also identified inadequate water supply as a significant unavoidable impact. San Mateo receives water from the CWS–Mid-Peninsula District and Estero MID; 77 percent of CWS-Mid Peninsula District service area is within San Mateo and 10 percent of the Estero MID service area is within San Mateo. Both water agencies obtain all of their water from the SFPUC. The EIR projected that San Mateo's demand would increase from 10.2 mgd in 1988 to 12.1 mgd in 2005, and that the existing 1990 water supply contract (of 184 mgd for the wholesale service area as a whole) would not be adequate to meet the needs of the wholesale service area in 2005. As mitigation, the EIR specified conservation measures (i.e., requiring new development to install water-saving bathroom fixtures and use drip irrigation) and inquiry into the use of groundwater for irrigation of public parks and facilities.

As it turned out, 2001 purchases for the wholesale service area totaled 171 mgd (URS, 2004b), somewhat less than the 184 mgd contract limit the general plan EIR indicated would be inadequate to meet service area demand in 2005. In addition, according to the latest BAWSCA annual survey (BAWSCA, 2006b), purchases of SFPUC water for the wholesale service area in FY 2004/2005 totaled 167 mgd. The wholesale demand study estimated base year (2001) demand for the CWS–Mid-Peninsula District to be 17.9 mgd and 2005 demand to be 17.5 mgd, and projected that 2030 demand would increase to 18.1 mgd. The 2001 demand for Estero MID was estimated at 5.8 mgd, 2005 demand at 6 mgd, and 2030 demand at 6.8 mgd. Based on these numbers and San Mateo's share of the total (based on the percentage of these two wholesale customers within the San Mateo jurisdictional boundary), 2001 demand for San Mateo was approximately 13.8 mgd and estimated demand for 2005 was 14.1 mgd, somewhat higher than was projected for 2005 in the 1990 EIR. Assuming the current proportion of service from the two districts, San Mateo's projected demand for 2030 would be approximately 14.8 mgd. Obviously, the WSIP was not available to mitigate the impact of insufficient water supply projected in the general plan EIR for 2005; it is, however, designed to address projected future capacity shortfalls in the wholesale service area and to meet 2030 purchase requests of the two districts serving San Mateo.

The *City of Fremont General Plan Final Program EIR* (1991b) identifies effects on water supply due to increases in population and employment as a significant but mitigable impact. However, the focus of the impact and its mitigation is on the share of the city's supply from the State Water Project. As mitigation, the EIR identifies general plan policies intended to conserve water, and also recommends that Fremont work with area cities and water districts to find a means of increasing the state's water supply for the area. The ACWD, the wholesale customer that serves Fremont, Newark, and Union City, projects an increase in purchases from the SFPUC of only 1.8 mgd above the FY 2001/2002 purchase of 11.99 mgd (to 13.76 in 2030), although the total projected increase in demand for ACWD is 8.2 mgd. The WSIP would meet the ACWD's 2030 purchase estimate.

Key Regional Effects of Planned Growth

This section provides a summary discussion of the key regional effects in the SFPUC service area identified in general plan EIRs, which concern traffic, air quality, and water quality.

Traffic and Circulation

Planned growth in the SFPUC service area is expected to significantly affect local and regional transportation systems, including roadways, highways, transit, and pedestrian and bicycle facilities. Transportation impacts as a result of planned growth in the service area include the following (see Appendix E, Section E.5):[34]

- Increased traffic relative to existing traffic and the capacity of the street system (significant and unavoidable)
- Degradation of levels of service on area roads or highways (significant and unavoidable)
- Increased vehicle delays at area intersections and impacts on intersections in adjacent cities (significant and unavoidable)
- Declines of average speeds on individual roadway segments (significant but mitigable)
- Cumulative traffic impacts on roadway segments and/or intersections (significant and unavoidable)
- Traffic safety impacts (significant and unavoidable)
- Impacts on parking capacity (significant but mitigable)
- Traffic congestion interference with transit service and/or bicycle levels of service (significant but mitigable)
- Constraints on providing for bicycle and pedestrian travel as a result of increased competition for use of roads and highways by motor vehicles (significant but mitigable)

[34] The most severe level of impact cited by any jurisdiction is indicated; the same impact may have a less severe (or no) effect in some jurisdictions.

- Loss of homes due to road widening (significant and unavoidable)
- Construction traffic impacts (significant but mitigable)

As mitigation for traffic and circulation impacts, the general plan EIRs of numerous jurisdictions specify coordination and cooperation with other agencies to develop or improve regional transportation facilities. The following is an overview of the agencies responsible for transportation planning in the four counties of the SFPUC service area.

Transportation planning is addressed at the regional level by the Metropolitan Transportation Commission (MTC), the agency responsible for transportation planning, coordination, and financing for the nine-county Bay Area. California state law requires every county that includes an urbanized area to develop, and update biennially, a congestion management program (CMP). The congestion management agency (CMA) of each county is responsible for developing the CMP. In order to receive state and federal funds, transportation projects must be recommended by that county's CMA as part of its CMP. The CMAs for each of the four counties are as follows: the Alameda County Congestion Management Agency, the Santa Clara Valley Transportation Authority, the City/County Association of Governments of San Mateo County, and the San Francisco County Transportation Authority.

The MTC is responsible for updating the regional transportation plan, a comprehensive, long-range document that charts the future development of mass transit, highway, airport, seaport, railroad, bicycle, and pedestrian facilities. The current plan, *Transportation 2030,* promotes smart growth development patterns through programs that link transportation and land use decisions.

Air Quality

The four counties served by the SFPUC are located in the San Francisco Bay Area Air Basin (SFBAAB). The SFBAAB lies to the west of the Coast Range mountains, which, in the Bay Area, split into western and eastern ranges. San Francisco Bay lies between the two ranges. Air flows into the SFBAAB from the west at the Golden Gate, and then flows out of the SFBAAB to the east at the Carquinez Strait (where it enters the neighboring San Joaquin Valley Air Basin). The SFPUC service area is located in 3 of 11 climatological regions of the SFBAAB: West Alameda, Santa Clara Valley, and Peninsula. Of these, air pollution potential is highest in the Santa Clara Valley, where high summer temperatures, stable air, and the surrounding mountains combine to promote ozone formation. There are also many emissions sources within and upwind of these areas. West Alameda has a relatively high pollution potential during the summer and fall. Planned growth in the SFPUC service area is expected to significantly affect air quality within the air basin. Impacts on air quality as a result of planned growth in the service area include the following (see Appendix E, Section E.5):[35]

- Increases in air emissions and/or ozone precursors (significant and unavoidable)

[35] The most severe level of impact cited by any jurisdiction is indicated; the same impact may have a less severe (or no) effect in some jurisdictions.

- Periodic construction- and/or demolition-related air quality impacts (significant but mitigable)
- Violation of stationary source air quality standard or contribution to an existing or projected air quality violation (significant and unavoidable)
- Increases in exhaust emissions from traffic (significant and unavoidable)
- Cumulative impacts on regional air quality in the Bay Area (significant and unavoidable)
- Exposure of new sensitive land uses to toxic air contaminant or local odor emissions sources (significant and unavoidable)
- Conflicts with, or obstruction of, the implementation of an applicable air quality attainment plan or congestion management plan (significant but mitigable)

With respect to federal air quality standards, the SFBAAB is designated as nonattainment for ozone, unclassified for fine particulate matter, and attainment for other applicable criteria pollutants. With respect to state air quality standards, the SFBAAB is designated as nonattainment for ozone and particulate matter, unclassified for hydrogen sulfide, and attainment for other criteria pollutants.

The Bay Area Air Quality Management District (BAAQMD) is the regional agency responsible for air quality regulation within the SFBAAB. The BAAQMD's *Clean Air Plan* (CAP), last adopted in 2000, applies control measures to stationary and mobile sources and outlines transportation control measures. Although the 2000 CAP is an ozone plan, it includes attainment planning for particulate matter as an informational item. The 1997 CAP and 2000 CAP included 19 transportation control measures, many of which were partially implemented between 1998 and 2000. The 2000 CAP continues to implement and expand key mobile-source programs included in the 1997 CAP.

In response to the federal designation as nonattainment for ozone, the BAAQMD, ABAG, and MTC prepared and adopted an ozone attainment plan to meet the federal standard. The current plan, adopted in 2001, updates and supplements the previous (1999) ozone attainment plan and contains control strategies for stationary and mobile sources. To achieve compliance with the state and federal ozone standards, in September 2005 the BAAQMD, MTC, and ABAG prepared the draft *Bay Area 2005 Ozone Strategy.* This document shows how the San Francisco Bay Area will achieve compliance with the state and federal ozone standards, reduce transport of ozone to neighboring air basins, and fulfill California Clean Air Act planning requirements for the state ozone standard. The draft ozone strategy includes stationary-source control measures, mobile-source control measures, and transportation control measures. (Refer to Section 4.9, Air Quality, for more information.)

The BAAQMD reviews proposed development projects and has permit authority over most types of stationary emission sources. The BAAQMD can impose emission limits, set fuel or material specifications, or establish operational limits to reduce air emissions. The BAAQMD also regulates new or expanding stationary sources of toxic air contaminants. Measures identified in

the general plan EIRs to mitigate air quality impacts include working with the BAAQMD to include specific measures in the CAP, but more commonly involve transportation issues and the promotion of alternative modes of transportation.

As discussed under Impact 7.1, above, it is expected that planned growth in the existing SFPUC service area also could contribute to significant increases in greenhouse gas (GHG) emissions. Since the California Global Warming Solutions Act of 2006 (AB 32) was recently codified (in September 2006), the general plan EIRs reviewed for this PEIR do not address the impact of planned growth on GHG emissions and climate change. Because AB 32 limits statewide GHG emissions to 1990 levels, increases in GHG emissions associated with planned growth could impede achievement of mandated future reductions in GHG emissions, which would be a potentially significant and unavoidable impact. AB 32 requires the California Air Resources Board (CARB) to establish a GHG emissions cap for 2020 as well as to adopt Early Action Measures and a plan to ensure that emissions reductions (as mandated by AB 32) will be achieved. All future growth will be required to comply with the CARB's adopted measures by January 1, 2011 (enforced by January 1, 2012). Adherence to these measures will presumably achieve reductions that would help minimize overall GHG emissions increases. However, there is insufficient information available at this programmatic level of analysis to determine the extent of GHG emissions that may result from planned growth in the SFPUC service area and the relationship between CARB's Early Action Measures and growth-related sources of GHG emissions.

Hydrology and Water Quality

Planned growth in the SFPUC service area is expected to significantly affect hydrology and water quality. These impacts include the following (see Appendix E, Section E.5):[36]

- Degradation of surface water and/or groundwater quality (significant but mitigable)
- Increases in impervious surfaces and/or alteration of area drainage resulting in flood hazards and/or the need for new drainage facilities (significant and unavoidable)
- Exposure to people and property to flooding (significant but mitigable)
- Flood hazards, including hazards related to potential dam failure (significant but mitigable)
- Water pollution from stormwater runoff (significant and unavoidable)
- Erosion and sedimentation impacts from increased runoff from inadequately designed drainage systems (significant but mitigable)
- Increased demand on groundwater resources (significant but mitigable)
- Increased frequency and severity of downstream flooding due to increase in impervious surfaces from cumulative development (significant but mitigable)

[36] The most severe level of impact cited by any jurisdiction is indicated; the same impact may have a less severe (or no) effect in some jurisdictions.

The California State Water Resources Control Board and the nine Regional Water Quality Control Boards (RWQCBs) implement and enforce the National Pollutant Discharge Elimination System (NPDES) program, which was established to protect water quality under the federal Clean Water Act. Water quality is regulated at the state level under the Porter-Cologne Water Quality Control Act through standards and objectives set forth in water quality control plans, known as basin plans. The San Francisco Bay RWQCB regulates water quality in the SFPUC service area through its basin plan, which was adopted in 1995. Stormwater in Alameda, Santa Clara, and San Mateo Counties is managed in accordance with an NPDES permit from the San Francisco Bay RWQCB. The NPDES permit includes a comprehensive plan to reduce the discharge of pollutants and requires participating communities to implement an approved stormwater management plan. The stormwater programs incorporate construction controls, stormwater ordinances and other regulatory approaches, public education and industrial outreach, inspections, wet-weather monitoring, and special studies. In 2003, the San Francisco Bay RWQCB updated provisions in its municipal stormwater permits to require that new development and redevelopment projects incorporate treatment measures and other source control and site design features to reduce the level of pollutants in stormwater discharges and to manage runoff flows. Mitigation measures typically identified in general plan EIRs in the SFPUC service area include requiring development projects to incorporate best management practices consistent with the NPDES permit, identify and remediate drainage system deficiencies, and implement erosion and sediment control plans for construction projects.

Conclusion: Indirect Effects of Growth Supported by the WSIP

As indicated above, the WSIP would indirectly contribute to environmental impacts caused by growth; some of these impacts would be unavoidable.

The WSIP would support some of the growth that is reflected in the adopted land use plans of jurisdictions in the SFPUC service area. The EIRs prepared for general plans and related land use plans in the service area identified impacts of planned growth and mitigation measures to reduce the identified impacts. Some of the impacts of planned growth cannot be reduced to a less-than-significant level. In these cases, the respective decision-making body (e.g., city council) identified overriding considerations that justified adoption of the general plan despite its adverse impacts. Due to the longer planning horizon of the WSIP and relative age of some of the adopted general plans, and differing expectations about the level of job growth that will occur in the coming decades, not all of the growth that the WSIP would in part support has been addressed in adopted land use plans or evaluated in the plans' CEQA documents. Therefore, the WSIP could result in impacts that are somewhat more severe than those identified in the general plan EIRs, although it is likely that the impacts would be similar in kind to those previously identified. Potential impacts beyond those previously identified would generally be related either to increased density of development or to the conversion of less developed areas to urban uses. The measures specified in adopted general plans to mitigate the impacts of growth should also serve to reduce impacts of the WSIP.

The key regional effects of planned growth relate to air quality, traffic congestion, and water quality. Regional agencies, including the MTC, BAAQMD, and RWQCB, and the jurisdictions in the service area, are working both regionally and locally to address these impacts.

By providing water to support planned growth, the WSIP would help to mitigate the environmental impact identified in general plan EIRs for some jurisdictions in the service area of insufficient water supply.

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CHAPTER 9
CEQA Alternatives

Sections

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9.1 Introduction

9.1.1 CEQA Guidance for Alternatives Analysis

The California Environmental Quality Act (CEQA) Guidelines, Section 15126.6(a), state that an environmental impact report (EIR) must describe and evaluate a reasonable range of alternatives to the proposed project that would feasibly attain most of the project's basic objectives, but that would avoid or substantially lessen any significant adverse environmental effects of the project. An EIR is not required to consider every conceivable alternative to a proposed project. Rather, it must consider a reasonable range of potentially feasible alternatives that will foster informed decision-making and public participation. CEQA Guidelines Section 15126.6(e) states that, "The specific alternative of 'no project' shall also be evaluated along with its impact" (which, in the case of this Program EIR, is referred to as the No *Program* Alternative). The EIR must evaluate

the comparative merits of the alternatives and include sufficient information about each alternative to allow meaningful evaluation, analysis, and comparison with the proposed project.

9.1.2 WSIP Goals and Objectives

Program alternatives were evaluated for their ability to attain most of the basic objectives of the proposed Water System Improvement Program (WSIP or program), consistent with CEQA. The WSIP goals, objectives, and proposed levels of service (presented in Chapter 3, Program Description, Section 3.3) are repeated here for ease of reference. The goals and objectives, based on a planning horizon through 2030, are founded on two fundamental principles pertaining to the existing regional water system: (1) maintaining a clean, unfiltered water source from the Hetch Hetchy system, and (2) maintaining a gravity-driven system. The overall goals of the WSIP for the regional water system are to:

- Maintain high-quality water
- Reduce vulnerability to earthquakes
- Increase delivery reliability and improve the ability to maintain the system
- Meet customer water supply purchase requests in nondrought and drought periods
- Enhance sustainability in all system activities
- Achieve a cost-effective, fully operational system

To further these program goals, the WSIP includes objectives that address system performance in the areas of water quality, seismic reliability, delivery reliability, and water supply through the year 2030. The system performance objectives provide design guidelines for facility improvement projects and provide the basis for the proposed system operations and water supply option. **Table 9-1** presents the WSIP goals and objectives, and **Table 9-2** summarizes and compares the levels of service under the existing condition and the proposed program.

9.1.3 Organization of this Chapter

This chapter presents the key alternatives analysis and results, then describes the background process and evaluation that led to those results, as follows:

- Section 9.2 presents the alternatives selected for inclusion in the PEIR based on CEQA criteria. The section describes each alternative, including the No Program Alternative, and discusses San Francisco Public Utilities Commission (SFPUC) actions as well as possible wholesale customer actions associated with each alternative. For each alternative, the section also describes feasibility issues associated with its implementation, as well as its ability to meet WSIP objectives and its effectiveness in avoiding or reducing environmental impacts. Section 9.2 then compares the environmental effects of each alternative with the effects of the WSIP.

- Section 9.3 summarizes and compares the alternatives, identifying trade-offs and the environmentally superior alternative.

- Section 9.4 describes the process used to identify program alternatives. It summarizes the significant adverse impacts of the WSIP, identifies strategies to avoid or substantially lessen these effects that could be implemented through an alternative to the WSIP rather

TABLE 9-1
WSIP GOALS AND OBJECTIVES

Program Goal	System Performance Objective
Water Quality – *maintain high water quality*	▪ Design improvements to meet current and foreseeable future federal and state water quality requirements. ▪ Provide clean, unfiltered water originating from Hetch Hetchy Reservoir and filter all other surface water sources. ▪ Continue to implement watershed protection measures.
Seismic Reliability – *reduce vulnerability to earthquakes*	▪ Design improvements to meet current seismic standards. ▪ Deliver basic service to the three regions in the service area (East/South Bay, Peninsula, and San Francisco) within 24 hours after a major earthquake. Basic service is defined as average winter-month usage, and the performance objective for the regional system is 229 million gallons per day (mgd). The performance objective is to provide delivery to at least 70 percent of the turnouts (i.e., water diversion point) in each region, with 104, 44, and 81 mgd delivered to the East/South Bay, Peninsula, and San Francisco regions, respectively. ▪ Restore facilities to meet average-day demand of 300 mgd within 30 days after a major earthquake.
Delivery Reliability – *increase delivery reliability and improve ability to maintain the system*	▪ Provide operational flexibility to allow planned maintenance shutdown of individual facilities without interrupting customer service. ▪ Provide operational flexibility to minimize the risk of service interruption due to unplanned facility upsets or outages. ▪ Provide operational flexibility and system capacity to replenish local reservoirs as needed. ▪ Meet the estimated average annual demand of 300 mgd for 2030 under the conditions of one planned shutdown of a major facility for maintenance concurrent with one unplanned facility outage.
Water Supply – *meet customer water needs in nondrought and drought periods*	▪ Meet average annual water purchase requests of 300 mgd from retail and wholesale customers during nondrought years for system demands through 2030. ▪ Meet dry-year delivery needs through 2030 while limiting rationing to a maximum 20 percent systemwide reduction in water service during extended droughts. ▪ Diversify water supply options during nondrought and drought periods. ▪ Improve use of new water sources and drought management, including use of groundwater, recycled water, conservation, and transfers.
Sustainability – *enhance sustainability in all system activities*	▪ Manage natural resources and physical systems to protect watershed ecosystems. ▪ Meet, at a minimum, all current and anticipated legal requirements for protection of fish and other wildlife habitat. ▪ Manage natural resources and physical systems to protect public health and safety.
Cost-effectiveness – *achieve a cost-effective, fully operational system*	▪ Ensure cost-effective use of funds. ▪ Maintain gravity-driven system. ▪ Implement regular inspection and maintenance program for all facilities.

SOURCE: SFPUC, 2005 and 2006.

TABLE 9-2
EXISTING AND PROPOSED REGIONAL SYSTEM LEVELS OF SERVICE[a]

Operating Parameter	Existing Level of Service (2005)	Proposed Level of Service with WSIP (2030)
Water Quality	Meet all existing local, state, and federal water quality requirements	Meet all local, state, and federal water quality requirements in 2030
Seismic Response After Major Earthquake	Not defined	Provide basic service[b] of 229 mgd within 24 hours; average-day service of 300 mgd within 30 days
Delivery During System Maintenance	Not defined	Average day demand of 300 mgd
Average Annual Water Supply	265 mgd	300 mgd
Regional System Firm Yield[c]	219 mgd	256 mgd
Drought-Year Rationing	No maximum limit to rationing	Up to 20 percent systemwide rationing

a Level of service flow rates are defined on a systemwide basis and are not specific to any customer turnout (i.e., water diversion point).
b Basic service is defined as winter-month demand, estimated to be 229 mgd systemwide in 2030.
c System firm yield is defined as the average annual water delivery that can be sustained by the regional water system during an extended drought. The SFPUC uses an 8.5-year design drought for planning purposes. Currently, due to operating restrictions imposed on Calaveras Dam by the California Division of Safety of Dams in December 2001, the system firm yield is reduced from its normal system firm yield of 226 mgd to about 219 mgd.

SOURCE: SFPUC, 2006.

than through mitigation measures, and reviews suggestions and concepts for alternatives that were raised during the scoping period. Section 9.4 presents the rationale and screening process used for accepting or rejecting potential alternatives and summarizes the reasons for eliminating alternatives from further consideration.

- Section 9.5 provides additional background information about and more detail on the reasons for rejecting alternative concepts identified in Section 9.4 that were considered but rejected either as part of the WSIP development process or as part of the CEQA alternatives analysis process.

9.2 Alternatives Analysis

9.2.1 Selected Alternatives for Comparative Analysis

In accordance with CEQA, appropriate alternatives for EIR analysis are those that meet most of a project's basic objectives *and* avoid or substantially lessen the significant environmental impacts of the proposed project. As described in more detail in Section 9.4, several steps were taken to identify potential alternatives and assemble a reasonable range of alternatives for evaluation in the PEIR in comparison in the WSIP, including:

1. Review the significant effects resulting from the WSIP and identify possible strategies to avoid or lessen such impacts.

2. Review ideas and alternative concepts suggested during the PEIR scoping process.

3. Categorize and evaluate strategies and concepts for the ability to both meet the basic project objectives and avoid or lessen significant impacts.

4. Develop preliminary alternatives based on strategies and concepts retained from preliminary screening. Evaluate feasibility with respect to technical, institutional, cost, and regulatory considerations.

5. Select and refine a final set of alternatives for CEQA analysis.

From this process seven alternatives, in addition to the required No Program Alternative, were selected for further evaluation and comparison to the WSIP. Together, this set of eight alternatives represents a broad range of options in terms of how key aspects of the proposed program could be implemented. Each alternative in the set differs from the WSIP in one or more of the following important ways:

- *Demand level served*. The WSIP plans to meet an average annual delivery requirement of 300 mgd by 2030 reflecting the customer purchase request increase of 35 mgd over current average annual demand. Two alternatives do not fully satisfy customer purchase requests in 2030.

- *Water supply source(s) / level of additional Tuolumne River diversion.* The WSIP proposes to increase Tuolumne River diversion under the CCSF's existing water rights coupled with development of additional recycled water, conservation, and local groundwater in San Francisco, a conjunctive groundwater use program in the Westside Basin (San Mateo County), and acquisition of a dry-year surface water transfer. Two alternatives include a smaller increase in diversion of Tuolumne River water compared to the WSIP and two alternatives include no increase in Tuolumne River water diversion; one of these alternatives looks at demand management strategies (conservation and water recycling) while the other evaluates an alternative supply source – seawater desalination. Another alternative considers a new point of diversion on the lower Tuolumne River, which, although it is still Tuolumne River water, represents an alternative source of supply in terms of shifting from a Sierra Nevada supply source to a Central Valley supply source.

- *Level of drought rationing.* As part of implementing the WSIP the SFPUC proposes to meet an objective of up to 20 percent maximum systemwide rationing in any year of a drought. Two alternatives require higher levels of rationing.

- *Facilities – number of projects required / extent of facilities construction.* The WSIP includes implementation of 22 facility improvement projects evaluated in this PEIR. One alternative, the No Program Alternative, includes only a few of these facility improvement projects. Seven of the eight alternatives include all 22 of the facility improvement projects plus additional required facilities ranging from a new desalination plant and transmission pipelines to additional recycled water treatment plants, groundwater wells, and distribution facilities.

As noted in Section 9.4, many other alternative concepts were identified that would modify the WSIP in one of the key areas identified in the bullet list above. However, the set of eight alternatives selected for further evaluation was judged to best represent the range of identified strategies and concepts. For example, a Delta water supply source was one of the supply source

concepts proposed as an alternative to increasing diversion from the Tuolumne River. However, an alternative to divert water off the lower Tuolumne River better represents the concept of diverting, in effect, Tuolumne River water from a point downstream in the valley, lower in the watershed. Similarly, a seawater desalination alternative is included in the range of alternatives evaluated as a supply source alternative that involves no additional Tuolumne River water. Section 9.4, below, describes the alternatives development and screening process in further detail and explains the reasons for eliminating various strategies and concepts from further evaluation.

This section evaluates the comparative merits of the selected alternatives relative to the WSIP. Since the alternatives are generally conceptual, the evaluation is based on the available information and reasonable assumptions about how each alternative would be implemented. For each alternative, this section presents the following:

- Description of the alternative, including associated facility improvement projects, water supply sources, and system operations. The descriptions include SFPUC actions as well as reasonable expectations regarding the wholesale customer actions that would occur under each alternative. The description includes a review of potential feasibility issues as well.

- Ability to meet primary WSIP goals and objectives

- Environmental impacts of each alternative compared to those of the WSIP. This section is divided into three groups: facility impacts (construction and operation), water supply and system operations impacts, and growth-inducement impacts. Under the facility impacts, impacts associated with each alternative are compared to those described in Chapter 4 of this PEIR for the proposed WSIP facility improvement projects; additionally, impacts of other facilities that would or could be required under an alternative but not under the WSIP are described, along with associated potential impacts on other water bodies and associated resources not affected by the WSIP. Under the water supply and system operations impacts, the potential impacts within the SFPUC regional system under each alternative are compared to those analyzed for the WSIP in Chapter 5 of this PEIR.[1] The comparative evaluation of growth-inducement impacts is discussed based on the analysis presented in Chapter 7 of this PEIR.

Table 9-3 identifies the eight CEQA alternatives evaluated in detail in this PEIR. There are seven main alternatives but there are also two variations of the Aggressive Conservation / Water Recycling and Local Groundwater Alternative that are each evaluated in detail in comparison to the WSIP; thus these are counted as two separate alternatives, for a total of eight. The table provides a brief description of each alternative and highlights how it differs from the WSIP and what impact areas it is intended to address.

[1] The potential impacts of the WSIP on water supply and system operations were determined based on modeling results of the Hetch Hetchy/Local Simulation Model, as described in Section 5.1. Modeling results for the CEQA alternatives are discussed in Appendices H1 through H3. It should be noted that development of the conceptual alternatives continued after the performance of modeling for the CEQA alternatives; however, results presented in this PEIR are adequate to assess the comparative impacts of the alternatives and the WSIP. In particular, the modeling results of the CEQA alternatives do not account for restoration of the historical capacity of Crystal Springs Reservoir (i.e., implementation of the Lower Crystal Springs Dam project, PN-4) and the associated 1 mgd of system firm yield; however, the comparative analysis qualitatively addresses the change in system operations that would occur with implementation of PN-4.

TABLE 9-3
SELECTED ALTERNATIVES FOR CEQA ANALYSIS

Alternative / Description	How Does This Alternative Differ From The WSIP?	What WSIP Impacts Is The Alternative Intended to Address?
No Program –SFPUC would implement only those WSIP facility improvement projects driven by regulatory requirements or existing agreements with regulatory agencies. It would endeavor to meet increasing customer purchase requests through the year 2030 by diverting additional Tuolumne River water only when available under CCSF's existing water rights. The wholesale customers would have to pursue supplemental supply sources and/or conservation measures to make up the supply shortfall/reduced reliability under this alternative.	▪ *2030 Avg. Annual Delivery Target:* Same ▪ *Supply Sources*: Tuolumne River. No dry-year water transfer, Westside Groundwater basin, or 10 mgd recycled water / conservation / groundwater in SF ▪ *Additional Tuolumne River diversion*: Less ▪ *Level of Rationing*: Allow for greater than 20% systemwide rationing ▪ *Facility projects*: Fewer	▪ Required by CEQA ▪ Fewer facilities construction impacts (fewer facilities would be constructed)
No Purchase Request Increase – SFPUC would implement all of the proposed WSIP facility improvement projects but would limit wholesale customers' future purchases to the terms of the existing Master Water Sales Agreement instead of providing all of their 2030 purchase requests. The wholesale customers would have to pursue supplemental supply sources and/or conservation measures to make up the supply shortfall under this alternative.	▪ *2030 Avg. Annual Delivery Target:* Less ▪ *Supply Sources*: Same ▪ *Additional Tuolumne River diversion*: Less ▪ *Level of Rationing*: Same ▪ *Facility projects*: Same	▪ Growth inducement potential and associated secondary effects of growth ▪ Impacts on Pilarcitos Creek
Aggressive Conservation/Water Recycling and Local Groundwater – The SFPUC would implement all of the proposed WSIP facility improvement projects and endeavor to serve the projected 2030 delivery target of 300 mgd solely through additional conservation, water recycling, and local groundwater projects. A maximum of 19 mgd of the 25 mgd projected annual average increase in purchase requests might be met through such local projects, as feasible. Since this alternative would not meet the full 2030 customer purchase request, the SFPUC would have to either (a) limit future deliveries to the level that can be met under this alternative (estimated to be 294 mgd or less) or (b) supplement supply to make up the delivery shortfall. Two variations of this alternative are evaluated as follows: ***No Supplemental Tuolumne River Supply*** – The SFPUC would not provide supplemental water from the Tuolumne River to augment this alternative to meet the 2030 customer purchase requests of 300 mgd. ***With Supplemental Tuolumne River Supply*** – The SFPUC would supplement this alternative with additional Tuolumne River diversions under its existing water rights.	***No Supplemental Tuolumne River Supply*** ▪ *2030 Avg. Annual Delivery Target:* Less ▪ *Supply Sources*: More recycled water and local groundwater. No additional Tuolumne River; no dry-year water transfer; no Westside Groundwater Basin ▪ *Additional Tuolumne River diversion*: None ▪ *Level of Rationing*: Requires greater than 20 percent rationing ▪ *Facility projects*: Same ***With Supplemental Tuolumne River Supply*** ▪ *2030 Avg. Annual Delivery Target:* Same ▪ *Supply Sources*: More recycled water and local groundwater. Less additional Tuolumne River; no dry-year water transfer; no Westside Groundwater Basin ▪ *Additional Tuolumne River diversion*: Less ▪ *Level of Rationing*: Same	▪ Impacts on the Tuolumne River, Alameda Creek and Peninsula Watershed water resources including Pilarcitos Creek

TABLE 9-3 (continued)
SELECTED ALTERNATIVES FOR CEQA ANALYSIS

Alternative / Description	How Does This Alternative Differ From The WSIP?	What WSIP Impacts Is The Alternative Intended to Address?
Lower Tuolumne River Diversion – The SFPUC would implement all of the proposed WSIP facility improvement projects and would serve the projected increase in customer purchase requests through 2030 through diversions on the lower Tuolumne River per an agreement with the Turlock and Modesto Irrigation Districts (TID and MID) and construction of conveyance and treatment facilities to blend the new supply into the regional system.	▪ *2030 Avg. Annual Delivery Target:* Same ▪ *Supply Sources*: Same but new Tuolumne River diversion point ▪ *Additional Tuolumne River diversion*: Same ▪ *Level of Rationing*: Same ▪ *Facility projects*: More	▪ Impacts on the Tuolumne River
Year-round Desalination at Oceanside – The SFPUC would implement all of the proposed WSIP facility improvement projects and construct a 25-mgd desalination plant in San Francisco at Oceanside to serve the projected increase in customer purchase requests through 2030. The plant would provide year-round supplies during all hydrologic year types to blend into the regional system.	▪ *2030 Avg. Annual Delivery Target:* Same ▪ *Supply Sources*: Desalinated seawater ▪ *Additional Tuolumne River diversion*: None ▪ *Level of Rationing*: Same ▪ *Facility projects*: More	▪ Impacts on the Tuolumne River, Alameda Creek and Peninsula watershed water resources including Pilarcitos Creek
Regional Desalination for Drought – The SFPUC would implement all of the proposed WSIP facility improvement projects and would partner with other Bay Area water agencies to develop a regional desalination plant that would provide supplemental supply to the SFPUC during drought years.	▪ *2030 Avg. Annual Delivery Target:* Same ▪ *Supply Sources*: Desalinated brackish bay water ▪ *Additional Tuolumne River diversion*: Less ▪ *Level of Rationing*: Same ▪ *Facility projects*: More	▪ Impacts on the Tuolumne River, Alameda Creek and Peninsula watershed water resources including Pilarcitos Creek
Modified WSIP – The SFPUC would implement all of the proposed facility improvement projects. This alternative would modify proposed system operations to minimize environmental effects and increase conservation, water recycling and local groundwater development as part of the water supply option.	▪ *2030 Avg. Annual Delivery Target:* Same ▪ *Supply Sources*: Additional conservation, water recycling and/or local groundwater ▪ *Additional Tuolumne River diversion*: Similar ▪ *Level of Rationing*: Same ▪ *Facility projects*: Additional regional water recycling and groundwater facilities ▪ Modifies proposed system operations	▪ Impacts on the Tuolumne River, Alameda Creek and Peninsula watershed water resources including Pilarcitos Creek and Crystal Springs Reservoir

The following series of tables provides summary information about key aspects of each alternative in comparison to the proposed WSIP and supports the description and evaluation of each of the eight alternatives that follows in this section. The tables provide summary information and evaluations that are explained in detail in the text.

Table 9-4 describes the characteristics of each of these alternatives in comparison with existing conditions and the proposed program. **Table 9-5** indicates the estimated average annual diversions from the Tuolumne River that would occur under each alternative compared to the WSIP over the modeled 82-year period of hydrologic record and presents estimates of the extent of drought-year shortages associated with each alternative based on modeling results. Two estimates of drought-year shortages are presented. First presented is the total number of years over the modeled 82-year hydrologic record that there would be shortages of 10, 20, and/or greater than 20 percent. Second, the table shows the number of years during the 8.5-year design drought that shortages of 10, 20, or greater than 20 percent would occur. The information in these two tables is used to evaluate how each alternative performs with respect to some of the key level of service goals and system performance objectives established for the WSIP. This information is also used in the subsequent discussion of the extent to which each alternative meets the program objectives. **Table 9-6** summarizes the ability of each alternative to meet the objectives established by the SFPUC for the WSIP. This table uses the following terms to simplify and abbreviate the detailed information provided on each alternative in the following sections:

> "Yes" indicates that an alternative fully meets one of the specific sub-objectives.
>
> "No" indicates that an alternative does not meet the sub-objective.
>
> "Partial" indicates that an alternative could meet the sub-objective in part but it would not fully meet the sub-objective of a level of service equivalent to the WSIP; this may be because the alternative would only serve a reduced 2030 delivery target, and/or would increase the facility requirements.
>
> "Uncertain" reflects the fact that there are questions about supply availability and reliability in addition to outstanding feasibility, cost, regulatory and public acceptance issues.

With respect to environmental impacts, **Tables 9-7**, **9-8**, and **9-9** summarize the comparison of significant water supply and system impacts (identified in Chapter 5) between the proposed WSIP and each alternative. No tables are used to illustrate how the alternatives compare to the WSIP in terms of impacts resulting from facility improvement projects or growth inducement potential and the associated secondary effects of growth, but these topics are evaluated for each alternative in the following text.

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TABLE 9-4
DESCRIPTION OF CEQA ALTERNATIVES

Program Element	Existing Condition	Proposed Program	No Program Alternative	No Purchase Request Increase Alternative	Aggressive Conservation/Water Recycling and Local Groundwater Alternative		Lower Tuolumne River Diversion Alternative	Year-round Desalination at Oceanside Alternative	Regional Desalination for Drought Alternative (Variant 2)	Modified WSIP Alternative
					No Supplemental Tuolumne River Water	With Supplemental Tuolumne River Water				
Planning Year	2005	2030	2030	2030	2030	2030	2030	2030	2030	2030
Target Delivery Level (annual average)	265 mgd	300 mgd	300 mgd	275 mgd	300 mgd	300 mgd	300 mgd	300 mgd	300 mgd	300 mgd
Water Supply Sources (during nondrought and drought periods)	▪ Local watersheds (with Calaveras and Lower Crystal Springs Reservoirs operating at reduced levels based on Division of Safety of Dams restrictions) ▪ Tuolumne River	▪ Local watersheds (with Calaveras and Lower Crystal Springs Reservoirs restored) ▪ Tuolumne River, with increased average annual diversions ▪ Recycled water/ groundwater/additional conservation in San Francisco, 10 mgd	▪ Local watersheds (with Calaveras and Lower Crystal Springs Reservoirs restored) ▪ Tuolumne River, with increased average annual diversions	▪ Local watersheds (with Calaveras and Lower Crystal Springs Reservoirs restored) ▪ Tuolumne River, with increased average annual diversions ▪ Recycled water/ groundwater/additional conservation in San Francisco, 10 mgd ▪ *Wholesale customers expected to pursue supplemental supply or conservation to make up for 2030 supply shortfall*	▪ Local watersheds (with Calaveras and Lower Crystal Springs Reservoirs restored) ▪ Tuolumne River, with no increase in average annual diversions ▪ Recycled water/ groundwater/additional conservation in San Francisco, 10 mgd ▪ Regional recycled water/ groundwater/ conservation in service area outside of San Francisco, 19 mgd ▪ *Wholesale customers expected to pursue supplemental supply (e.g., water transfer) to make up for 2030 supply shortfall*	▪ Local watersheds (with Calaveras and Lower Crystal Springs Reservoirs restored) ▪ Tuolumne River (during nondrought years), with increased average annual diversions ▪ Recycled water/ groundwater/additional conservation in San Francisco, 10 mgd ▪ Regional recycled water/ groundwater/ conservation in service area outside of San Francisco, 19 mgd ▪ *Wholesale customers expected to pursue supplemental supply (e.g., water transfer) to make up for 2030 supply shortfall*	▪ Local watersheds (with Calaveras and Lower Crystal Springs Reservoirs restored) ▪ Tuolumne River, with increased average annual diversions ▪ Recycled water/ groundwater/additional conservation in San Francisco, 10 mgd	▪ Local watersheds (with Calaveras and Lower Crystal Springs Reservoirs restored) ▪ Tuolumne River, with no increase in average annual diversion ▪ Recycled water/ groundwater/additional conservation in San Francisco, 10 mgd ▪ Potable water from SFPUC desalination plant	▪ Local watersheds (with Calaveras and Lower Crystal Springs Reservoirs restored) ▪ Tuolumne River, with increased average annual diversions ▪ Recycled water/ groundwater/additional conservation in San Francisco, 10 mgd	▪ Local watersheds (with Calaveras and Lower Crystal Springs Reservoirs restored, but with managed use of the restored historical capacity of Lower Crystal Springs Reservoir) ▪ Tuolumne River, with increased average annual diversions ▪ Recycled water/ groundwater/additional conservation in San Francisco, 10 mgd ▪ 5 – 10 mgd of regional recycled water / groundwater / conservation in regional service area
Supplemental Dry-Year Water Supply Sources (for implementation during drought periods only)	None	▪ Additional Tuolumne River diversions from Turlock and Modesto Irrigation District (TID and MID) transfers of 23 mgd (average over design drought) ▪ Westside Basin conjunctive use, 6 mgd (average over design drought)	None ▪ *Wholesale customers expected to pursue supplemental dry-year supply (e.g., water transfer) to make up for drought period supply shortfalls*	▪ Additional Tuolumne River diversions from TID and MID transfers of 1 mgd (average over design drought) ▪ Westside Basin conjunctive use, 6 mgd (average over design drought) ▪ *Wholesale customers expected to pursue supplemental dry-year supply (e.g., water transfer) to make up for drought period supply shortfalls*	None ▪ *Wholesale customers expected to pursue supplemental dry-year supply (e.g., water transfer) to make up for drought period supply shortfalls*	None ▪ *Wholesale customers expected to pursue supplemental dry-year supply (e.g., water transfer) to make up for drought period supply shortfalls*	▪ Additional Tuolumne River diversions from TID and MID transfers of 23 mgd ▪ Westside Basin conjunctive use, 6 mgd (average over design drought)	▪ Westside Basin conjunctive use, 6 mgd (average over design drought)	▪ Potable water from regional desalination plant, 23 mgd (average over design drought) ▪ Westside Basin conjunctive use, 6 mgd (average over design drought)	▪ Additional Tuolumne River diversions from TID and MID transfers of 23 mgd – conserved water only[1] ▪ Westside Basin conjunctive use, 6 mgd (average over design drought)
Maximum Drought Rationing Policy	No defined limit, but assumed incidental rationing of up to 25%	20%	No defined limit, but assumes 30% would be needed during design drought conditions	20% at reduced target delivery level	25%	20%	20%	20%	20%	20%
System Firm Yield	219 mgd	256 mgd	226 mgd	233 mgd	226 mgd	226 mgd	256 mgd	256 mgd	256 mgd	~ 256 mgd
WSIP PEIR Facility Improvement Projects	None	All projects	▪ Advanced Disinfection (SJ-1) ▪ Alameda Creek Fishery Enhancement (SV-1) ▪ Calaveras Dam Replacement (SV-2) ▪ SVWTP – Treated Water Reservoirs (SV-5)	All projects, but facilities reevaluated and sized appropriately for a reduced target delivery level	All projects, but facilities reevaluated and sized appropriately for a reduced target delivery level	All projects, but facilities reevaluated and sized appropriately given the different supply sources	All projects, but facilities reevaluated and sized appropriately given the different supply sources	All projects, but facilities reevaluated and sized appropriately given the different supply sources	All projects	All projects

TABLE 9-4 (Continued)
DESCRIPTION OF CEQA ALTERNATIVES

Program Element	Existing Condition	Proposed Program	No Program Alternative	No Purchase Request Increase Alternative	Aggressive Conservation/Water Recycling and Local Groundwater Alternative		Lower Tuolumne River Diversion Alternative	Year-round Desalination at Oceanside Alternative	Regional Desalination for Drought Alternative (Variant 2)	Modified WSIP Alternative
					No Supplemental Tuolumne River Water	With Supplemental Tuolumne River Water				
WSIP PEIR Facility Improvement Projects (cont.)			▪ Lower Crystal Springs Dam Improvements (PN-4)							
Other Facility Improvements	None	None	None by the SFPUC *Wholesale customers expected to develop other facilities or projects to secure supplemental supply to improve water supply reliability, including drought supplies*	None by the SFPUC *Wholesale customers expected to develop other facilities or projects to meet additional demands*	Additional regional and local recycled water and groundwater projects in the wholesale customer service area, outside of San Francisco. *Wholesale customers expected to develop other facilities or projects to meet additional demands*	Additional regional and local recycled water and groundwater projects in the wholesale customer service area, outside of San Francisco	▪ Intake pipeline in lower Tuolumne River and pumping plant ▪ 2.5-mile raw water pipeline ▪ Lower Tuolumne River water treatment plant ▪ Treated water pump station	▪ SFPUC desalination plant in San Francisco and associated seawater intake structure, intake pipeline, pump stations, and treatment facilities ▪ Treated water pump station ▪ 2.4-mile treated water pipeline	▪ Bay Area regional desalination plant(s) and associated pumping plant(s) and pipelines needed for intertie facilities	▪ Alameda Creek bypass structure ▪ Additional facilities for regional recycled water/ groundwater/ conservation projects in the wholesale service area
Delivery, Operations, and Maintenance	As described in Chapter 2, Section 2.3	Improved to meet WSIP goals and objectives (as described in Chapter 3, Section 3.8)	Similar to existing conditions, except increased frequency of shortages and need for rationing; during drought years, rationing could be up to 30% Lack of comprehensive maintenance program and likely increased emergency repairs and replacement projects.	Similar to proposed program (but adjusted for the reduced target delivery level)	Similar to proposed program, except increased water demands served with regional recycled water, conservation and groundwater projects that would require operation and maintenance by wholesale customers in coordination with the SFPUC	Similar to proposed program, except increased water demands served with regional recycled water, conservation and groundwater projects that would require operation and maintenance by wholesale customers in coordination with the SFPUC	Similar to proposed program, except for additional operation and maintenance requirements for lower Tuolumne River diversion, conveyance, treatment, and blending facilities.	Similar to proposed program, except for additional operation and maintenance requirements for desalination and blending facilities. Customers on the westside of San Francisco would receive predominantly desalinated water.	Same as proposed program except for participation in additional operation and maintenance requirements for regional desalination facilities and any interties or transfers among the participating agencies.	Similar to proposed program, but with modified operations, specifically at the Alameda Creek Diversion Tunnel and at Crystal Springs Reservoir
Permits, Approvals, and other Decisions/Actions	As described in Chapter 2, Sections 2.4 and 2.5	▪ San Francisco Planning Commission certifies final PEIR ▪ SFPUC adopts CEQA findings/mitigation monitoring and reporting program and approves and adopts the WSIP ▪ Water transfer agreements with TID and MID ▪ Operating agreements with Daly City, San Bruno, and California Water Service Company for Westside Basin conjunctive-use program ▪ Water sales agreements with retail and wholesale customers (see Chapter 3, Section 3.13)	Same as existing conditions, except SFPUC would be required to submit an explanation describing reason for change in the proposed program to the California Department of Health Service and Seismic Safety Commission for AB 1823 compliance	Same as proposed program except: ▪ Transfer agreements with TID and MID for 1 mgd instead of 23 mgd during drought years ▪ Agreements with California Department of Health Services for any new drinking water sources developed by wholesale customers that would be introduced into the regional system	Same as proposed program except: ▪ Addition of various permits and agreements with wholesale customers to develop and implement recycled water, conservation, and groundwater projects ▪ No agreements with Daly City, San Bruno, and California Water Service. There would be no Westside Basin conjunctive-use program ▪ No water transfer agreements with TID and MID ▪ Agreements with California Department of Health Services for any new drinking water sources	Same as proposed program except: ▪ Addition of various permits and agreements with wholesale customers to develop and implement recycled water, conservation, and groundwater projects ▪ No agreements with Daly City, San Bruno, and California Water Service, There would be no Westside Basin conjunctive-use program ▪ No water transfer agreements with TID and MID ▪ Agreements with California Department of Health Services for any new drinking water sources	Same as proposed program except: ▪ The State Water Resources Control Board could require additional water appropriation permit or license ▪ Right-of-way purchase and permits to construct pipelines through levees, access the river, and protect the river and fish ▪ Agreement/coordination with TID/MID regarding operational schedule for releases at La Grange Dam ▪ Agreements with California Department of Health Services for any new drinking water sources	Same as proposed program except: ▪ Brine disposal would require a National Pollutant Discharge Elimination System permit ▪ Watershed sanitary survey needed, in accordance with California Department of Health regulations ▪ Impingement and entrainment study for the California Coastal Commission would be required to determine impacts on aquatic resources ▪ Project review and approval by the U.S. Army Corps of Engineers ▪ Agreements with California Department of Health Services for any new drinking water sources. ▪ No water transfer agreements with TID and MID	Same as proposed program except: ▪ Agreements with partners in Bay Area regional desalination project ▪ See Table 8.4 for a list of potential permits for the Bay Area regional desalination plant ▪ No water transfer agreements with TID and MID ▪ Agreements with California Department of Health Services for any new drinking water sources	Same as proposed program except: ▪ Agreements for participation in regional recycled water / conservation/ local groundwater projects that could offset SFPUC supply

Italic text indicates expected action by wholesale customers.

[1] In this alternative the water transfer of conserved water would be acquired for use every year, not just for dry-year supplement; this would avoid all impacts below La Grange Dam associated with the SFPUC's increased diversion of Tuolumne River water.

SOURCE: SFPUC, 2007b.

TABLE 9-5
AVERAGE ANNUAL TUOLUMNE RIVER DIVERSIONS AND DROUGHT-YEAR SHORTAGES FOR THE CEQA ALTERNATIVES (2030)

Program/Alternative	Estimated Tuolumne River Diversions Over the 82-Year Period of Hydrologic Record		Drought-Year Shortages Based on 82-Year Period of Hydrologic Record				Drought-Year Shortages During Design Drought (8.5 years)		
	Average Annual Increase by the SFPUC[1] (mgd)	Average Annual Diversions by the SFPUC (mgd)	Years of Shortages (10% Shortage)	Years of Shortages (20% Shortage)	Years of Shortages >20% Shortage)	No. of Years Drought-Year Supplies Triggered	Years of Shortages (10% Shortage)	Years of Shortages (20% Shortage)	Years of Shortages (25% to 30% Shortage)
Existing Conditions	N/A	218	6 out of 82 (1 in 14 years)	8 out of 82 (1 in 10 years)	None	N/A	1	5	1.5
Proposed Program	27	245	6 out of 82 (1 in 14 years)	2 out of 82 (1 in 41 years)	None	24	3	3.5	None
No Program Alternative	8	226	24 out of 82 (1 in 3 years)	10 out of 82 (1 in 8 years)	8 out of 82 (1 in 10 years)	No drought supplies. Rationing would be needed 42 out of 82 years	0	1	6.5
No Purchase Request Increase Alternative	3	221	9 out of 82 (1 in 9 years)	2 out of 82 (1 in 41 years)	None	17	3	3.5	None
Aggressive Conservation/Water Recycling and Local Groundwater Alternative – No Supplemental Tuolumne River Water	0	218	N/A	N/A	15 at 25%	There are no supplemental drought supplies	N/A	N/A	7.5
Aggressive Conservation/Water Recycling and Local Groundwater Alternative – With Supplemental Tuolumne River Water	5	223	7 out of 82 (1 in 12 years)	8 out of 82 (1 out of 10 years)	None	There are no supplemental drought supplies	1	6.5	None
Lower Tuolumne River Diversion	27	245	6 out of 82 (1 in 14 years)	2 out of 82 (1 in 41 years)	None	24	3	3.5	None
Year-round Desalination at Oceanside Alternative	0	218	6 out of 82 (1 in 14 years)	2 out of 82 (1 in 41 years)	None	24	3	3.5	None
Regional Desalination for Drought Alternative (Variant 2)	20	238	6 out of 82 (1 in 14 years)	2 out of 82 (1 in 41 years)	None	23	3	3.5	None
Modified WSIP Alternative (assumes no reduction in WSIP levels of service performance	~27	~245	Approximately the same as the WSIP				Approximately the same as the WSIP		None

[1] Represents the difference in average annual diversion modeled over 82-year historical hydrology, but does not represent year-to-year variation. Thus, even with zero average annual increase in diversions, there would still be year-to-year variations in diversions compared to the existing condition due primarily to modified system operations for maintenance and implementation of the conjunctive use program.

TABLE 9-6
SUMMARY OF ABILITY OF ALTERNATIVES TO MEET PROGRAM OBJECTIVES[1]

Objectives	Proposed Program	No Program Alternative	No Purchase Request Increase Alternative	Aggressive Conservation/Water Recycling and Local Groundwater Alternative		Lower Tuolumne River Diversion Alternative	Year-round Desalination at Oceanside Alternative	Regional Desalination for Drought Alternative	Modified WSIP Alternative
				No Supplemental Tuolumne River Water	With Supplemental Tuolumne River Water				
Water Quality									
Design improvements to meet current and foreseeable future federal and state water quality requirements?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Provide clean, unfiltered water originating from Hetch Hetchy Reservoir and filter all other surface water sources?	Yes	Yes	Yes	Yes	Yes	Partial	Yes	Yes	Yes
Continue to implement watershed protection measures?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Seismic Reliability									
Complies with current seismic standards?	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Capable of delivering basic service to all regions in the service area following a major earthquake?	Yes	No	Partial	Uncertain	Uncertain	Uncertain	Yes	Yes	Yes
Facilities restored to meet average-day demand within 30 days of a major earthquake?	Yes	No	Partial	Partial	Partial	Partial	Yes	Yes	Yes
Delivery Reliability									
Provides operational flexibility to allow for planned maintenance without service interruptions?	Yes	No	Yes	Yes	Yes	Partial	Partial	Yes	Yes
Provides operational flexibility and system capacity to replenish local reservoirs, as needed?	Yes	No	Yes	Uncertain	Uncertain	Uncertain	Yes	Yes	Yes
Capable of minimizing risk of service interruption due to unplanned facility upsets or outages?	Yes	No	Yes	Uncertain	Uncertain	Uncertain	Yes	Yes	Yes

TABLE 9-6 (continued)
SUMMARY OF ABILITY OF ALTERNATIVES TO MEET PROGRAM OBJECTIVES

Objectives	Proposed Program	No Program Alternative	No Purchase Request Increase Alternative	Aggressive Conservation/Water Recycling and Local Groundwater Alternative		Lower Tuolumne River Diversion Alternative	Year-round Desalination at Oceanside Alternative	Regional Desalination for Drought Alternative	Modified WSIP Alternative
				No Supplemental Tuolumne River Water	With Supplemental Tuolumne River Water				
Delivery Reliability (cont.)									
Capable of serving average 2030 demand of 300 mgd with one planned shutdown of a major facility and one unplanned facility outage?	Yes	No	Partial	Uncertain	Uncertain	Uncertain	Yes	Yes	Yes
Water Supply									
Meets average annual purchase requests of 300 mgd during nondrought years for system demands through 2030?	Yes	Partial	No, 275 mgd	No, 294 mgd	Yes	Yes	Yes	Yes	Yes
Meets 20% systemwide rationing limit during droughts?	Yes	No	Partial	No	Uncertain	Yes	Yes	Yes	Yes
Meets system firm yield of 256 mgd?	Yes	No	No	No	No	Yes	Yes	Yes	Yes
Diversifies water supply options during nondrought and drought periods?	Yes	No	Yes	Partial	Partial	Yes	Yes	Yes	Yes
Improves use of new water sources and drought management, including use of groundwater, recycled water, conservation, and transfers?	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sustainability									
Manages natural resources and physical systems to protect watershed ecosystems?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Meets current and anticipated legal requirements for protection of fish and other wildlife habitat?	Yes	Yes	Yes	Yes	Yes	Uncertain	Uncertain	Uncertain	Yes
Manages natural resources and physical systems to protect public health and safety?	Yes	No	Yes	Yes	Yes	Uncertain	Uncertain	Uncertain	Yes

TABLE 9-6 (continued)
SUMMARY OF ABILITY OF ALTERNATIVES TO MEET PROGRAM OBJECTIVES

Objectives	Proposed Program	No Program Alternative	No Purchase Request Increase Alternative	Aggressive Conservation/Water Recycling and Local Groundwater Alternative		Lower Tuolumne River Diversion Alternative	Year-round Desalination at Oceanside Alternative	Regional Desalination for Drought Alternative	Modified WSIP Alternative
				No Supplemental Tuolumne River Water	With Supplemental Tuolumne River Water				
Cost-effectiveness									
Ensure cost-effective use of funds?	Yes	No and likely greater cost	Unknown, but greater cost	Unknown, but greater cost	Unknown, but greater cost	Unknown, but greater cost	Unknown, but greater cost	Unknown, but greater cost	Same, but greater cost
Maintains gravity-driven system?	Yes	Yes	Yes	Partial	Partial	Partial	Partial	Partial	Partial
Implement regular inspection and` maintenance program for all facilities?	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes

NOTES: 1. This assessment is based on SFPUC actions under each alternative only and does not account for the actions that BAWSCA and/or the wholesale customers might take in order to make up for any shortfall in the regional system's ability to meet the program objectives. See text for full discussion of ability of each alternative to meet objectives. In general, the terms in the table are used as follows:

Yes: Indicates that the alternative would fully meet the sub-objective at an equivalent level to the WSIP.

Partial: Indicates that the alternative could meet the objective in part, but it would not fully meet the objective at an equivalent level to the WSIP, due to variation associated with an alternative such as the reduced delivery targets, increased facility requirements and associated issues.

No: Indicates the alternative would not meet the sub-objective.

Uncertain: Indicates that there are outstanding questions regarding supply availability and reliability; feasibility, cost or other issues that require further study; and/or institutional, regulatory or permitting issues to be resolved.

TABLE 9-7
SUMMARY OF SIGNIFICANT WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR CEQA ALTERNATIVES – TUOLUMNE RIVER WATERSHED

Impact	Proposed Program	No Program Alternative	No Purchase Request Increase Alternative	Aggressive Conservation/Water Recycling and Local Groundwater Alternative		Lower Tuolumne River Diversion Alternative	Year-round Desalination at Oceanside Alternative	Regional Desalination for Drought Alternative	Modified WSIP Alternative
				No Supplemental Tuolumne River Water	With Supplemental Tuolumne River Water				
Section 5.3.6, Fisheries									
Impact 5.3.6-4: Effects on fishery resources along the Tuolumne River below La Grange Dam									
	In wet or above-normal years when Don Pedro Reservoir is being filled, changes in the timing and duration of releases from the reservoir would decrease average monthly flows along the lower Tuolumne River beneath La Grange Dam. The greatest average flow reductions would occur during June and could potentially result in elevated water temperatures. Changes to stream flow and water temperature would result in a reduction in the linear extent of suitable habitat for rearing Chinook salmon and oversummering steelhead/rainbow trout, potentially adversely affecting these fish populations in the lower Tuolumne River. (PSM)	Similar to but less than proposed program. (PSM)	Similar to but much less than proposed program. (LS)	Similar to existing condition. (LS)	Similar to but much less than proposed program. (LS)	Similar to proposed program. (PSM)	Similar to existing condition. (LS)	Similar to but less than proposed program (PSM)	Similar to existing condition (LS)
Section 5.3.7, Terrestrial Biological Resources									
Impact 5.3.7-2: Impacts on meadow / alluvial features along the Tuolumne River below O'Shaughnessy Dam									
▪ Sensitive habitats	Delayed snowmelt releases, reductions in flow, and the resulting reduction in groundwater recharge would result in an incremental reduction in the extent and diversity of wetland and riparian habitats, including sensitive wetland and riparian habitats in the Poopenaut Valley. (PSM)	Similar to but less than proposed program. (PSM)	Similar to but less than proposed program. (PSM)	Similar to but less than proposed program. (PSM)	Similar to but less than proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to but less than proposed program. (PSM)	Similar to proposed program (PSM)	Similar to proposed program (PSM)
▪ Key special status species	A reduction in wetland and riparian habitat would reduce suitable breeding habitat for key special-status species potentially occurring along this reach (e.g., foothill yellow-legged frog, California red-legged frog, and willow flycatcher), the populations of which are already critically reduced in the Sierra Nevada. (PSM)	Similar to but less than proposed program. (PSM)	Similar to but less than proposed program. (PSM)	Similar to but less than proposed program. (PSM)	Similar to but less than proposed program. (PSM)	Similar proposed program. (PSM)	Similar to but less than proposed program. (PSM)	Similar to proposed program (PSM)	Similar to proposed program (PSM)
▪ Other species of concern	A reduction in the extent and diversity of wetland and riparian habitats would reduce habitat quality and extent for animal and plant species of concern. (PSM)	Similar to but less than proposed program. (PSM)	Similar to but less than proposed program. (PSM)	Similar to but less than proposed program. (PSM)	Similar to but less than proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to but less than proposed program. (PSM)	Similar to proposed program (PSM)	Similar to proposed program (PSM)
▪ Common habitats and species	All habitats affected by the WSIP are considered sensitive. A large number of common animal species depend on sensitive meadows and larger riparian areas potentially affected by the WSIP for food and cover. (PSM)	Similar to but less than proposed program. (PSM)	Similar to but less than proposed program. (PSM)	Similar to but less than proposed program. (PSM)	Similar to but less than proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to but less than proposed program. (PSM)	Similar to proposed program (`PSM)	Similar to proposed program (PSM)
Impact 5.3.7-6: Impacts on biological resources along Tuolumne River below La Grange Dam									
▪ Sensitive habitats	Delayed spring releases and reductions in average and total flow (particularly during and following an extended drought) below La Grange Dam would reduce or eliminate suitable conditions for recruitment of some riparian species along the river. (PSM)	Similar to but less than proposed program. (PSM)	Similar to but much less than proposed program. (LS)	Similar to existing condition. (LS)	Similar to but much less than proposed program. (LS)	Similar to proposed program. (PSM)	Similar to existing condition. (LS)	Similar to but less than proposed program (PSM)	Similar to existing condition (LS)
▪ Key special status species	Because of the known presence of key special-status species and the very limited amount of remaining suitable habitat along this reach of the Tuolumne River, this incremental impact would be potentially significant. (PSM)	Similar to but less than proposed program. (PSM)	Similar to but much less than proposed program. (LS)	Similar to existing condition. (LS)	Similar to but much less than proposed program. (LS)	Similar to proposed program. (PSM)	Similar to existing condition. (LS)	Similar to but less than proposed program (PSM)	Similar to existing condition (LS)
▪ Other species of concern	Species of concern that would be adversely affected by changes in the extent and quality of suitable riparian habitat include western pond turtle, several bat species, and a wide variety of riparian- and marsh-associated bird species. (PSM)	Similar to but less than proposed program. (PSM)	Similar to but much less than proposed program. (LS)	Similar to existing condition. (LS)	Similar to but much less than proposed program. (LS)	Similar to proposed program. (PSM)	Similar to existing condition. (LS)	Similar to but less than proposed program (PSM)	Similar to existing condition (LS)
▪ Common habitats and species	The populations of common species that depend on riparian habitat could be adversely affected by the alteration of habitat. (PSM)	Similar to but less than proposed program. (PSM)	Similar to but much less than proposed program. (LS)	Similar to existing condition. (LS)	Similar to but much less than proposed program. (LS)	Similar to proposed program. (PSM)	Similar to existing condition. (LS)	Similar to but less than proposed program (PSM)	Similar to existing condition (LS)

LS = Less than Significant, no mitigation required
SM or PSM = Significant or Potentially Significant, can be Mitigated to less than significant
SU or PSU = Significant Unavoidable or Potentially Significant Unavoidable, cannot be mitigated to less than significant

TABLE 9-8
SUMMARY OF SIGNIFICANT WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR CEQA ALTERNATIVES – ALAMEDA WATERSHED

Impact	Proposed Program	No Program Alternative	No Purchase Request Increase Alternative	Aggressive Conservation/Water Recycling and Local Groundwater Alternative		Lower Tuolumne River Diversion Alternative	Year-round Desalination at Oceanside Alternative	Regional Desalination for Drought Alternative	Modified WSIP Alternative
				No Supplemental Tuolumne River Water	With Supplemental Tuolumne River Water				
Section 5.4.1, Stream Flow and Reservoir Water Levels									
Impact 5.4.1-2: Effects on flow along Alameda Creek below diversion dam.									
	In all year types, system operations under the WSIP would increase diversions from Alameda Creek to Calaveras Reservoir between the months of December and May, nearly eliminating low and moderate (1 to 650 cubic feet per second) flows in Alameda Creek downstream of the diversion dam and substantially reducing many higher (greater than 650 cubic feet per second) flows that have occurred since 2002. The resultant reduction in stream flows and alteration of the stream hydrograph is considered an adverse effect. (SU)	Similar to proposed program, but winter diversions from Alameda Creek would be greater. (SU)	Similar to proposed program, but winter diversions would be slightly less. (SU)	Similar to proposed program, but winter diversions would be slightly less. (SU)	Similar to proposed program, but winter diversions would be slightly less. (SU)	Similar to proposed program. (SU)	Similar to proposed program. (SU)	Similar to proposed program (SU)	Similar to proposed program (SU)
Section 5.4.5, Fisheries									
Impact 5.4.5-3: Effects on fishery resources.									
	Following implementation of the Calaveras Dam Replacement project (SV-2), operation of Calaveras Reservoir and the Alameda Creek Diversion Dam would be restored to pre-2002 conditions. A substantial increase in diversions from Alameda Creek to Calaveras Reservoir would reduce flows in this stretch of the creek. Diversion of most or all flows during late winter and spring months would reduce the ability of resident rainbow trout to spawn and for eggs to incubate. In addition, the increased diversion of flows to the reservoir would divert fish from Alameda Creek to the reservoir, prevent fish passage to downstream reaches of the creek, and increase the potential for fish entrainment since there are currently no screens on the diversion. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program (PSM)	Much less than proposed program (LS)
Section 5.4.6, Terrestrial Biological Resources									
Impact 5.4.6-1: Impacts on riparian habitat and related biological resources in Calaveras Reservoir.									
▪ Sensitive Habitats	Increased reservoir storage elevations would result in inundation and permanent loss of seasonal wetlands, seeps, perennial freshwater marsh, and riparian habitat that have established since 2002. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program (PSM)	Same as proposed program (PSM)
▪ Key Special Status species	Since 2002, yellow-legged frogs have occupied approximately 10,000 linear feet of stream channel along Arroyo Hondo between the maximum reservoir elevation mandated by the Division of Safety of Dams and the spillway elevation. Higher maintained reservoir levels would reduce the length of this high-quality habitat along the creek and adversely affect existing populations of foothill yellow-legged frog. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program (PSM)	Same as proposed program (PSM)
Impact 5.4.6-2: Effects on riparian habitat and related biological resources along Alameda Creek from below the diversion dam to the confluence with Calaveras Creek.									
▪ Key special status species	A reduction in the frequency, duration, and magnitude of flows below the diversion dam would reduce the total available aquatic breeding habitat and food sources for California red-legged frog and foothill yellow-legged frog populations that currently occupy this reach of Alameda Creek. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program (PSM)	Similar to proposed program (PSM)
Impact 5.4.6-3: Effects on riparian habitat and related biological resources along Calaveras Creek from Calaveras Reservoir to the confluence with Alameda Creek.									
▪ Key special status species	Future outlet works at Calaveras Dam would have the capacity to make higher volume releases than under existing conditions. Depending on the timing and volume of operational releases, they could adversely affect the reproductive success of special-status amphibian species along this reach (e.g., California red-legged frog and foothill yellow-legged frog). (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program (PSM)	Similar to proposed program (PSM)
Impact 5.4.6-4: Effects on riparian habitat and related biological resources along Alameda Creek from Calaveras Creek to San Antonio Creek,									
▪ Key special status species	Depending on annual rainfall and localized site conditions along this creek segment, changes in winter and summer flows along this reach could result in both beneficial and adverse impacts on habitat for California red-legged frog and foothill yellow-legged frog populations. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program (PSM)	Similar to proposed program (PSM)

TABLE 9-8 (continued)
SUMMARY OF SIGNIFICANT WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR CEQA ALTERNATIVES – ALAMEDA WATERSHED

Impact	Proposed Program	No Program Alternative	No Purchase Request Increase Alternative	Aggressive Conservation/Water Recycling and Local Groundwater Alternative		Lower Tuolumne River Diversion Alternative	Year-round Desalination at Oceanside Alternative	Regional Desalination for Drought Alternative	Modified WSIP Alternative
				No Supplemental Tuolumne River Water	With Supplemental Tuolumne River Water				
Section 5.4.7, Recreational and Visual Resources									
Impact 5.4.7-1: Effects on recreation									
	Operations under the WSIP would substantially reduce flows along Alameda Creek in the Sunol Regional Wilderness during winter and early spring months and adversely affect the recreational experience of hikers. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program (PSM)	Much less than proposed program (LS)
Impact 5.4.7-2: Visual effects									
	WSIP-induced reductions in stream flows along Alameda Creek would substantially change the quality of visual resources in the Sunol Regional Wilderness. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program (PSM)	Much less than proposed program (LS)

LS = Less than Significant, no mitigation required
SM or PSM = Significant or Potentially Significant, can be Mitigated to less than significant
SU or PSU = Significant Unavoidable or Potentially Significant Unavoidable, cannot be mitigated to less than significant

TABLE 9-9
SUMMARY OF SIGNIFICANT WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR CEQA ALTERNATIVES – PENINSULA WATERSHED

Impact	Proposed Program	No Program Alternative	No Purchase Request Increase Alternative	Aggressive Conservation/Water Recycling and Local Groundwater Alternative		Lower Tuolumne River Diversion Alternative	Year-round Desalination at Oceanside Alternative	Regional Desalination for Drought Alternative	Modified WSIP Alternative
				No Supplemental Tuolumne River Water	With Supplemental Tuolumne River Water				
Section 5.5.3, Surface Water Quality									
Impact 5.5.3-2: Water quality in Pilarcitos Reservoir									
	Operations under the WSIP would increase summer drawdown of Pilarcitos Reservoir and could cause the reservoir to destratify earlier in the season, which could improve water quality. However, the ability of the reservoir to support cold freshwater habitat could be reduced due to a reduced volume of cool water below the thermocline. During dry years, summertime releases from Pilarcitos Reservoir to Pilarcitos Creek would be eliminated or reduced to a low level for a longer period of time with the WSIP, which would increase the temperature of instream flows between Pilarcitos Creek and Stone Dam and reduce the creek's ability to support designated cold freshwater habitat along this reach. (PSM)	Similar to proposed program. (PSM)	Similar to but much less than proposed program. (LS)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program (PSM)	Similar to existing condition (LS)
Section 5.5.5, Fisheries									
Impact 5.5.5-1: Effects on fishery resources in Crystal Springs Reservoir									
	Elevated water levels in Crystal Springs Reservoir would inundate approximately 1,500 linear feet of trout spawning habitat upstream of the reservoir along Laguna and San Mateo Creeks. (PSU)	Same as proposed program. (PSU)	Same as proposed program. (PSU)	Same as proposed program. (PSU)	Same as proposed program. (PSU)	Same as proposed program. (PSU)	Same as proposed program. (PSU)	Same as proposed program (PSU)	Similar to proposed program (PSU)
Impact 5.5.5-4: Effects on fisheries resources in Pilarcitos Reservoir									
	Reduction in average monthly storage in Pilarcitos Reservoir would reduce the volume of coldwater habitat available for resident fish species. (PSM)	Similar to proposed program. (PSM)	Similar to but much less than proposed program. (LS)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program (PSM)	Similar to existing condition (LS)
Impact 5.5.5-5: Effects on fisheries resources along Pilarcitos Creek below Pilarcitos Reservoir									
	Under the WSIP, the extended period of no or very little flow in Pilarcitos Creek below Pilarcitos Reservoir during summer months of dry years would result in significant impacts on resident trout, other resident fish species and aquatic resources, and habitat quality and availability for anadromous steelhead. Increased drawdown of Pilarcitos Reservoir would increase the temperature of releases in summer and fall and reduce the quality and availability of habitat for coldwater fish species. A reduction in the frequency and magnitude of spills over Stone Dam would reduce flows along the lower reach. Reduced instream flows during winter months would adversely affect migratory fish habitat. (PSM)	Similar to proposed program. (PSM)	Similar to but less than proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program (PSM)	Similar to existing condition (LS)
Section 5.5.6, Terrestrial Biological Resources									
Impact 5.5.6-1: Impacts on biological resources in Upper and Lower Crystal Springs Reservoirs									
▪ Sensitive Habitats	Implementation of the Lower Crystal Springs Dam Improvements project (PN-4) would raise average monthly water levels in Crystal Springs Reservoir and result in a short-term reduction in the overall extent of freshwater marsh as the reservoir fills. Proposed changes in operations would maintain maximum reservoir levels during summer for longer periods than under existing conditions, which could affect the composition and structure of riparian habitats. In addition, sensitive upland habitats that are unable to tolerate these longer periods of inundation would be lost. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program (PSM)	Similar to pre-1983 conditions (LS)
▪ Key special status species	Elevated reservoir levels would inundate existing populations of special-status plant species, including serpentine-associated fountain thistle and Marin western flax, and their habitat could be permanently lost. The extent of available habitat for San Francisco garter snake and California red-legged frog would be temporarily reduced during reservoir refill, but wetland habitat that would establish at higher elevations could potentially be more extensive. Raised reservoir levels would provide greater opportunities for largemouth bass and other predators to access frogs and snakes. Periodic drawdown during planned maintenance could adversely affect San Francisco garter snake foraging habitat. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program (PSM)	Similar to pre-1983 conditions (LS)

TABLE 9-9 (Continued)
SUMMARY OF SIGNIFICANT WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR CEQA ALTERNATIVES – PENINSULA WATERSHED

Impact	Proposed Program	No Program Alternative	No Purchase Request Increase Alternative	Aggressive Conservation/Water Recycling and Local Groundwater Alternative		Lower Tuolumne River Diversion Alternative	Year-round Desalination at Oceanside Alternative	Regional Desalination for Drought Alternative	Modified WSIP Alternative
				No Supplemental Tuolumne River Water	With Supplemental Tuolumne River Water				
Section 5.5.6, Terrestrial Biological Resources (cont.)									
▪ Other species of concern	Changes in wetland habitat due to reservoir refill and proposed operations would adversely affect reptile and bird species of concern, particularly if permanent changes in the composition of wetland vegetation occur. Permanent loss of upland habitat, including upland trees, grassland, and coastal scrub, would result in significant impacts on several bird and mammal species of concern. Serpentine- and grassland-associated plant species unable to tolerate extended periods of inundation would be lost. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program (PSM)	Similar to pre-1983 conditions (LS)
▪ Common Habitats and species	Due to the extent of area involved, impacts on common habitats and species would be significant. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program (PSM)	Similar to pre-1983 conditions (LS)
Impact 5.5.6-4: Impacts on biological resources in Pilarcitos Reservoir									
▪ Key special status species	Proposed operations could reduce the extent of suitable habitat for California red-legged frog and San Francisco garter snake. Special-status species that utilize adjacent upland vegetation would not be affected. (PSM)	Similar to proposed program. (PSM)	Similar to but much less than proposed program. (LS)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program (PSM)	Similar to existing condition (LS)
Impact 5.5.6-5: Impacts on biological resources along Pilarcitos Creek									
▪ Sensitive habitats	In summer months of dry years, an extended period of no or little flow would stress or kill riparian vegetation. (PSM)	Similar to proposed program. (PSM)	Similar to but much less than proposed program. (LS)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program (PSM)	Similar to existing condition (LS)

LS = Less than Significant, no mitigation required
SM or PSM = Significant or Potentially Significant, can be Mitigated to less than significant
SU or PSU = Significant Unavoidable or Potentially Significant Unavoidable, cannot be mitigated to less than significant

9.2.2 No Program Alternative

The No Program Alternative is the scenario that would most likely unfold between now and 2030 if the WSIP were not implemented. CEQA Guidelines Section 15126.6(e) provides the following guidance on the "no project" alternative:

- The specific alternative of "no project" shall also be evaluated along with its impact. The purpose of describing and analyzing a no project alternative is to allow decision-makers to compare the impacts of approving the proposed project with the impact of not approving the proposed project.

- The no project alternative is not the baseline for determining whether the proposed project's environmental impacts may be significant, unless it is identical to the existing environmental setting analysis, which does establish that baseline.

- The no project analysis shall discuss the existing conditions at the time the Notice of Preparation is published as well as what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services.

- When the proposed project is the revision of an ongoing operation, the no project alternative will be the continuation of the existing operation into the future.

- If the proposed project is a development project on identifiable property, the no project alternative is the circumstance under which the project does not proceed.

Consistent with the above guidance, the No Program Alternative reflects continued operation of the regional system and system upgrades and maintenance as well as implementation of actions that are reasonably expected to occur if the WSIP as a comprehensive program or policy is not approved. Compared to the WSIP this alternative would develop less in terms of new water supplies for the regional system and would implement far fewer of the proposed facility improvement project.

Description of SFPUC and Wholesale Customer Actions

SFPUC Actions

Under the No Program Alternative, the SFPUC would continue to rely on water supply sources from local watersheds and the Tuolumne River. Similar to existing conditions, the SFPUC would have no supplemental dry-year water supply sources and there would be no diversification of water supply sources from groundwater development, recycled water projects, water transfers, or additional conservation beyond what is occurring now and what is mandated by regulation (i.e., the plumbing code). This alternative assumes that the SFPUC would endeavor to serve the projected 2030 increase in purchase requests when water is available. The additional water demand would be served from increased diversions from the Tuolumne River under the City and County of San Francisco's (CCSF) existing water rights as well as increased use of local watershed supplies, primarily associated with the restoration of Calaveras and Lower Crystal Springs Reservoirs (discussed below). Under the No Program Alternative, the SFPUC would continue its existing operation of the regional water system and associated facilities, including

compliance with all regulatory requirements and ongoing system maintenance. Thus, under this alternative, it is assumed that by 2030 the SFPUC would implement the following WSIP facility improvement projects that have been mandated or previously agreed to by regulatory agencies:

- *Advanced Disinfection (SJ-1)*. This project must be implemented to comply with the Long Term 2 Enhanced Surface Water Treatment Rule under the federal Safe Drinking Water Act.

- *Alameda Creek Fishery (SV-1)*. This water recapture project would ensure compliance with the 1997 Memorandum of Understanding (MOU) between the SFPUC and California Department of Fish and Game (described in Chapter 2, Section 2.5.3) following completion of the Calaveras Dam project (SV-2). The MOU, which stipulates the magnitude and timing of flows released from Calaveras Reservoir for the purpose of improving habitat conditions for fisheries along Alameda and Calaveras Creeks, also states that the water released to meet minimum flow requirements may be recaptured downstream for consumptive use in the SFPUC service area. Although the Alameda Creek Fishery project would not in itself increase the firm yield of the system, it is necessary to avoid the loss of yield associated with fishery releases from Calaveras Reservoir.

- *Calaveras Dam (SV-2)*. The existing dam is currently operating under California Division of Safety of Dams (DSOD) interim restrictions, as described in Chapter 2, Section 2.2.3. The DSOD restrictions include maximum operating levels, with the provision that the SFPUC pursue an aggressive schedule for remediation of Calaveras Dam. Therefore, long-term operation of the reservoir at this restricted level is not an option (Verigin, 2003). The proposed replacement dam would not increase the delivery capacity of the regional water system above its historical (pre-2002) value and would restore the reservoir's operating storage to the level allowed before the DSOD placed restrictions on the reservoir. Use of local watershed supplies provided by Calaveras Dam and Reservoir is a fundamental part of the SFPUC's existing system operations, and restoring Calaveras Reservoir to historical storage levels is thus considered a continuation of the existing operation into the future.

- *Treated Water Reservoirs (SV-5)*. This project is needed in order to comply with requirements of the California Department of Health Services for water quality and public health purposes.

- *Lower Crystal Springs Dam (PN-4)*. The DSOD has placed operational restrictions on Lower Crystal Springs Dam due to concerns regarding the ability of the dam to provide adequate protection from the probable maximum flood (described in Chapter 2, Section 2.2.5). The DSOD has indicated that if the SFPUC does not implement improvements to the dam, it would likely impose further, more severe restrictions on reservoir operations due to updated calculations of the probable maximum flood (Mavroudis, 2007). The extent of these more severe restrictions would result in substantial adverse effects on water supply and delivery reliability and reduce existing water quality reliability, severely limiting continuation of existing system operations into the future.

Implementation of the above projects would be subject to environmental review under CEQA as determined by the San Francisco Planning Department. However, if any of the regional system facilities were to fail in the future, such as in the event of an earthquake or other disaster, the SFPUC would proceed with the necessary emergency repairs/replacements, which may not be subject to CEQA, and those repairs or replacements would be conducted on an individual basis and not as part of a comprehensive and coordinated program. The No Program Alternative also

assumes that the SFPUC would proceed with implementation of other capital improvement projects and related activities funded under the WSIP but not considered part of the program analyzed in this PEIR (as described in Chapter 3, Sections 3.13 and 3.4.6). Under the No Program Alternative, it is assumed that the SFPUC would continue to maintain water sales agreements with wholesale and retail customers to meet the supply assurance of 184 mgd and make further sales to the wholesale customers on an interruptible, as-available basis to reduce the rate impact on City retail customers.

If the SFPUC were to adopt a change in the proposed program, such as the No Program Alternative, the CCSF would be required to submit an explanation to the California Department of Health Services and the Seismic Safety Commission as described in Assembly Bill No. 1823 (the Wholesale Regional Water System Security and Reliability Act).

Wholesale Customer Actions

As described in more detail below under Ability to Meet Program Objectives, the regional water system would have reduced seismic, delivery, and water supply reliability under the No Program Alternative compared to the WSIP. According to hydrologic modeling, regional system customers could experience water shortages as often as every one in two years (refer to Table 9-5) compared to one in ten years for the proposed program, and wholesale customers (as well as retail customers) would likely need to implement water rationing, up to 30 percent.

The wholesale customers have obligations, through laws, contracts, and other legal instruments, to provide water service to their customers. The ability of wholesale customers to impose limits on urban growth as a means of controlling demand is limited. Consequently, in the absence of reliable water service from the SFPUC, the wholesale customers would likely pursue other projects, either individually or collectively,[2] to meet their water needs for both drought and nondrought periods. Numerous factors inhibit the ability of the wholesale customers to address the decreased reliability associated with this alternative, including the following:

- The WSIP addresses sudden (emergency) as well as gradual changes in water availability. The ability of the wholesale customers to meaningfully influence the reliability of their water supplies is very limited in the event of emergency conditions (for example, if part of the regional system failed due to an earthquake). Under the No Program Alternative, most of the key projects needed to improve the seismic reliability would not be implemented.

- Water demand among all customers is highest when supplies are most constrained (i.e., during dry years and warm-weather periods) and therefore more difficult to secure. Securing water supplies in California is increasingly difficult, particularly in dry years, as overall demand increases and conflicts among competing interests for water supply arise.

- A major new water supply project can take as many as 20 to 25 years to complete (Johnson and Loux, 2004).

[2] Bay Area Water Supply and Conservation Agency (BAWSCA) has the authority to pursue and secure water supplies on behalf of the SFPUC wholesale customers (its members) as well as to coordinate recycled water and conservation projects to benefit its members. While it is likely that BAWSCA would lead any effort to secure water supplies, either BAWSCA or individual SFPUC wholesale customer agencies could pursue such actions.

- Some wholesale customers are wholly reliant on SFPUC for water, whereas others have multiple sources of supplies. Customers with diverse water supply portfolios would likely have more flexibility to augment supplies from sources other than the SFPUC. Under existing conditions, the SFPUC meets more than 50 percent of the demand for all but three of the wholesale customers; 16 wholesale customers rely entirely on the SFPUC for water purchases to meet existing demand.

- The wholesale customers' purchase requests already include a foreseeable level of increased conservation and recycling in addition to existing conservation and recycling. (The next subsection describes the opportunities for, and challenges to implementing, aggressive conservation and recycling programs.)

- The current urban water management plans for the wholesale customers do not address the issue of developing substitute supplemental supplies, since the customers anticipate receiving and have requested supplemental supply from the SFPUC.

In short, the ability of the wholesale customers to develop additional water supplies is uncertain, and further studies would be required to evaluate technical and institutional feasibility. Determining (a) the specific projects that each wholesale customer would pursue and (b) the likelihood that the wholesale customers could successfully implement the projects is speculative and outside the control of the SFPUC. A discussion of representative projects that the wholesale customers might pursue is presented below. This discussion is intended to provide decision-makers and other interested parties with information about the potential options that exist, the challenges associated with each, and attendant environmental impacts.

The basic water management strategies that the wholesale customers could pursue to offset the severely reduced reliability under the No Program Alternative involve increasing supplies and decreasing demand. Among the options associated with these strategies are water purchases or transfers, groundwater management/use, aggressive recycling and conservation, and desalination. Water purchases/transfers and conjunctive use are discussed below. Currently, some of the wholesale customers are already actively developing recycled water/groundwater/ conservation projects to address their increasing demands and it is assumed that the wholesale customers will continue to do so in the future. Additional aggressive recycling, groundwater, and conservation is described separately under its own alternative (presented in Section 9.2.4). Similarly, there are two separate alternatives addressing desalination (presented in Sections 9.2.6 and 9.2.7).

Regarding water purchases or transfers, statewide trends indicate that while urban water use is increasing, agricultural water use is decreasing, in part because agricultural water users are selling water rights or contracts to urban agencies (Department of Water Resources, 2005). Potential sources of supplies for the wholesale customers include water-rights holders north of the Delta, in the Delta, or south of the Delta. The agencies with the rights to the greatest quantities of water in the state, the U.S. Bureau of Reclamation (USBR) and California Department of Water Resources (DWR), would not be sources of new water supply contracts/agreements because of their commitments to existing contractors and to the protection, restoration, and enhancement of fish and wildlife habitat. Challenges to water purchases and transfers pertain to restrictions associated with entitlements, contracts, and water rights; permitting requirements; effects caused by the cessation of water application to an area (e.g., land fallowing, economic impacts); Delta pumping

restrictions; and wheeling arrangements[3] (Johnson and Loux, 2004). Existing water delivery infrastructure could theoretically be used through agreements with other agencies (such DWR, USBR, SFPUC, East Bay Municipal Utility District, Alameda County Water District, or Santa Clara Valley Water District) to convey water to the wholesale customers, if and when system capacity is available. Construction or expansion of interties or connecting pipelines in urban areas would likely be required.

A supplemental water supply must be available concurrent with annual and seasonal demands or must be stored during periods of adequate supply and low demand. An agency could pursue its own storage project, either through conjunctive use of a groundwater basin or through construction of a new storage facility. Conjunctive use of a groundwater basin is likely a potential option only for agencies that currently utilize groundwater. Review of current urban water management plans for the wholesale customers indicates that seven customers currently rely on groundwater for part of their supply; however, the ability of these agencies to implement additional conjunctive-use projects beyond any existing or planned projects to help offset any supply shortfall under this alternative is uncertain. Challenges to implementing conjunctive-use projects pertain to the sustainable yield of the groundwater basin, restrictions on appropriative rights, and existing regional and local groundwater management policies, ordinances, and practices. Regarding construction of new storage facilities for surface water supplies, very few agencies have constructed major reservoirs in Northern California in recent decades due to ecological impacts, cost, availability of suitable sites, and other issues, although several proposals to increase storage at existing reservoirs that provide water to the Bay Area are currently under study. The ability of a wholesale customer to acquire, through agreements with other agencies, use of a portion of an existing storage facility is uncertain; the terms of such agreements favor the dry-year and seasonal supply needs of the reservoir owner/operator. A key issue associated with use of existing storage is whose water spills first and is therefore “lost” before it can be used.

Feasibility Issues

While the No Program Alternative would present no engineering or technical feasibility issues, it would raise some fundamental institutional issues regarding the ability of the SFPUC to fulfill its basic mission to provide reliable, high quality and affordable water to its customers. The No Program Alternative would place the regional system at significant risk to seismic hazards, increased facility failures, and increased supply shortages on a day-to-day basis, as well as result in prolonged service disruptions to many customers in the event of an earthquake or other emergency due to inadequate facility redundancy and operational flexibility. The SFPUC customers would likely seek alternatives, as described above, and it is unlikely that the public would support this alternative. In addition, this alternative could add substantial long-term costs due to the increased likelihood of facility failures and increased need for emergency repairs or replacement in the event of an earthquake or other emergency. This unknown and likely substantial additional cost raises questions about cost and financing feasibility and customer rate impacts.

[3] Wheeling arrangements are agreements to use existing infrastructure owned by a third party to transport/convey water from a source to a customer.

The feasibility of rationing at levels of 20 percent or more and the effects of such rationing are key issues facing the regional system customers raised by the No Program Alternative and several of the other alternatives that require the wholesale customers to address average annual supply shortfalls and/or less dry-year reliability from the regional system on top of being prepared for dry-year rationing. Since the last drought (1987 – 1992), the state's population has increased and the amount of agricultural plantings that require water during drought years (i.e., vineyards and orchards) has increased. At the same time virtually all of the State's largest water agencies have implemented conservation and other demand management actions. Residential, commercial and industrial sectors have reduced water demand through conservation, and to a lesser extent, water recycling. The SFPUC wholesale customers already implement some level of conservation and some have existing water recycling projects; they have factored additional conservation and water recycling into their projections and used these as the basis for determining their 2030 purchase request from the SFPUC regional system. To the extent that water conservation is already being practiced and will increase in the future, the more difficult it will be to implement adequate cutbacks in water use in the future to achieve the rationing that may be required during a drought period. Demand hardening refers to the increasing difficulty and expense of achieving short-term water conservation levels during shortages as more long-term conservation measures are implemented and water-use efficiency is maximized. As described by the California Department of Water Resources, demand hardening:

> "occurs when agencies implement water conservation programs that result in permanent reductions in water use, such as retrofitting plumbing fixtures or installing low-water-use landscaping. These measures lessen agencies ability to implement rationing to reduce water use during droughts, and can result in great impacts to urban water users (e.g., loss of residential landscaping) when rationing is imposed. For example, the extensive Los Angeles retrofit program helped the city maintain reductions in urban per capita water use it achieved during the last drought. These permanent water use reductions will make it more difficult for the city to duplicate its previous 15 percent water use reduction goal during a future drought" (Department of Water Resources (DWR), 2005)

With respect to the effects of droughts and rationing on customers, droughts gradually affect water service. The socioeconomic effects of drought-related shortages depend on many factors, including the frequency, size, and duration of the supply shortage; types of water use affected; the options available to an agency and water users for managing shortages; the drought management strategies implemented, customer response to drought management strategies, and the costs of contingency water management and losses associated with shortages (DWR, 2000). From a statewide perspective, examples of drought impacts include (DWR, 2000):

- Lost jobs and revenue in landscaping / nursery industries
- Homeowner costs for replacing lawns and landscaping
- Unemployment and other socioeconomic impacts in farming-dependent communities
- Increased wildfire damages
- Widespread loss of trees in the Sierra Nevada
- Declines in fish populations

- Lost revenues to water-based recreation business
- Reduced hydroelectric power generation

The most recent prolonged drought lasted six years (1987 – 1992). Much of the information available about the economic consequences of this drought focuses on the agricultural sector. At the time, little information was available on the comprehensive, statewide impacts to urban customers from droughts. The California Urban Water Agencies (CUWA) formed in 1990 in part to study such effects and to promote the need for reliable, high quality water supplies for current and future urban water users. CUWA commissioned several reports on the adverse consequences of drought to urban customers.[4] Findings from those studies, as well as other literature reviewed are summarized in the following bullet item list. The experiences among water suppliers and their customers during the 1987-1992 drought varied considerably:

- *Distribution of Water Shortage Impacts.* Water shortages were not evenly distributed throughout the state. The cumulative deficit was worst in the Central Coast region. The degree of water shortage varied among agencies and, although target cutbacks ranged from 15 to 30 percent, there were differences between planned and actual cutbacks.

- *Drought Management Strategies.* The different drought management policies implemented by water suppliers created different consumption patterns and attendant economic losses.[5] For example, the City of Santa Barbara implemented mandatory conservation directives with steeply rising tiered water rates, resulting in a 62 percent reduction in consumption for single-family residences; neighboring Goleta Water District implemented quantity restrictions and higher flat rates for water, resulting in a 40 percent reduction in consumption for single-family residences (Rand, 1993).

- *Impacts Among Customer Types*. Cutbacks were not evenly distributed among residential, commercial, and industrial customers. Residential customers typically were cut back more than industrial or commercial users, although the horticulture sector of commercial customers suffered substantial losses.

- *Exterior and Interior Water Use.* Urban rationing programs typically shift the worst impacts to residential exterior and commercial landscaping uses and away from industrial use, commercial non-landscaping use, and residential interior use (DWR, 2005). Consequently a 30 percent shortage overall can translate to a 35 percent shortage for residential users, for example.

- *Other effects.* Because there was an economic recession in 1990-1991, water use and production output reductions in the commercial and industrial sectors during these years may not have been due to drought.

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4 The CUWA-commissioned studies include: *Assessment of the Economic Impacts of California's Drought on Urban Areas, A Research Agenda* (RAND, 1993); *Drought Management Policies and Economic Effects in Urban Areas of California, 1987 – 1992* (RAND, 1996); *Cost of Industrial Water Shortages* (Wade, et al, 1991); *The Value of Water Supply Reliability: Results of a Contingent Valuation Survey of Residential Customers* (Barakat & Chamberlin, Inc, August 1994); Water Reliability Analysis and Planning (WRAP) (Barakat & Chamberlin, Inc, August 1993); and *CUWA Survey of 1991 Drought Management Measures*, June 1991.

5 Examples of the drought management policies implemented during the 1987 – 1992 drought include: quantity restrictions, type-of-use restrictions, public education programs, device distribution program (e.g., low-flow shower heads), price increases, supply augmentation strategies (greater groundwater pumping, greater use of recycled water, and water transfers) (Rand, 1993).

According to DWR, genuine health and safety concerns (i.e., running out of water for drinking, sanitation, and firefighting) during the past recorded droughts generally have been limited to small, rural communities relying on marginal water sources. Estimated losses to residences from droughts vary, and studies of actual monetary losses sustained by residential customers are uncommon. A survey of impacts to residents in Alameda County Water District, which modeled household response to steeply increasing water rate structure, calculated average welfare losses per household in the range of $14-$23 per household for the period July 1991 to December 1992.

Because of the challenges in quantifying economic losses in the residential sector, CUWA determined that contingent valuation, or willingness to pay, was the best available method for studying residential water shortage losses. Contingency valuation is based on estimating how much people will pay for something that is not available on the private market, in this case, how much people are willing to pay to avoid water shortages of varying magnitude and frequency (Barakat and Chamberlain, 1994). Using the willingness to pay methodology, the 1994 survey found concluded that California residents were willing to pay $12 to $17 more per month per household for water to avoid the kinds of water shortages that occurred in the 1987–1992 drought. An estimate of impacts to Orange County residents used the same methodology to estimate economic losses by residents from 20 percent cutbacks over three years at about $13 billion in 2002 dollars (Orange County Business Council, 2003). As noted in DWR (2005), property values for residential users and their quality of life may be lower in an area with less reliable dry-year water services if the expected cost of shortage-related landscaping replacement is high enough to discourage planting high-investment landscaping.

Based on data collected in a 1990 industry survey, the report *Cost of Industrial Water Shortages* (Spectrum Economics, Inc., 1991) indicated that direct losses in industry production from a 30 percent shortage in 1990 dollars would be $0.93 billion for Alameda County, $5.3 billion for Santa Clara County, $0.9 billion for San Francisco County, and $7.6 billion for San Mateo County. In May 2005, BAWSCA submitted a report to the SFPUC regarding the economic consequences to the Bay Area of water shortages (Wade, 2005). The report, which advocates that the SFPUC reconsider the 20 percent maximum systemwide rationing goal established for the WSIP, characterizes water use in the industrial sector of wholesale customer communities as follows:

> The companies that account for the majority of industrial sector water use are those in the computer equipment and electronic component manufacturing categories. These water-dependent industries are the backbone of the Bay Area economy. In some industries, water is an essential element of the production process, not ancillary to plant production and employee use. For example, 75 percent of the water use in the food products industry is employed directly in the process. Water essentially is the product for many beverage processors. Microchips are manufactured in a wet environment. … Biotechnology, an emerging industry in the Bay Area requires water. Genentech, for example, is the largest industrial user of water in South San Francisco. Over 75 percent of the water used in its South San Francisco plant is employed directly in the manufacturing process, while research and development uses account for most of the remainder.

The report estimates the value of production losses (lost value of shipments in 2001 dollars) in water-critical industries located in the BAWCA service area caused by water shortage of up to 20 percent at $2.5 billion to $7.7 billion per year, and notes that this estimate is conservative because of demand hardening. The report also cited the following information from an SFPUC report to the Federal Energy Regulatory Commission (FERC) (Hetch Hetchy Water and Power Department, 1993)

- "The economic impact resulting from a water supply cutback will be concentrated in two industries: electronic components and accessories, and computer office equipment. Other industries could experience larger production cutbacks, but their economic impact will be small by comparison, except for the beverage industry.

- A 15 percent cutback in water supply could reduce direct shipments from the electronic component industry in 1990 dollars by $68 million and $163 million from the computer industry. The secondary impact could increase loss from these two industries by $294 million.

- A 15 percent cutback in water supply could result in more than 2,000 jobs lost in the two industries and their ancillary service areas.

- At a 15 percent cutback in water supply, the beverage industry would experience the largest production cutback of 10.4 percent and lost sales of approximately $72.4 million (1990 dollars)."

Although the information on the effects of water shortages during drought is limited, studies completed to date indicate that rationing cutbacks of 15 to 20 percent can have substantial economic impact on commercial, industrial and residential sectors and well as lifestyle effects on residents. To date, these studies have not identified significant environmental impacts resulting from such rationing in urban areas and the economic consequences do not appear to have resulted in major physical changes such businesses and/or residents leaving the area to an extent that land use patterns change. However, requiring rationing of up to 20 percent during a drought of customers who have already implemented aggressive conservation and water recycling would result in more severe economic and lifestyle effects.

Ability to Meet Program Objectives

Tables 9-5 and 9-6, above, show how the No Program Alternative would perform in terms of meeting the level of service goals and system performance objectives established for the WSIP (no assumptions are made regarding the ability of the wholesale customers to develop alternative supplies to offset water supply shortages or reduced system reliability). While this alternative could occasionally satisfy the 2030 customer purchase requests of 300 mgd, the alternative would fail to meet the WSIP level of service goals with respect to seismic, delivery, and water supply reliability. The water quality level of service goal would be achieved, since the SFPUC would implement required facility improvements to meet federal and state water quality regulations for the regional system (assuming no new supply would be wheeled through the SFPUC's system from wholesale customer actions; the SFPUC would not be responsible for regulatory compliance for any new sources obtained by wholesale customers).

Under the No Program Alternative, the regional system could not reliably meet the average 2030 demand of 300 mgd during nondrought years. With the restoration of Calaveras and Lower Crystal Springs Reservoirs under this alternative, water supply reliability would be somewhat improved over existing conditions, but this alternative would still not meet the WSIP level of service goals for seismic and delivery reliability due to other system deficiencies related to water availability during maintenance or outages, storage, conveyance, and treatment. In addition, this alternative would fail the WSIP objective of limiting drought-year rationing to a maximum of 20 percent systemwide. Systemwide shortages of greater magnitude and frequency would occur compared to both existing conditions and the proposed program. Using the Hetch Hetchy/Local Simulation Model (HH/LSM) and assuming a maximum rationing of 30 percent, the regional system would experience shortages during 42 years of the 82-year period of hydrologic record—as much as one in every two years. There would be no supplemental dry-year sources (e.g., the Westside Groundwater Program) to potentially forestall customer shortages.

With the exception of the Calaveras Dam project (SV-2), key WSIP facility improvement projects that were identified as needed to meet the seismic reliability performance objectives would not be implemented.[6] As a result, the system would continue to be subject to seismic hazards. In the event of a major earthquake, critical facilities could fail, leading to prolonged outages; customers could be without water service (including drinking water supplies and water for firefighting) for more than 14 days and possibly more than 30 days. Furthermore, without the WSIP facility improvement projects, the system would not have sufficient redundancy to reliably maintain or quickly restore basic service following a major earthquake.

Under the No Program Alternative, comprehensive maintenance and repair of the regional system would continue to be deferred, resulting in an increasing risk of failure and service disruption; in addition, some facilities (such as the Irvington Tunnel) could not be inspected, serviced, or repaired without loss of service to customers. The system would also have a limited ability to respond to unplanned outages resulting from power failures, earthquakes, or water quality events at Hetch Hetchy Reservoir. Aging infrastructure and substandard maintenance under the No Program Alternative would severely compromise overall delivery reliability[7] compared to existing conditions, due to increased demand on the system coupled with a greater likelihood of facility failure. Facilities would not be in place to replenish local reservoirs as needed to prepare for drought, and, as previously stated, customers would be subject to more severe and more frequent shortages and rationing.

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6 Key WSIP projects needed to meet seismic reliability levels of service include Calaveras Dam (SV-2), New Irvington Tunnel (SV-4), BDPL Reliability Upgrade (BD-1), BDPL 3 and 4 Seismic Upgrade at Hayward Fault (BD-3), Baden and San Pedro Valve Lots (PN-1), CS/SA Transmission (PN-2), HTWTP Long-Term (PN-3), and SAPL 3 Installation (SF-1). In addition, two WSIP projects identified as having independent utility—New Crystal Springs Bypass Tunnel and Bay Division Pipelines Nos. 3 and 4 Crossover/Isolation Valve at Hayward Fault—would be required (SFPUC, 2006).

7 Key WSIP projects needed to meet delivery reliability levels of service during maintenance conditions include SJPL System (SJ-3), 40-mgd Treated Water (SV-3), New Irvington Tunnel (SV-4), BDPL Reliability Upgrade (BD-1), CS/SA Transmission (PN-2), and HTWTP Long-Term (PN-3). Key WSIP projects needed to meet delivery reliability levels of service during a Hetch Hetchy water quality event or unplanned outage include Calaveras Dam (SV-2), 40-mgd Treated Water (SV-3), and HTWTP Long-Term (PN-3) (SFPUC, 2006).

If the wholesale customers and/or BAWSCA were to pursue supplemental water sources to compensate for the reduced reliability of the SFPUC's regional system under the No Program Alternative, additional studies would be required to determine both the technical and institutional feasibility of such supplemental sources. The resultant ability of the alternative to meet the program objectives would then depend in part on the wholesale customer actions and would be outside the control of the SFPUC.

While the SFPUC would continue to provide watershed protection and meet legal requirements for protection of fish and other wildlife, under the No Program Alternative, the system would not be managed in a comprehensive and coordinated manner to best manage natural resources and physical systems; therefore, the system would not meet all the sustainability objectives. Similarly, while the system would maintain its gravity-driven attributes, the system would not meet all of the WSIP cost-effectiveness objectives because the increased risk of facility failures and outages and likely increased need for emergency repairs and replacement would not be considered efficient or cost-effective use of resources or funds and the SFPUC would not be able to implement a regular inspection and maintenance program for all facilities.

Environmental Impacts Compared to those of the WSIP

Facility Construction and Operations Impacts

WSIP Facilities

Under the No Program Alternative, only five WSIP facility improvement projects would be constructed—Advanced Disinfection (SJ-1), Alameda Creek Fishery (SV-1), Calaveras Dam (SV-2), Treated Water Reservoirs (SV-5), and Lower Crystal Springs Dam (PN-4). None of the impacts attributable to the other WSIP facility projects would occur. The construction and operational impacts of these five facilities would be identical to those described in Chapter 4, Sections 4.3 to 4.15. As with the WSIP, the program-level analysis indicates that implementation of these five projects would result in potentially significant and unavoidable construction-related noise increases. In addition, implementation of the Advanced Disinfection project would result in potentially significant and unavoidable impacts related to temporary noise disturbance along construction haul routes; the Calaveras Dam project would result in potentially significant and unavoidable impacts related to visual resources as well as to historic districts and the historical significance of individual facilities; the Lower Crystal Springs Dam project would result in potentially significant impacts related to the historical significance of individual facilities. All other identified program-level impacts for these five projects would either be less than significant or could be mitigated to a less-than-significant level with implementation of identified mitigation measures.

Potentially significant unavoidable impacts associated with construction noise would be avoided at the 17 remaining WSIP facility improvement project sites. Impacts in the San Joaquin Region would be limited to the Tesla Portal area, and potentially significant unavoidable land use and/or vibration impacts associated with the SJPL System (SJ-3) and SJPL Rehabilitation (SJ-4) projects would be avoided. Impacts in the Sunol Valley Region would be limited to the Alameda Creek,

Calaveras Dam, and Sunol Valley Water Treatment Plant (WTP) areas; and potentially significant unavoidable land use and/or cultural resource impacts associated with the 40-mgd Treated Water (SV-3), New Irvington Tunnel (SV-4), and SABUP (SV-6) projects would be avoided. There would be no construction or operations impacts in the Bay Division Region, and potentially significant unavoidable land use and/or vibration impacts associated with the three projects in this region would be avoided. Impacts in the Peninsula Region would be limited to the Crystal Springs Reservoir area, and potentially significant unavoidable land use and cultural resource impacts associated with the CS/SA Transmission project (PN-2) as well as potentially significant unavoidable vibration impacts associated with the Baden and San Pedro Valve Lots project (PN-1) would be avoided. There would be no construction or operations impacts in the San Francisco Region, and potentially significant unavoidable land use and/or vibration impacts associated with the three projects in this region would be avoided.

Under the No Program Alternative, all potentially significant collective impacts (with the exception of cultural resources) would be less than significant or avoided due to the greatly reduced number of projects. Only two of the three projects in the Sunol Valley—Alameda Creek Fishery (SV-1) and Calaveras Dam (SV-2)—would have overlapping construction schedules, and project-specific mitigation measures would be adequate to reduce any combined effects of construction activities on Calaveras Road to a less-than-significant level. Thus, multi-regional and overlapping collective impacts under the No Program Alternative would be less than significant.

Unlike the proposed program, the contribution of facilities impacts under the No Program Alternative to cumulative impacts on traffic and biological resources would be mitigated through project-specific mitigation; other WSIP-related activities such as the Habitat Reserve Program (if implemented, see Chapter 3, Section 3.12) would also reduce cumulative impacts on biological resources. However, similar to the proposed program, the contribution of the No Program Alternative's impacts to cumulative impacts on air quality and cultural resources would be cumulatively considerable, particularly due to the extent of construction activities associated with the Advanced Disinfection (SJ-1) and Calaveras Dam (SV-2) projects.

Other Facilities Potentially Implemented Under this Alternative

The ability of the wholesale customers to develop additional water supplies is uncertain and outside the control of the SFPUC. The types of projects that the wholesale customers might pursue and the potential facility and operations impacts associated with such projects are presented in **Table 9-10** for consideration by decision-makers and other interested parties. In general, certain types of impacts are common to water supply transfers/acquisition and include: the cessation of water application to lands irrigated by the water being transferred; changes related to flows, fisheries, and water quality; and impacts caused by the use of existing or the construction of new infrastructure. Typically, the water rights-holder previously applied the water to agricultural land. The transfer can result in the conversion of agricultural land to nonagricultural land. Beneficial environmental effects (related to retiring drainage-impaired lands, reducing the application of pesticides, etc.) can also occur. The need for new facilities and/or changes in the operations of existing facilities depend on the source of supply (e.g.,

TABLE 9-10
SUMMARY OF POTENTIAL IMPACTS AND MITIGATION STRATEGIES ASSOCIATED WITH REPRESENTATIVE WATER SUPPLY ACQUISITION PROJECTS

Actions Associated with Water Supply Acquisition Projects	Potential Impacts	Mitigation Strategy
Supplemental Water Supply Source		
Increased Water Use Efficiency/Conservation (e.g., conversion to drip irrigation); tiered water pricing	Reduced groundwater recharge. Exposure of soils to wind erosion leading to air quality impacts. Could lead to increased groundwater pumping.	None required. See below regarding increased groundwater pumping.
Conversion of More Water-Intensive to Less Water-Intensive Crops, Land Fallowing	Land fallowing could create pressure to convert land to urban uses and loss of agricultural land. Economic impacts to community.	Include consideration of farming interests in decision-making process for transfer.
Increased Groundwater Pumping/Conjunctive Use of Groundwater	Groundwater level reductions and overdraft if there is insufficient sustainable yield to accommodate increased pumping. Water quality issues include decreased aesthetic quality in drinking water (hardness, tastes, odors), health risk from potential contaminants in groundwater basin.	Determine sustainable yield of the basin, implement monitoring program, regulate groundwater pumping to preserve safe yield, provide treatment and/or blending if necessary to remove contaminants and control taste and odor. Local assistance programs for remediation of affected wells.
Delta Diversions	Potential impacts on sensitive Delta fisheries including: winter-run, spring-run Chinook salmon, Delta smelt, steelhead trout, and Delta splittail.	Compliance with existing and future pumping requirements related to threatened and endangered species protection.
	Changes in Delta inflow, outflow. Potential impacts on flows associated with wheeling Delta transfers through the Delta, resulting in secondary impacts on Delta fisheries and other biological resources.	Transfer would require review/approval by applicable regulatory agencies. Analysis of flow impacts and commitment to minimize adverse secondary impacts on biological resources (e.g., through transfer timing, pumping restrictions).
	Water quality for the Delta and downstream water users (including salinity, bromides, potential contaminants from agricultural and industrial run-off, taste and odor problems, disinfection byproducts, and temperature).	Compliance with existing and future applicable water quality control. Regulations. Treatment to bring up to water quality equitable to Tuolumne River.
	Water quality for the Delta and downstream water users (including salinity, bromides, and temperature).	Transfer would require review/approval by applicable regulatory agencies. Analysis of flow impacts and commitment to minimize adverse impacts on other water users (e.g., through transfer timing, pumping restrictions).

TABLE 9-10 (Continued)
SUMMARY OF POTENTIAL IMPACTS AND MITIGATION STRATEGIES ASSOCIATED WITH REPRESENTATIVE WATER SUPPLY ACQUISITION PROJECTS

Actions Associated with Water Supply Acquisition Projects	Potential Impacts	Mitigation Strategy
Facilities Required		
Conveyance	Mostly temporary impacts from construction of pipelines, valves, and pumps (disturbance of soils, surface water quality, biological resources, cultural resources, air quality, traffic, noise, land use, hazardous materials, aesthetics).	Most impacts associated with facility construction could be mitigated to a less-than-significant level with the types of measures identified in Chapter 6. As is the case with the proposed WSIP facilities, some impacts (e.g., short-term noise and traffic) could be unavoidable.
Pumping	Noise, energy consumption, air pollutant emissions from energy consumption.	Muffle noise. Use energy-efficient pumps and alternative energy sources.
Treatment	Temporary construction impacts, including land use, traffic, noise and air quality impacts. Potential long-term impacts could include increase in energy consumption, air pollutant and greenhouse gas emissions from energy consumption.	Use standard construction mitigations. Use energy-efficient pumps and alternative energy sources.
Groundwater Basin Storage of Surface Water	Potential degradation of groundwater quality, hydrofracturing (injection).	Pretreatment, groundwater quality monitoring, groundwater basin modeling, modifications to recharge and pumping practices.
Storage – Development of New Offstream Storage	Temporary and long-term impacts from construction of dam, pipelines, pumps, and appurtenant features (direct and indirect impacts on wetland and upland fish and wildlife and attendant habitat; impacts related to cultural resources, air quality, traffic, noise, land use, aesthetics, etc.).	Most impacts associated with facility construction could be mitigated to a less-than-significant level with the types of measures identified in Chapter 6. Some impacts would likely be unavoidable.

Tuolumne River through transfers with TID and MID, water-rights holders north of the Delta, in the Delta, or south of the Delta), the quantity of supply, and the means of conveyance. Construction or expansion of interties or connecting pipelines could be required, potentially resulting in impacts similar to those described for WSIP pipeline projects. The use of existing infrastructure to convey water to the wholesale customer would require extensive hydrologic, hydraulic and seismic reliability modeling to confirm that there would be no adverse consequences to the supply availability of other system users under all normal and emergency conditions. Without the WSIP improvements, capacity is already extremely limited, so ability to provide additional conveyance capacity is unlikely.

Water Supply and System Operations Impacts

Under the No Program Alternative, the estimated average annual diversions from the Tuolumne River would be 226 mgd, based on HH/LSM modeling of the no-program assumptions over the 82-year hydrologic record. This amount is 19 mgd less than the 245 mgd average annual diversions from the Tuolumne River under the WSIP, but 8 mgd more than the 218 mgd average annual diversions under existing conditions, as shown in Table 9-5, above. The potential impacts on water resources in the Tuolumne River, Alameda Creek, and Peninsula watersheds associated with this level of diversion are described below and compared to the impacts that would occur under the WSIP.

Tuolumne River Watershed

Currently, water storage in Hetch Hetchy Reservoir follows a seasonal pattern. The SFPUC typically draws the reservoir down in the summer, fall, and winter. During the summer, fall, and winter, only the minimum required release is made to the Tuolumne River below O'Shaughnessy Dam. The SFPUC refills Hetch Hetchy Reservoir with snowmelt in the spring and, once it is full, or in anticipation of it filling, releases excess to the river. The amount of the release in any particular year depends on the mass of snow that has accumulated in the previous winter.

Based on projected increases in customer water demand in 2030 the amount of water delivered to customers by the SFPUC regional system under the WSIP would be greater than under the existing condition. To meet the increased demand under the WSIP, the SFPUC would draw down Hetch Hetchy Reservoir to a greater extent in the summer, fall, and winter compared to the existing condition. A higher proportion of the snowmelt runoff would be required to refill the reservoir in the spring, and a smaller proportion would be released to the Tuolumne River below O'Shaughnessy Dam. Average annual releases to the Tuolumne River would be reduced by about 3.5 percent. The reduction in average annual releases to the river would manifest itself as a delay in the start of the spring release. The average delay would be 1 day, the maximum delay would be 8 days and a delay greater than 2 day would occur about once every 4 years.[8] The delay in spring releases would have a significant adverse effect on terrestrial biological resources in streamside meadows, particularly in the Poopenaut Valley, as described in Section 5.3.7.

[8] The estimates of delay in spring releases are based on the assumption that operators would release water from Hetch Hetchy Reservoir at a rate of 3,000 cfs. Review of past practice indicates that this a typical springtime release rate. If the release rate was reduced, as might happen in a dry year, the delay would be extended.)

The No Program Alternative would also result in a delay in spring releases from Hetch Hetchy Reservoir. This delay would occur because, under the No Program Alternative, water demand would increase (as it would with the WSIP), and the SFPUC would attempt to satisfy the increase in demand by drawing more water from Hetch Hetchy Reservoir. The SFPUC would not draw as much water from Hetch Hetchy Reservoir with the No Program Alternative as it would with the WSIP because it would not provide the same level of delivery reliability during drought it would with the WSIP. This substantial reduction in delivery reliability during drought results in more frequent reductions to full deliveries during nondrought years. The average annual release of water to the Tuolumne River below O'Shaughnessy Dam would still be reduced (by about 1.3 percent). The delay in spring releases would be less with the No Program Alternative than with the WSIP. With the No Program Alternative the average delay would about half a day and the maximum delay would be 5.5 days. Delays of more than two days would occur about once every six years. The delays would still have a significant adverse effect on terrestrial biological resources.

Water storage in Don Pedro Reservoir also follows a seasonal pattern. The Turlock Irrigation District (TID) and Modesto Irrigation District (MID) typically draw the reservoir down in the summer and early fall by diversion to their service areas and releases from La Grange Dam to the Tuolumne River. During the summer and fall, typically only the minimum required release is made to the Tuolumne River below La Grange Dam. TID and MID replenish storage in Don Pedro Reservoir with rainfall runoff from the watershed in the winter and snowmelt in the spring. Because one of the purposes of Don Pedro Reservoir is flood control, space must be retained in the reservoir through the winter to capture runoff from large winter storms. In years when runoff exceeds the available capacity of the reservoir, TID and MID release the excess to the river below La Grange Dam. The amount of the release in any particular year depends on the size and frequency of winter storms and the mass of snow that has accumulated in the upper watershed in the previous winter. Releases may occur in a series of pulses rather than in a single defined spring release as typically occurs at Hetch Hetchy Reservoir.

As noted above, water demand in 2030 would be greater than under the existing condition. To meet the increased demand, with the WSIP the SFPUC would divert more water from the Tuolumne River at Hetch Hetchy Reservoir than under the existing condition. There would be a corresponding reduction in inflow to Don Pedro Reservoir. As a result, Don Pedro Reservoir would be drawn down farther by the late fall than it is under the current condition. A higher proportion of the rainfall and snowmelt runoff would be required to replenish storage in Don Pedro Reservoir in the winter and spring, and a smaller proportion would be released to the Tuolumne River below La Grange Dam. The reduction in average annual releases to the river with the WSIP would manifest itself as a delay in the start of pulse releases in the winter and spring. The combination of a reduction in the average annual volume of releases (of about 4 percent) and a delay in releases would have a significant adverse effect on fisheries in the Tuolumne River and on terrestrial biological resources in the riparian corridor, as described in Sections 5.3.6 and 5.3.7.

As noted above, water demand would increase with the No Program Alternative (as it would with the WSIP), and the SFPUC would attempt to satisfy the increase in demand by drawing more

water from Hetch Hetchy Reservoir. Withdrawal of more water from Hetch Hetchy Reservoir would reduce inflow into Don Pedro Reservoir and result in a greater drawdown of storage in that reservoir compared to the existing condition. The No Program Alternative would reduce the average annual release of water to the Tuolumne River below La Grange Dam (by about 1.3 percent) and delay the initial release, but to a much lesser extent than with the WSIP. The reduction in total releases and the delay in the initial release would have an adverse effect on fisheries in the Tuolumne River and on terrestrial biological resources in the riparian corridor, but the impact would be less than significant.

Alameda Creek Watershed

The proposed improvements to Calaveras Dam included under the WSIP would also occur under the No Program Alternative. As a result of the improvements and associated modification in system operations, the maximum water level in Calaveras Reservoir would rise by about 50 feet. The rise in water level would have significant adverse impacts on terrestrial biological resources, as described in Section 5.4.6.

Under the No Program Alternative, as with the WSIP, restoration of historical water levels at Calaveras Reservoir would enable greater diversions of water from Alameda Creek into the reservoir. The consequent reductions in flow would have significant and unavoidable impacts on the hydrology of the creek below the diversion dam and significant adverse impacts on fisheries and terrestrial biological resources. The improvements to Calaveras Dam would also lead to changes in flow in Calaveras Creek and Alameda Creek below the Calaveras Creek confluence, which would have significant adverse impacts on terrestrial biological resources. The changes in water level in Calaveras Reservoir and changes in flow in the creeks would have a significant adverse effect on recreational and visual resources. Under the No Program Alternative, the SFPUC would operate its facilities in the Alameda Creek watershed in a similar manner as it would with the WSIP. Consequently, the environmental impacts of the No Program Alternative would be similar to those of the WSIP.

Peninsula Watershed

Currently, water storage in Pilarcitos Reservoir follows a seasonal pattern. The SFPUC typically draws the reservoir down in the summer. During the summer, water is released from the reservoir to Pilarcitos Creek to supply the Coastside County Water District (CWD). Coastside CWD diverts water from Pilarcitos Creek at Stone Dam. By late summer, Pilarcitos Reservoir is typically drawn down to its minimum, and the SFPUC supplies Coastside CWD from Crystal Springs Reservoir. The SFPUC refills Pilarcitos Reservoir in the winter and spring.

Water demand in 2030 would be greater than under the existing condition, including water demand in the Coastside CWD service area. To meet the increased demand in the Coastside CWD service area, the SFPUC would draw down Pilarcitos Reservoir more rapidly in the summer than under the existing condition and end stored water releases to Pilarcitos Creek at an earlier date. The more rapid drawdown and the earlier cessation of releases to Pilarcitos Creek would have a significant adverse effect on water quality, fisheries, and terrestrial biological resources in the reservoir and the creek, as described in Sections 5.5.3, 5.5.5, and 5.5.6.

Water demand would increase with the No Program Alternative, as it would with the WSIP. The SFPUC would try to serve increased demand in the Coastside CWD service area from Pilarcitos Reservoir, exactly as it would with the WSIP. The consequent, more rapid drawdown of Pilarcitos Reservoir and the earlier cessation of stored water releases to Pilarcitos Creek would have a significant adverse effect on water quality, fisheries, and terrestrial biological resources in the reservoir and the creek.

The improvements to Lower Crystal Springs Dam that would occur with the WSIP would also be part of the No Program Alternative. As a result of the improvements and associated modification in system operations, the maximum water level in Crystal Springs Reservoir would rise by about 20 feet. The rise in water level would have significant adverse impacts on terrestrial biological resources, as described in Section 5.5.6. Because the No Program Alternative would include the same improvements to Lower Crystal Springs Dam as the WSIP, the SFPUC would generally operate its facilities in the Peninsula watershed in a similar manner as it would with the WSIP. Consequently, the environmental impacts of the No Program Alternative would be similar to those of the WSIP.

Growth-Inducement Potential and Secondary Effects of Growth

The growth-inducement potential for this alternative is expected to be similar to that of the proposed program. Under this alternative, the SFPUC would not be able to provide a water supply with a reliability comparable to the WSIP in all nondrought years, or in dry years and drought periods; nonetheless, it is reasonable to expect that the SFPUC wholesale customers (either separately or together through BAWSCA) would seek to acquire supplemental dry-year water supplies to complement the supply increases the SFPUC is able to deliver under this alternative and to provide a comparable level of supply reliability. As a result, this alternative would have the same indirect, secondary effects of growth as the proposed program. As discussed in Chapter 7, growth has occurred in some communities, such as San Francisco, without a corresponding increase in water supply. In the future, the projected population and/or employment growth for some communities are clearly greater than the corresponding projected increase in water supply need, indicating that water use efficiency is increasing and that additional supply is not necessarily required for growth to occur. It is possible that approval of additional development within the SFPUC's wholesale customer service areas might be slowed somewhat in some communities because the wholesale customers would have to pursue other projects and actions to achieve adequate dry-year supplies and reliability, but it is not expected that this would deter communities from taking actions to support planned growth.

9.2.3 No Purchase Request Increase Alternative

Under the No Purchase Request Increase Alternative, the SFPUC would implement all of the proposed WSIP facility improvement projects but would limit wholesale customers' future purchases to terms of the existing Master Water Sales Agreement instead of providing for their 2030 purchase requests. The wholesale customers would have to pursue supplemental supply sources and/or conservation measures to make up the supply shortfall under this alternative. This alternative assumes there would be no increase in the existing level of supply assurance

(275 mgd, annual average which reflects the wholesale customer supply assurance under the Master Water Sales Agreement of 184 and a demand of 91 mgd in the SFPUC retail service area), but there would be a slight increase in demand compared to the existing purchase request level of 265 mgd. With the inclusion of 10 mgd of recycled water, groundwater and conservation projects in San Francisco, there would be limited need for additional Tuolumne River diversions except for drought supplies.

This alternative was included in the EIR alternatives analysis to evaluate the consequences of the SFPUC not meeting the future increase requested by its customers in an effort to avoid or minimize the potential growth-inducing effects and secondary effects of growth associated with providing more water to the regional customers.

Description of SFPUC and Wholesale Customer Actions

SFPUC Actions

Table 9-4 summarizes the main characteristics of this alternative in comparison to those of the proposed program. Under the No Purchase Request Increase Alternative, the SFPUC would implement the same water supply option and facility improvement projects as those proposed under the WSIP; however, instead of serving the full 2030 purchase requests of 300 mgd (average annual), the SFPUC would limit customer deliveries to 275 mgd (as compared to current deliveries of 265 mgd), with 184 mgd for wholesale customers and 91 mgd for retail customers. Master Water Sales Agreement Terms

Currently, the SFPUC's wholesale customers purchase an annual average of 170 mgd from the regional water system. The wholesale customers estimate that, by 2030, they will need to purchase an annual average of 209 mgd from the regional system. Under the WSIP, the regional system would meet the needs of wholesale customers for water. The No Purchase Request Increase Alternative assumes that the SFPUC would be able to limit the wholesale customers' future purchases to the terms of the existing Master Water Sales Agreement it holds with the wholesale customers, who are represented by BAWSCA (see Chapter 2, Section 2.5.5 for a description of the agreement). Under this agreement, the CCSF has agreed that the wholesale customers may collectively purchase up to 184 mgd on an average annual basis, subject to reductions in the event of a drought, water shortage, earthquake, other natural disaster, or rehabilitation and maintenance of the system ("the supply assurance"). Additional sales are made on an interruptible basis to San Jose and Santa Clara. The current master contract expires in 2009, but in the event the contract is not renewed or renegotiated, or the parties agree to a new contract without an increase in the supply assurance, the current supply assurance of the contract would remain in force. Thus, under the No Purchase Request Increase Alternative, it is assumed that the SFPUC and its customers would choose not to negotiate a new contract and instead would continue with the existing contract in which the customer water delivery for 2030 would be 184 mgd for the wholesale customers instead of 209 mgd and would be the same as under the WSIP for retail customers (91 mgd). Therefore, under the No Purchase Request Increase Alternative, the wholesale customers would receive 25 mgd (average annual) less than under the WSIP. It is assumed that the wholesale customers, either individually or collectively, would seek

sources other than the SFPUC, through alternative supply sources, additional conservation, water recycling, or other demand management approaches, as described below. The SFPUC would need to work closely with BAWSCA to define where the additional 10 mgd would be served, and would need to redefine level of service objectives for seismic and delivery reliability based on the decreased supply and revised supply distribution.

Water Supply Characteristics

Under the No Purchase Request Increase Alternative, it is assumed that the total customer purchase requests to be served by the regional system by 2030 would be 275 mgd, consisting of 184 mgd for the wholesale customers and 91 mgd for the retail customers. As shown in Table 9-4, the increased water demand would be served through additional Tuolumne River diversions under existing CCSF water rights, increased use of local watershed supplies due to restoration of Calaveras and Crystal Springs Reservoirs, and 10 mgd from recycled water, groundwater, and conservation projects in San Francisco. During drought sequences, this supply would be supplemented by additional Tuolumne River diversions through a water transfer with TID and MID, similar to the proposed program, but for 1 mgd instead of 23 mgd. The supplemental dry-year supplies would also include implementation of the Westside Basin conjunctive-use program for 6 mgd (same as under the proposed program).

WSIP Facility Improvement Projects

The No Purchase Request Increase Alternative assumes that the SFPUC would implement all 22 WSIP facility improvement projects to meet the water quality, seismic reliability, and delivery reliability objectives of the WSIP. However, the design of some of the WSIP facilities would need to reevaluated and sized appropriately to meet the reduced delivery levels and corresponding adjusted performance objectives under this alternative. In addition, the No Purchase Request Increase Alternative assumes that the SFPUC would proceed with implementation of other capital improvement projects and related activities not considered part of the program analyzed in this PEIR (as described in Chapter 3, Sections 3.13 and 3.4.6).

Wholesale Customer Actions

Under this alternative, the SFPUC would serve 184 mgd out of the 209 mgd in wholesale customer purchase requests (demand) by 2030. BAWSCA and/or individual SFPUC wholesale customers could pursue supplemental water supplies on their own to compensate for the 25 mgd in additional demand, or possibly develop additional conservation programs or other demand management approaches. A potential approach for BAWSCA and the wholesale customers to secure supplemental water supplies and associated issues are described under the No Program Alternative. However, unlike the No Program Alternative (under which the SFPUC could at times meet the full purchase requests but with uncertain reliability), the No Purchase Request Increase Alternative would on average provide 184 mgd, or 88 percent, of wholesale customer demand with a high level of reliability. Nevertheless, the wholesale customers might elect to obtain supplemental supplies to meet the additional 25 mgd in demand using an approach similar to that described above under the No Program Alternative.

Feasibility Issues

Similar to the No Program Alternative, the No Purchase Request Increase would present no engineering or technical feasibility issues, but it would likely result in institutional and legal issues since it assumes that the SFPUC and it customers would collectively agree to maintain the current Master Water Sales Agreement contract provisions (and other individual contracts). However, without such an agreement BAWSCA and/or wholesale customers would likely pursue legal remedies to compel the SFPUC to meet the 2030 customer purchase request. Whether or not the SFPUC could agree with its customers on such an alternative, BAWSCA and/or wholesale customers would also likely seek other water supply sources to meet customer water needs; each alternate water source would have its own set of technical, cost, legal, and regulatory considerations that would require additional studies. With respect to public acceptance, it is unlikely that the SFPUC's regional system customers would support this alternative. In addition, depending on the outcome of customer actions, this alternative could add substantial capital and/or operation and maintenance costs as a result of having to accommodate alternate water sources in addition to the costs of the 22 facility improvement projects included in the WSIP. This unknown but possibly substantial additional cost raises questions about total program cost and financing feasibility and customer rate impacts.

Ability to Meet Program Objectives

Table 9-6, above, shows how the No Purchase Request Increase Alternative would perform in terms of meeting the WSIP level of service goals and system performance objectives compared to the proposed program. This alternative would fully meet the WSIP level of service goal with respect to water quality for the SFPUC system (although the SFPUC would not be responsible for regulatory compliance of new water sources obtained by wholesale customers; in addition, if new sources are to be "wheeled" through the SFPUC system, then the water quality objective may not be achieved). Seismic reliability would be improved over existing conditions, but due to the reduced target delivery level, the alternative would not meet the WSIP objective of providing 300 mgd average day demand but would meet a reduced objective of 275 mgd average day demand. In addition, there is no certainty about where the distribution of the additional 10 mgd would occur, so the seismic performance objectives of serving 70 percent of turnouts and meeting average day demand in the three customer regions (South Bay, Peninsula and San Francisco) could not be guaranteed and would need to be reevaluated to determine if the WSIP performance objective could be achieved. Delivery reliability of the regional system would be improved similar to the proposed program; however, this alternative would only partially meet those objectives, since it would not meet the average annual demand of 300 mgd under maintenance or outage conditions but instead meet the reduced target delivery level of 275 mgd. Comprehensive and regular repair and maintenance of the regional system would occur without service interruptions, and the risk of service interruptions due to unplanned facility upsets or outages would be minimal. Facilities would be in place to replenish local reservoirs as needed to prepare for drought, and the system would remain essentially gravity-driven.

The No Purchase Request Increase Alternative would fail to achieve the WSIP's water supply level of service goal during nondrought and drought periods and would not meet the 2030

customer purchase requests of 300 mgd. Under this alternative, the regional system would be capable of serving average annual purchase requests of 275 mgd during nondrought conditions (compared to 265 mgd delivered on average under existing conditions). Deliveries would be limited to an annual average of 275 mgd. Similarly, while this alternative would meet the WSIP objective of limiting drought-year rationing to a maximum of 20 percent systemwide, it would achieve this objective at the reduced demand level of 275 mgd. Unless wholesale customers were to obtain alternative supplies from other sources to supplement the SFPUC deliveries, the combined effect of reduced deliveries from the SFPUC and 20 percent rationing during droughts could effectively require rationing of over 20 percent of total demand during an extended drought sequence. However, the No Purchase Request Increase Alternative would succeed in diversifying the SFPUC water supply portfolio and improve use of new water sources during nondrought and drought periods.

In order to reevaluate levels of service objectives at a target delivery level of 275 mgd, system modeling using the hydrologic, hydraulic and seismic reliability models would need to be performed, and the level of service objectives would need to be revised to become compatible with the lower system delivery target. The distribution of future demands would need to be evaluated in order to determine if the seismic criteria of 70 percent of turnouts and average day demand to the three regional customer groups following a seismic event could be achieved.

If the wholesale customers and/or BAWSCA were to pursue supplemental water sources to compensate for the reduced supply provided by the SFPUC's regional system under this alternative, additional studies would be required to determine both the technical and institutional feasibility of such supplemental sources. The resultant ability of the alternative to meet the WSIP water supply and delivery reliability objectives would then depend in part on the wholesale customer actions and would be outside the control of the SFPUC.

Similarly, the No Purchase Request Increase Alternative would meet the WSIP sustainability objectives, within the bounds of the SFPUC actions, but it would be unknown with respect to the wholesale customer actions. If the wholesale customers were to take independent action from the SFPUC under this alternative, this would result in inefficient use of resources and funds and would not meet the WSIP objective for cost-effectiveness. The capital, operation and maintenance cost of the 22 facility improvement projects would be the same as the WSIP, but additional costs would be incurred from conservation or supply projects implemented by customers in place of the WSIP supply.

Environmental Impacts Compared to those of the WSIP

Facility Construction and Operations Impacts

WSIP Facilities

The No Purchase Increase Alternative assumes that all WSIP facility improvement projects would be implemented to meet the intent of the water quality, seismic reliability, and delivery reliability objectives of the WSIP. Therefore, the identical facility-related impacts described in Chapter 4 would occur under this alternative.

Other Facilities Potentially Implemented Under this Alternative

The ability of the wholesale customers to develop additional water supplies is uncertain and outside the control of the SFPUC. A potential approach for BAWSCA and the wholesale customers to secure supplemental water supplies is described under the No Program Alternative. The types of projects that the wholesale customers might pursue and the potential facility and operations impacts associated with such projects are presented in Table 9-10, above, for consideration by decision-makers and other interested parties.

This alternative could result in construction and operation of extensive additional recycled water, groundwater, and water conveyance facilities in the wholesale customer service areas; thus, collective impacts in the Bay Division and Peninsula Regions and associated cumulative effects (such as traffic, air quality, noise and vibration) would be more severe than those of the WSIP.

Water Supply and System Operations Impacts

Under the No Purchase Request Increase Alternative, the estimated average annual diversions from the Tuolumne River would be 221 mgd, based on HH/LSM modeling of this alternative over the 82-year hydrologic record. This amount is 24 mgd less than the 245 mgd average annual diversions from the Tuolumne River under the WSIP, but 3 mgd more than the 218 mgd average annual diversions under existing conditions, as shown in Table 9-5, above. The slight increase in diversions is due to the small increase in purchase request and the improvement in delivery reliability. The potential impacts on water resources in the Tuolumne River, Alameda Creek, and Peninsula watersheds associated with this level of diversion are described below and compared to the impacts that would occur under the WSIP.

Tuolumne River Watershed

Under the No Purchase Request Increase Alternative, the SFPUC would meet more purchase requests by 2030 than under the existing condition, but less than it would under the WSIP or any of the other alternatives analyzed in Section 9.2. The No Purchase Request Increase Alternative would result in a small reduction (less than 0.5 percent) in average annual releases to the Tuolumne River from Hetch Hetchy Reservoir and some reduction and delay in the spring releases on occasion compared to the existing condition. The reduction and delay in spring releases would occur because storage deficits in a series of dry years would accumulate in Hetch Hetchy Reservoir. The reduction and delay in spring releases would be less than with the WSIP, and a delay of more than two days would occur much less frequently, about once in every 10 years, with the No Purchase Request Increase Alternative than with the WSIP. The delay is still judged to be sufficient to have a significant adverse effect on terrestrial biological resources because of the ecological sensitivity of riverside meadows and their flora and fauna.

The No Purchase Request Increase Alternative would result in a small reduction in average annual releases to the Tuolumne River from La Grange Dam (less than 0.5 percent) and some reduction and delay in the winter/spring releases compared to the existing condition. The delay in winter/spring releases would have an adverse effect on fisheries in the Tuolumne River and on terrestrial biological resources in the riparian corridor, but the impact would be less than significant.

Alameda Creek Watershed

The improvements to Calaveras Dam that would occur with the WSIP would also be part of the No Purchase Request Increase Alternative. Furthermore, under this alternative, the SFPUC would operate its facilities in the Alameda Creek watershed in a similar manner as with the WSIP. Consequently, the environmental impacts of the No Purchase Request Increase Alternative would be similar to those of the WSIP.

Peninsula Watershed

Average annual system delivery to the wholesale customers would increase with the No Purchase Request Increase Alternative compared to the existing conditions, but to a much lesser degree than with the WSIP (10 mgd more rather than 25 mgd). The SFPUC would try to serve the smaller increase in demand in the Coastside CWD service area from Pilarcitos Reservoir, as it would with the WSIP. Drawdown of Pilarcitos Reservoir would occur more rapidly than under the existing condition but less rapidly than with the WSIP under the No Purchase Request Increase Alternative. Stored water releases to Pilarcitos Creek would cease earlier in the summer than under the existing condition but later than with the WSIP. The changes attributable to the No Purchase Request Increase Alternative would adversely affect water quality, fisheries, and terrestrial biological resources in the reservoir and the creek, but the impact would be less than significant.

The improvements to Lower Crystal Springs Dam that would occur with the WSIP would also be part of the No Purchase Request Increase Alternative. As a result of the improvements and associated modifications in system operations, the maximum water level in Crystal Springs Reservoir would rise by about 20 feet. The rise in water level would have significant adverse impacts on terrestrial biological resources, as described in Section 5.5.6. Since the No Purchase Request Increase Alternative would include improvements to Lower Crystal Springs Dam, the SFPUC would generally operate its facilities in the Peninsula watershed in a similar manner as it would with the WSIP. Consequently, the environmental impacts of this alternative would be similar to those of the WSIP.

Growth-Inducement Potential and Secondary Effects of Growth

This alternative, would have less growth-inducement potential than the WSIP, because the SFPUC would only provide additional water to its wholesale customers up to the existing contract amount of 184 mgd (average annual), compared with 209 mgd (average annual) under the WSIP. Under this alternative, the SFPUC would only improve system reliability for existing customers, providing for water delivery in accordance with the existing Master Sales Agreement between the SFPUC and the wholesale customers. As discussed above in the description of this alternative, it is reasonable to assume that the SFPUC wholesale customers would seek to acquire (either separately or together through BAWSCA) supplemental water supplies to meet their projected needs, as represented by the increased purchase requests they submitted to the SFPUC.

As discussed in Chapter 7, growth has occurred in some communities, such as San Francisco, without a corresponding increase in water supply. In the future, the projected population and/or

employment growth in some communities are clearly greater than the corresponding projected increase in water supply needs, indicating that water use efficiency is increasing and that additional supply is not necessarily required for growth to occur. It is possible that approval of additional development within the SFPUC's wholesale customer service area might be slowed somewhat in some communities because the wholesale customers would have to pursue other projects and actions to achieve adequate dry-year supplies and reliability, but it is not expected that this would deter communities from taking actions to support planned growth. Thus, the growth-inducement potential under this alternative could be similar to that of the proposed program. The difference is that the WSIP would not support this additional growth, but the growth would occur anyway as a result of SFPUC wholesale customers and/or BAWSCA pursuing substitute supplemental water supplies.

Even assuming that growth potential under this alternative were appreciably reduced within Bay Area communities served by the regional system, it is nonetheless likely that growth pressure would increase elsewhere in the Bay Area, such as eastern Contra Costa County, Solano and Sonoma Counties, and southern Santa Clara County, or beyond to tributary areas in the Central Valley. It is also likely that growth in these outlying areas would have similar types of environmental impacts but of potentially greater magnitude and consequence due to the effects of new development or "sprawl" versus the infill that would occur in the existing Bay Area communities served by the SFPUC's regional system.

9.2.4 Aggressive Conservation/Water Recycling and Local Groundwater Alternative (with and without Tuolumne River Supplement)

The Aggressive Conservation/Water Recycling and Local Groundwater Alternative examines the potential for the SFPUC and the wholesale customers to meet the 2030 service goals for the regional system, including serving the 2030 customer purchase requests of 300 mgd average annual supply through a combination of additional conservation efforts and recycled water and local groundwater projects. Since the WSIP already includes some conservation, water recycling, and local groundwater projects, this alternative would require aggressive efforts in these three areas that go beyond those proposed as part of the WSIP. This alternative represents alternate sources of supply and different target delivery levels for the regional system compared to the WSIP. This alternative is evaluated to address the impacts to the Tuolumne River, Alameda Creek, and the Peninsula watershed, including Pilcarcitos Creek.

Conservation, water recycling, and local groundwater projects are already included in the proposed program in three ways. First, the effects of plumbing codes currently in place in the SFPUC service area (which provide passive conservation savings) are already incorporated into the projected total service area demand. Second, in the development of their 2030 purchase requests, the wholesale customers incorporated their current and anticipated future conservation programs and water recycling projects as well as local groundwater projects. The estimated 2030 purchase requests to the SFPUC reflect the wholesale customers' current assessment of the conservation, groundwater, and water recycling potential in their service areas. In addition, the proposed WSIP water supply

option includes a combination of conservation, water recycling, and groundwater use in San Francisco to achieve an additional offset of 10 mgd of potable water demand from the regional system by the year 2030 (under the Groundwater and Recycled Water Projects, SF-2 and SF-3).

It is assumed that the wholesale customers would continue to actively participate in developing additional local and/or regional recycled water/groundwater/conservation projects to reduce the increased demand on surface water supplies during nondrought and drought periods in addition to the groundwater, recycled water, and conservation projects they are already committing to implement locally.

The SFPUC undertook a study, in coordination with its wholesale customers and BAWSCA, to assess the potential for more aggressive conservation coupled with local recycled water and naturally renewable groundwater projects[9] for potential regional development within the SFPUC service area. In preparing the *Investigation of Regional Water Supply Option No. 4 Technical Memorandum*, the SFPUC interviewed representatives of 27 wholesale customers to identify potential recycled water and groundwater projects that were not already considered implemented locally prior to estimating SFPUC regional water system purchases through the year 2030, and that could potentially be implemented regionally to offset SFPUC regional water system deliveries. In all, 53 recycled water and groundwater projects were identified for investigation of the potential to offset demand on the SFPUC regional water system. In addition, regional conservation programs consisting of between 8 and 23 conservation measures were evaluated. The regional conservation measures evaluated for the programs included a subset of the original 32 conservation measures evaluated in the 2004 conservation potential study (all but 8 of the original 32 measures that involved city of county ordinances or would be difficult to implement regionally), as well as four new measures and two revised original measures. The measures were evaluated individually and grouped into three regional programs. These conservation programs and the identified groundwater and recycled water projects were then screened to identify the feasibility and likelihood of implementation for each project/program.

The SFPUC assessed the likelihood of implementation on the basis of the degree to which various milestones in the project development and approval process had been completed by the local sponsoring agency, including: feasibility studies, cost estimate, conceptual engineering, CEQA environmental review, user commitments, community support, plans, and specifications. The projects identified as being eligible for the program (those that could potentially offset SFPUC regional water system deliveries) fell into three categories according to the likelihood of implementation with up to about 11 mgd in Category 1 (likely to be implemented), up to about 15.2 mgd in Category 2 (in early planning stages), and up to about 2.25 mgd in Category 3 (projects considered potentially eligible for future consideration). Due to their higher likelihood of implementation, the SFPUC incorporated the Category 1 San Francisco local projects into the WSIP's proposed water supply option for 10 mgd of additional supply (see Chapter 3, Section 3.6 for a description of these projects). The remaining projects in Categories 1, 2 and 3 have varying

[9] Naturally renewable groundwater was defined as groundwater that, when pumped out of the ground, is naturally recharged in such a way that there is minimal or immeasurable effect on the beneficial uses of surface water. Further, this is groundwater that can be withdrawn from the ground at a sustainable rate without requiring imported surface water for recharge and without adversely affecting the local water resource.

degrees of feasibility; because most remain in the early stages of development and evaluation, information about their yield and ability to be implemented in a reasonable timeframe is limited, as well as their ability to ultimately offset SFPUC regional water system deliveries. This is likely the reason the SFPUC customers did not include them in their original SFPUC regional water system purchases estimates.

Table 9-11 lists the identified potential conservation, recycled water, and groundwater projects that could potentially provide for up to 19 mgd of water supply to meet the increasing delivery requests assuming it is determined that they can offset SFPUC regional water system supplies and are implementable. The 19 mgd is an optimistic, high estimate that combines the estimated high-range yield of remaining Category 1 projects as well as both projects in Categories 2 and 3, including some projects only at a conceptual stage. The implementation of the identified projects is uncertain due to numerous unknown factors, including water quality issues, end-users, long-term sustainable yield, production rates, feasibility, institutional arrangements, and permitting. Among many unknown factors, for example, is the degree to which other water agencies that serve some of the same customers as the SFPUC may choose to pursue the same actions and seek to reduce their use of other water supplies. Therefore, while the list of identified projects illustrates that there are opportunities within the service area to develop more conservation, recycled water, and local groundwater, the total yield of these potential projects is unknown. For purposes of analysis, this PEIR evaluates a maximum supply/supply offset of 19 mgd, identified as the high-range of potential yield that might offset SFPUC purchases, might be developed through this alternative over the planning horizon.

This discussion is intended to provide decision-makers and interested parties with information about the potential options that exist, the challenges associated with each, and (as discussed in a subsequent section) attendant environmental impacts. Even assuming that 19 mgd could be developed through these projects, this alternative could meet approximately 75 percent of the additional projected 2030 average annual water supply need. However, at least 6 mgd of the projected average annual 2030 demand would be unmet, and this alternative would also provide less drought supply reliability compared to the WSIP, requiring increased frequency of rationing at 20 percent.

Tuolumne River Supplement

For purposes of the analysis of alternatives, the PEIR considers a second scenario for this alternative in which the SFPUC would provide supplemental Tuolumne River water to fully meet the 2030 customer purchase requests.

In the first scenario, the SFPUC would not divert additional water from the Tuolumne River. SFPUC rationing of its deliveries would increase above the 20 percent objective during a drought. It is expected that the wholesale customers would pursue a supplemental supply, such as a water transfer, to augment this alternative to serve their 2030 purchase requests. Potential effects of pursuing a water transfer are described generally under Section 9.2.2 No Program Alternative, above. In the second scenario, the SFPUC would provide for the full 2030 customer purchase requests of 300 mgd by augmenting the 19 mgd of additional conservation, water recycling, and

TABLE 9-11
REGIONAL RECYCLED WATER, GROUNDWATER, AND CONSERVATION PROJECTS INCLUDED IN THE AGGRESSIVE CONSERVATION/WATER RECYCLING AND LOCAL GROUNDWATER ALTERNATIVE

Location/Jurisdiction	Type of Supply	Description	Low Range Yield (mgd)	High-Range Yield (mgd)
Category 1 – Projects Likely to be Implemented				
City of Daly City	Recycled Water	Expansion of recycled water uses from an existing facility to irrigate an additional park and landscape medians.	-	0.01
North Coast County Water District/San Francisco	Recycled Water	Various irrigation uses for school grounds and highway uses.	0.15	0.58
		Subtotal Category 1	**0.15**	**0.6**
Category 2 – Eligible Projects in Early Planning Stages				
Mountain View	Recycled Water	Irrigation and industrial usage – joint project with City of Palo Alto	-	1
Various	Conservation	Eight conservation measures to be implemented by a regional body	2.3	5.7
Various	Conservation	Seven additional conservation measures to be implemented by a regional body	0.6	1.5
Palo Alto	Recycled Water	Irrigation in Palo Alto and East Palo Alto	-	1
Cal Water–Mid-Peninsula	Groundwater	New well in Mid-Peninsula District for potable use	-	1
Cal Water–Bear Gulch	Groundwater	New well shared with Menlo Park for potable use	-	1
East Palo Alto	Groundwater	Reestablish use of existing well	-	0.5
Redwood City	Recycled Water	Expand recycled water system for use by additional customers outside of service area	2.2	4.5
South San Francisco and San Bruno	Recycled Water	Replace current groundwater irrigation uses with recycled water	-	0.3
		Project Overlap Adjustment[1]		(1.5)
		Subtotal Category 2	**5.1**	**15**
Category 3 – Potentially Eligible Projects for Future Consideration				
Menlo Park	Groundwater	Groundwater well for emergency use	Unknown	Unknown
Sunnyvale	Recycled Water	Extend existing recycled water project	-	0.7
Various	Conservation	Eight additional conservation measures to be implemented by a regional body	0.5	1.4

TABLE 9-11 (continued)
REGIONAL RECYCLED WATER, GROUNDWATER, AND CONSERVATION PROJECTS INCLUDED IN THE AGGRESSIVE CONSERVATION/WATER RECYCLING AND LOCAL GROUNDWATER ALTERNATIVE

Location/Jurisdiction	Type of Supply	Description	Low Range Yield (mgd)	High-Range Yield (mgd)
Category 3 – Potentially Eligible Projects for Future Consideration (cont.)				
Burlingame	Groundwater	Rehabilitate existing well	-	0.02
Burlingame	Recycled Water	Irrigation of commercial landscaping	-	0.25
		Project Overlap Adjustment		(0.14)
		Subtotal Category 3	**0.5**	**2.23**
Total			**5.75**	**~19**

[1] Project overlap adjustment represents the amount of potential conservation program savings overlap with respect to other projects to avoid double counting.

SOURCE: SFPUC, 2007b.

conservation with additional diversions from the Tuolumne River when available. In many years, alternative could fully meet the 2030 customer purchase requests by diverting the additional required amount from the Tuolumne River under the SFPUC's existing water rights. This would require diversion of some additional water from the Tuolumne River (at least approximately 5 mgd, average annual) compared to the existing condition, but substantially less than proposed under the WSIP (27 mgd, average annual). There would continue to be a shortfall in firm water supply during drought which would lead to more frequent need to ration water deliveries at 20 percent. Alternatively, the SFPUC could develop additional water through a desalination project to serve the remaining 6 mgd of average annual delivery demand (see Section 9.2.6 for a discussion of the year-round desalination supply alternative).

For purposes of the analysis of alternatives, the PEIR considers two possible scenarios for this alternative: one in which the SFPUC would not provide supplemental Tuolumne River water and one in which the SFPUC would provide supplemental Tuolumne River water to fully meet the 2030 customer purchase requests.

Description of SFPUC and Wholesale Customer Actions

SFPUC Actions

Under this alternative, the SFPUC would implement all of the same WSIP facility improvement projects as proposed for the WSIP, although the capacities of some of the facilities might be somewhat reduced since some of the supply would be provided by customers. The design of some of the WSIP facilities would need to reevaluated and sized appropriately to meet the delivery

levels and performance objectives under this alternative. In addition, the SFPUC would proceed with implementation of other capital improvement projects and related activities not considered part of the program analyzed in this PEIR (as described in Chapter 3, Sections 3.13 and 3.4.6). The SFPUC would also implement the same system maintenance program and similar operational changes in the regional system as those proposed under the WSIP.

The SFPUC's role in helping its customers develop more aggressive conservation, recycled water, and local groundwater programs under this alternative could range from one of coordination and facilitation, to funding support, to full partnership with one or more customer in the design, construction, and/or operation of regional projects. The SFPUC's role in such projects would need to be defined on a case-by-case basis.

As discussed above, the maximum potential SFPUC regional water system delivery offset identified in the study is about 19 mgd (not including the 10 mgd of San Francisco local projects in the WSIP proposed program). The ability for the SFPUC and its customers to achieve this 19 mgd of yield by the year 2030 is highly uncertain, particularly the Category 3 project portion (2.25 mgd), for which the offset potential has not been determined even if the projects move forward. Assuming the 19 mgd is realized, this alternative still does not fully offset the regional water system increase of 25 mgd average annual supply needed to meet the 2030 purchase requests. In this case, the SFPUC could consider augmenting this alternative by providing an incremental increase in Tuolumne River supply to make up the potential delivery shortfall in years when water is available under their existing water rights. This would involve increasing the average annual Tuolumne River diversion by at least approximately 5 mgd over the existing average annual diversion. Alternatively, the SFPUC could provide a different supplemental source, such as potable water from a new desalination plant (described in Section 9.2.6).

This alternative includes the SFPUC implementing projects in San Francisco to achieve a 10-mgd offset on regional system demand through a combination of conservation, recycled water, and groundwater projects, as in the WSIP proposed program. However, without some additional Tuolumne River diversion there would be no supplemental dry-year water supply sources from water transfers or from the Westside Basin conjunctive-use program which would lead to delivery shortfalls during drought.

Wholesale Customer Actions

For this alternative, it is assumed that the wholesale customers would actively participate in developing additional recycled water/groundwater/conservation projects in their local service areas to reduce the increased regional demand on surface water supplies during nondrought and drought periods in addition to the groundwater, recycled water, and conservation projects they are already committing to implement locally. As indicated in Table 9-11, under this alternative, various wholesale customers, in partnership with the SFPUC and/or BAWSCA, would develop a variety of programs to increase local groundwater extraction and recycled water through more aggressive conservation efforts to offset 19 mgd of increased water demand on the SFPUC regional water system. It is also assumed that the wholesale customers, in coordination with the

SFPUC, would implements these actions in a timely manner so that the water supply/offset would be available as the estimated customer increase in purchase requests are realized.

If the SFPUC does not supplement this alternative with additional Tuolumne River water in order to fully meet the 2030 customer purchase requests, it is expected that the wholesale customers would pursue additional supplemental supply, such as a water transfer.

Feasibility Issues

The Aggressive Conservation/Water Recycling and Local Groundwater Alternatives, (with and without supplemental Tuolumne River supply), would have numerous technical, institutional, financial, and public acceptance issues to overcome prior to implementation. As described above, the estimated 19 mgd from regional conservation/water recycling and local groundwater projects represents an optimistic, high-end estimate based on very preliminary studies. There are numerous uncertainties with regard to water quality issues, end-users, long-term sustainable yield, and production rates; furthermore, in some communities, there remain public acceptance issues with regard to use of recycled water for non-potable uses. Institutional arrangements, funding sources, and permitting requirements for these programs are also unknown. Furthermore, even if these obstacles were overcome, this alternative would have questionable feasibility to require customers 20 percent rationing during drought periods due to demand hardening. It is unlikely that the SFPUC's regional system customers would support this alternative. In addition, this alternative would add substantial cost to overall program as a result of having to implement additional regional conservation/water recycling and local groundwater projects in addition to the costs of the 22 facility improvement projects included in the WSIP. This unknown but substantial additional cost raises questions about cost and financing feasibility and customer rate impacts.

Ability to Meet Program Objectives

The Aggressive Conservation/Water Recycling and Local Groundwater Alternative would meet the WSIP objectives for water quality only for the SFPUC actions; however, the objective could not be guaranteed for new sources provided by customers, nor if new sources are wheeled through the SFPUC's system, unless developed in cooperation with the SFPUC. As shown in Table 9-6, seismic reliability would be improved over existing conditions since all WSIP facility improvement projects would be implemented, but this alternative cannot meet the objective of providing basic service to all regions following a major earthquake with certainty, even with supplemental Tuolumne River water, since the reliability of new sources to be developed by customers is unknown. In addition, there is no certainty about where the distribution of the new sources would occur, so the seismic objectives of serving 70 percent of turnouts and meet basic service in the three customer regions (South Bay, Peninsula and City) could not be guaranteed. However, with implementation of all WSIP facility improvement projects, it is likely that facilities would be restored within 30 days of a major earthquake and the SFPUC could at least partially meet the average day demand.

Based on input from the wholesale customers throughout the SFPUC service area, aggressive conservation, recycled water, and local groundwater projects could partially but not fully meet the

WSIP delivery reliability and water supply performance objectives. Under this alternative, it might be possible to provide for much of (estimated up to approximately 19 mgd but with unknown certainty) but not all of the projected 25 mgd increase in customer purchase requests by 2030. To fully meet the 2030 purchase requests, a supplemental supply of at least 6 mgd would need to be provided to augment this alternative; otherwise, the SFPUC would not be able to fully serve the 2030 customer purchase requests. Even with the Tuolumne River water, the delivery reliability objectives could not be guaranteed due to the lack of SFPUC control over and the uncertainty of the wholesale customers' new sources of supply. Implementation of all the facility improvement projects would permit operational flexibility under planned maintenance conditions, when customer demands are low, but there is uncertainty over the reliability and availability of the full 19 mgd of regional recycled water /groundwater / conservation programs to provide sufficient operational flexibility when needed to replenish local reservoirs or during unplanned facility outages.

In addition, this alternative would provide less dry-year/drought supply reliability than the WSIP and would not meet the WSIP objective for system firm yield. As shown on Table 9-5, customers would experience rationing under this alternative of up to 20 percent (for the Tuolumne River supplemental supply scenario) or 25 percent (for the no supplemental supply scenario) with notably greater frequency than would customers under the WSIP. Furthermore, this degree of rationing would have different implications for customers under the Aggressive Conservation/Water Recycling and Local Groundwater Alternative compared to the WSIP. Demand hardening[10] refers to the increasing difficulty and expense of achieving short-term water conservation levels during shortages as more long-term conservation measures are implemented and water-use efficiency is maximized and is a concern among water conservation agencies regarding aggressive conservation programs. As a result of the water use efficiency or demand "hardening" that would be further institutionalized through this alternative, customers would have limited options for accommodating a period requiring 20 percent or more rationing in terms of what water uses they could cut back. Customers would have already increased their water use efficiency and eliminated less efficient uses such as many types of conventional outdoor use (e.g., landscape irrigation, car washing). In these cases, the water use cutbacks required to achieve 20 percent or more rationing would involve reductions in more essential water uses, such as indoor uses for cleaning and bathing, which could cause greater hardship on customers. This alternative would only partially meet the objective of diversifying water supply, since it does not provide for any dry year water sources.

This objective would meet the WSIP sustainability objectives, within the bounds of the SFPUC actions, but it would be unknown with respect to the wholesale customer actions. If the wholesale customers were to take independent action from the SFPUC under this alternative, this would

[10] As described by the California Department of Water Resources, demand hardening "occurs when agencies implement water conservation programs that result in permanent reductions in water use, such as retrofitting plumbing fixtures or installing low-water-use landscaping. These measures lessen agencies' ability to implement rationing to reduce water use during droughts, and can result in greater impacts to urban water users (e.g., loss of residential landscaping) when rationing is imposed. For example, the extensive Los Angeles retrofit program helped the city maintain reductions in urban per capita water use it achieved during the last drought. These permanent water use reductions will make it more difficult for the city to duplicate its previous 15 percent water use reduction goal during a future drought" (Department of Water Resources, 2005).

result in inefficient use of resources and funds and would not meet the WSIP objective for cost-effectiveness. While the system would remain largely gravity-driven, implementation of additional water recycling and groundwater projects would increase the pumping requirements of the overall system. The capital, operation and maintenance cost of the 22 facility improvement projects would be the same as the WSIP, but unknown and likely substantial additional costs would be incurred from conservation or supply projects implemented by customers in place of the WSIP supply.

Environmental Impacts Compared to those of the WSIP

Facility Construction and Operations Impacts

WSIP Facilities

The Aggressive Conservation/Water Recycling and Local Groundwater Alternative assumes that the same 22 facility improvement projects proposed under the WSIP would be implemented to meet the water quality, seismic reliability, and delivery reliability objectives of the WSIP; therefore, all of the impacts described in Chapter 4 would also occur under this alternative. Although the capacities of some of the proposed facilities, such as those under the SJPL System (SJ-3) and BDPL Reliability Upgrade (BD-1) projects, might be reduced compared to the WSIP, the impacts of constructing and operating these projects would be largely the same under this alternative as with the WSIP. This alternative relies on 19 mgd supply from the wholesale customers. However, as described below, this alternative could result in construction and operation of extensive additional recycled water and groundwater facilities in the wholesale customer service areas; thus, collective impacts in the Bay Division and Peninsula Regions and associated cumulative effects (such as traffic, air quality, noise, energy use, waste disposal, and vibration) would be more severe than those of the WSIP.

If the SFPUC were to supplement this alternative with additional Tuolumne River supply, no additional facilities beyond the proposed WSIP facilities and new customer facilities would be needed, except for recycling facilities or a possible desalination plant, as detailed in the next section. If the SFPUC were to supplement this alternative with a desalinated water supply, it would have to construct and operate a new desalination plant and conveyance facilities to connect to the regional system (see Section 9.2.6 for the discussion of a desalination alternative).

Other Facilities Potentially Implemented Under this Alternative

No significant environmental impacts would be expected from implementation of water conservation measures. However, implementation of the recycled water and groundwater projects listed in Table 9-11 would result in a full range of construction and operational impacts, similar to those described in Chapter 4 for the WSIP facilities, in the South Bay and Peninsula areas. The types of impacts associated with implementation of the local recycled water and groundwater projects are summarized in **Table 9-12** and generally relate to construction of new infrastructure, water quality, and groundwater resources and operational uses of energy and long-term air quality emissions.

TABLE 9-12
SUMMARY OF POTENTIAL IMPACTS AND MITIGATION STRATEGIES FOR RECYCLED WATER AND GROUNDWATER PROJECTS

Potential Impact	Mitigation Strategy
Groundwater Resources. Potential for increased groundwater pumping, groundwater level reductions, and overdraft if there is insufficient sustainable yield to accommodate increased pumping.	Determine sustainable yield of the basin, implement monitoring program, regulate groundwater pumping to preserve safe yield.
Surface Water, Groundwater Quality, and Public Health Issues. Recycled water applied to the irrigated lands would infiltrate through the subsurface levels, potentially affecting surface and groundwater quality. Groundwater may have contaminants with potential health effects. Groundwater lowers the aesthetic quality of the water through increased hardness, and potential for tastes and odors.	Comply with Title 22 Water Recycling Criteria. Groundwater may require disinfection, treatment and/or blending.
Energy use. Operation of both recycled water and groundwater projects would require increased energy use for treatment and distribution, and pumping. Increased energy production to support these activities along with plant operation would, in turn, generate additional air pollutant emissions, including greenhouse gases emissions.	Energy efficiency measures.
Treatment. Temporary construction impacts (disturbance of soils, surface water quality, biological resources, cultural resources, air quality, traffic, noise, land use, hazardous materials). Potential long-term impacts could include odor, depending on treatment processes and location relative to sensitive receptors. Plant operations could also generate long-term noise, traffic, and visual impacts depending on facility site location(s)and increased energy consumption and air pollutant emissions. **Pumping.** (groundwater pumping station)	Most impacts associated with facility construction could be mitigated to a less-than-significant level with the types of measures identified in Chapter 6. As is the case with the proposed WSIP facilities, odor control features (scrubbers) could reduce any odor impacts to a less-than-significant level.
Conveyance. Mostly temporary impacts from construction of pipelines, valves, and pumps (disturbance of soils, surface water quality, biological resources, cultural resources, air quality, traffic, noise, land use, hazardous materials, aesthetics).	Most impacts associated with facility construction could be mitigated to a less-than-significant level with the types of measures identified in Chapter 6. As is the case with the proposed WSIP facilities, some impacts (e.g., short-term noise and traffic) could be unavoidable.
Storage. Temporary construction impacts (disturbance of soils, surface water quality, biological resources, cultural resources, air quality, traffic, noise, land use, hazardous materials) and potential long-term impacts based on site-specific characteristics (e.g., slope stability, location within a scenic viewshed).	Most impacts associated with facility construction could be mitigated to a less-than-significant level with the types of measures identified in Chapter 6. As is the case with the proposed WSIP facilities, some impacts (e.g., short-term noise and traffic) could be unavoidable. Prepare and implement recommendations from a geotechnical study, implement measures to reduce visual contrast with surroundings (e.g., backfilling, earth-tone paint).

If the wholesale customers were to supplement this alternative with additional water through a water purchase, additional storage and/or limited conveyance facilities might be required. See the discussion of this topic under the No Program Alternative.

Water Supply and System Operations Impacts

This discussion addresses both alternative scenarios—the scenario in which the SFPUC would not supplement this alternative with additional supplies (could be anything), and the scenario in which the SFPUC would supplement this alternative with additional Tuolumne River diversions.

Aggressive Conservation/Water Recycling and Local Groundwater Alternative with No Supplemental Tuolumne River Water

Tuolumne River Watershed. Water demand would increase under the Aggressive Conservation/Water Recycling and Local Groundwater Alternative, but for this analysis, it is assumed that none of it would be met with water from the Tuolumne River. There would be no change in average annual releases to the Tuolumne River from Hetch Hetchy Reservoir with the Aggressive Conservation/Water Recycling and Local Groundwater Alternative compared to the existing condition. There may be changes in the pattern of releases from Hetch Hetchy Reservoir because of the improvements to conveyance facilities and improved maintenance practices. These changes could lead to year to year differences in the amount of water diverted from the Tuolumne River. There would be changes in the pattern of spring releases from Hetch Hetchy Reservoir, but these changes would be expected to have less severe impacts than the WSIP. However, the delay would still be enough to have a potentially significant adverse effect on terrestrial biological resources because of the ecological sensitivity of riverside meadows and their flora and fauna.

Similarly, the Aggressive Conservation/Water Recycling and Local Groundwater Alternative would result in no change in average annual releases to the Tuolumne River from La Grange Dam. The net effect of the small increases and decreases in the initial winter/spring releases would have a less-than- significant effect on fisheries in the Tuolumne River and the terrestrial biological resources in the riparian corridor.

Alameda Creek Watershed. The improvements to Calaveras Dam that would occur with the WSIP would also be part of the Aggressive Conservation/Water Recycling and Local Groundwater Alternative. Furthermore, under this alternative, the SFPUC would operate its facilities in the Alameda Creek watershed in a similar manner as the WSIP. Consequently, the environmental impacts of the Aggressive Conservation/Water Recycling and Local Groundwater Alternative would be similar to those of the WSIP.

Peninsula Watershed. Water demand would increase with the Aggressive Conservation/Water Recycling and Local Groundwater Alternative, as it would with the WSIP. The SFPUC would try to serve increased demand in the Coastside CWD service area from Pilarcitos Creek, exactly as it would with the WSIP. The consequent, more rapid drawdown of Pilarcitos Reservoir and the earlier cessation of stored water releases to Pilarcitos Creek would have a significant adverse effect on water quality, fisheries, and terrestrial biological resources in the reservoir and the creek.

The improvements to Lower Crystal Springs Dam that would occur with the WSIP would also be part of the Aggressive Conservation/Water Recycling and Local Groundwater Alternative. As a result of the improvements and associated modifications in system operations, the maximum water level in Crystal Springs Reservoir would rise by about 20 feet. The rise in water level would have significant adverse impacts on terrestrial biological resources, as described in Section 5.5.6. Since this alternative would include improvements to Lower Crystal Springs Dam, the SFPUC would generally operate its facilities in the Peninsula watershed in a similar manner as with the WSIP. Consequently, the environmental impacts of this alternative would be similar to those of the WSIP.

Aggressive Conservation/Water Recycling and Local Groundwater Alternative with Supplemental Tuolumne River Water

Tuolumne River Watershed. Water demand would increase under the Aggressive Conservation/Water Recycling and Local Groundwater Alternative, but a greater portion of the increase would be met by conservation, recycling, and groundwater than under the WSIP. This alternative would result in a small reduction in average annual releases to the Tuolumne River from Hetch Hetchy Reservoir (less than 1 percent) and some reduction and delay in the spring releases on occasion as compared to the existing condition. The reduction and delay in spring releases would occur because storage deficits in a series of dry years would accumulate in Hetch Hetchy Reservoir. The reduction and delay in spring releases would be less than with the WSIP, and a delay of more than two days would occur much less frequently, about once in every 10 years, with the Aggressive Conservation/Water Recycling and Local Groundwater Alternative than with the WSIP. The delay would still be enough to have a significant adverse effect on terrestrial biological resources because of the ecological sensitivity of riverside meadows and their flora and fauna.

The Aggressive Conservation/Water Recycling and Local Groundwater Alternative would result in a small reduction in average annual releases to the Tuolumne River from La Grange Dam (less than 1 percent) and some reduction and delay in the winter/spring releases as compared to the existing condition. The reduction and delay in winter/spring releases would have an adverse effect on fisheries in the lower Tuolumne River and on terrestrial biological resources in the riparian corridor, but the impact would be less than significant.

Alameda Creek Watershed. The improvements to Calaveras Dam that would occur with the WSIP would also be part of the Aggressive Conservation/Water Recycling and Local Groundwater Alternative. Furthermore, under this alternative, the SFPUC would operate its facilities in the Alameda Creek watershed in a similar manner as with the WSIP. Consequently, the environmental impacts of the Aggressive Conservation/Water Recycling and Local Groundwater Alternative would be similar to those of the WSIP.

Peninsula Watershed. Water demand would increase with the Aggressive Conservation/Water Recycling and Local Groundwater Alternative, as it would with the WSIP. The SFPUC would try to serve increased demand in the Coastside CWD service area from Pilarcitos Creek, exactly as it would with the WSIP. The consequent, more rapid drawdown of Pilarcitos Reservoir and the

earlier cessation of stored water releases to Pilarcitos Creek would have a significant adverse effect on water quality, fisheries, and terrestrial biological resources in the reservoir and the creek.

The improvements to Lower Crystal Springs Dam that would occur with the WSIP would also be part of the Aggressive Conservation/Water Recycling and Local Groundwater Alternative. As a result of the improvements and associated modifications in system operations, the maximum water level in Crystal Springs Reservoir would rise by about 20 feet. The rise in water level would have significant adverse impacts on terrestrial biological resources. Since this alternative would include improvements to Lower Crystal Springs Dam, the SFPUC would generally operate its facilities in the Peninsula watershed in a similar manner as with the WSIP. Consequently, the environmental impacts of this alternative would be similar to those of the WSIP.

Growth-Inducement Potential and Secondary Effects of Growth

The growth-inducement potential for the Aggressive Conservation/Water Recycling and Local Groundwater Alternative would be similar to that described above for the No Program Alternative. As discussed above under Ability to Meet Program Objectives, this alternative would meet the 2030 purchase request increase but would not provide the same level of supply reliability as the proposed program. As a result, it is expected that SFPUC wholesale customers and/or BAWSCA would pursue other projects and actions to provide the desired level of reliability. While the need to develop additional projects beyond the WSIP might have some slowing effect on development approvals in some communities, it is not expected to impede growth from continuing in accordance with adopted plans. As a result, this alternative would have similar secondary effects of growth as those described for the proposed program.

9.2.5 Lower Tuolumne River Diversion Alternative

Under the Lower Tuolumne River Diversion Alternative, the SFPUC would implement all of the proposed facility improvement projects and would serve the projected increase in customer purchase requests through 2030 through diversions from the lower Tuolumne River, in accordance with an agreement with TID and MID, and construction of conveyance and treatment facilities to blend the new supply into the regional system. This alternative is based on an alternative developed by the SFPUC planning studies conducted for the WSIP water supply option (SFPUC, 2007b). Compared to the WSIP, this alternative represents an alternative source of supply and is evaluated to address impacts to the Tuolumne River.

Description of SFPUC and Wholesale Customer Actions

SFPUC Actions

Table 9-4 summarizes the main characteristics of the Lower Tuolumne River Diversion Alternative in comparison to those of the proposed program. Under this alternative, the SFPUC would rely on the same water supply sources as it would under the WSIP during both drought and nondrought periods. The increase in purchase requests would be served through the restored

capacity of Calaveras and Crystal Springs Reservoirs, increased diversions from the Tuolumne River, and an equivalent of 10 mgd of supply from recycled water, groundwater, and conservation projects in San Francisco. Unlike the proposed program, however, the SFPUC would secure the increased diversions from the Tuolumne River at a downstream location near the confluence with the San Joaquin River. To meet the increase in purchase requests under this alternative, the SFPUC would release about 25 mgd (average annual) water from Hetch Hetchy Reservoir, allow it to flow to Don Pedro Reservoir, and release it from the New Don Pedro Dam to the lower Tuolumne River, in accordance with an agreement with TID/MID. A new SFPUC diversion facility located near the confluence of the San Joaquin and Tuolumne Rivers would recover the 25 mgd. From the diversion point, the recovered water would be pumped to a new treatment plant near Tesla Portal where it would be filtered and disinfected prior to blending with unfiltered Hetch Hetchy water. The lower Tuolumne River water would require treatment prior to blending into the Coast Range Tunnel because it would not meet the federal or state filtration exemption requirements. A conceptual schematic of this diversion is shown in **Figure 9.1**.

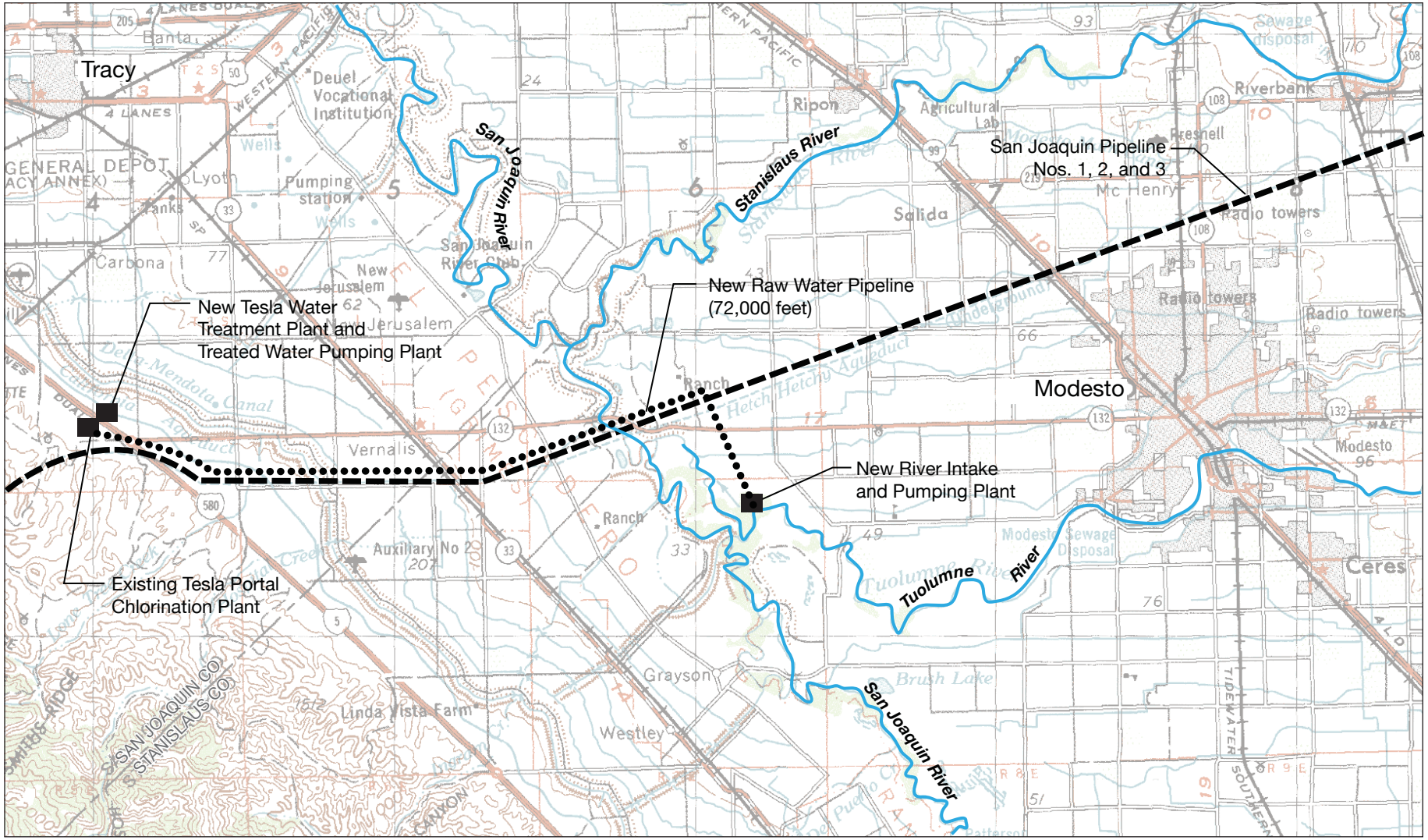
The Lower Tuolumne River Diversion Alternative assumes that all 22 WSIP facility improvement projects would be implemented. However, the design of some of the WSIP facilities would need to reevaluated and sized appropriately to meet the delivery levels and performance objectives under this alternative. In addition, the SFPUC would proceed with implementation of other capital improvement projects and related activities not considered part of the program analyzed in this PEIR (as described in Chapter 3, Sections 3.13 and 3.4.6). The SFPUC would also implement the same system maintenance program and similar operational changes in the regional system as those proposed under the WSIP with the addition of operation and maintenance of the additional facilities described below.

This alternative would require that the SFPUC construct and operate additional facilities not included under the WSIP, as summarized below:

- *Lower Tuolumne River Intake and Pumping Plant*. A new lower Tuolumne River intake and pumping plant would divert the 25 mgd (average annual) and lift the water to a new treatment plant near Tesla Portal. Depending on the suitability of the gravel bed, it is possible that the intake structure would be similar to that of the TID Infiltration Gallery Project, which consists of an array of perforated pipes installed in the lower Tuolumne River bed. If this design is not appropriate, the intake structure would be equipped with a fish screen designed to meet state and federal fish screen criteria. Two sites for the lower Tuolumne River intake and pumping plant have been considered at locations where the flood levels are not in place or already compromised. The facility would be sized appropriately (e.g., 55 mgd) to provide for seasonal diversions.

- *15-Mile Pipeline*. Diverted lower Tuolumne River flows would be pumped to the new treatment plant via a 15-mile, 48-inch-diameter welded steel pipe, the majority of which would run parallel to the existing San Joaquin Pipelines.

- *Lower Tuolumne Water Treatment Plant*. The Lower Tuolumne WTP would filter and disinfect the lower Tuolumne River water. The WTP would be located just north of Tesla Portal within the SFPUC property boundary and have a sustainable capacity of 55 mgd.



SOURCE: ESA+Orion, 2006

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Figure 9.1
Lower Tuolumne River Diversion Alternative
Facilities and Pipeline Alignment

- *Tesla Treated Water Pumping Plant*. The pumping plant would pump treated lower Tuolumne River water to Tesla Portal, where it would be combined with Hetch Hetchy water via a new vertical shaft to the Coast Range Tunnel. However, if the Advanced Disinfection project (SJ-1) is sited at Tesla Portal, a blending structure could be added to the new facility, and a new vertical shaft to the Coast Range Tunnel would not be required.

Wholesale Customer Actions

Like the proposed program, the Lower Tuolumne River Diversion Alternative would fully meet the WSIP delivery reliability and water supply level of service goals. Therefore, the SFPUC would serve the projected 2030 purchase requests for all customers, and wholesale customers would not be required to implement any additional conservation and/or recycled water projects or develop supplemental water supplies from other sources beyond what is identified in their respective urban water management plans.

Feasibility Issues

The Lower Tuolumne Diversion Alternative would pose a number of technical and institutional challenges and there is uncertainty regarding the availability of water at this location. The availability of water on the lower Tuolumne River to the SFPUC would be dependent upon: (1) agreements with TID and MID for making the necessary releases from Don Pedro Reservoir, (2) approval by the State Water Resources Control Board for a change in the point of diversion and possibly additional appropriation license to recover this water, (3) and regulatory constraints under the state and federal Endangered Species Act. Construction of the intake in the lower Tuolumne River and crossing the San Joaquin River could affect critical habitat for steelhead and Chinook salmon. There could also be water quality issues with the new source, depending on the location of the intake and the design of the treatment facility, and the overall quality of the regional system water would be reduced with the addition of treated water from the lower Tuolumne River. This alternative would likely arouse public opposition result in the San Joaquin Valley due to substantial construction and operational impacts, outside of the SFPUC service area. In addition, this alternative would add substantial cost to overall program as a result of having to build and operate a new intake, treatment plant, and transmission pipelines in addition to the costs of the 22 facility improvement projects included in the WSIP. This substantial additional cost raises questions about cost and financing feasibility and customer rate impacts.

Ability to Meet Program Objectives

Table 9-6 shows how the Lower Tuolumne River Diversion Alternative would perform in terms of meeting the WSIP level of service goals and performance objectives compared to the proposed program. This alternative is dependent on agreements with TID/MID to make the requisite water releases from New Don Pedro Dam; State Water Resources Control Board appropriation licenses, if applicable; and regulatory constraints under the California and Federal Endangered Species Acts. Thus, water from the Tuolumne River is reliable but not necessarily available under this scenario.

The Lower Tuolumne River Diversion Alternative would only partially meet the level of service goal related to water quality, since it would require full treatment prior to blending with other Hetch Hetchy supplies. Although both the WSIP and this alternative would meet all applicable water quality requirements, there would be a deterioration in water quality, including potentially more contaminants in the water, and reduced aesthetic quality (tastes and odor, hardness) under the Lower Tuolumne River Diversion Alternative compared to the WSIP.

The Lower Tuolumne River Diversion Alternative would include implementation of the 22 facility improvement projects as proposed under the WSIP needed to meet the seismic and delivery reliability level of service goals. However, due to the unknown availability of the lower Tuolumne River as a year-round source, there is uncertainty of the capability of this alternative to provide adequate delivery to all regions following a major earthquake or to serve average day demand during an unplanned facility outage. Similarly, while the facilities could be restored within 30 days after a major earthquake, this alternative could partially restore service to the customer but the availability of the full average day demand of 300 mgd would depend on the lower Tuolumne River diversion. With implementation of all the facility improvement projects, the system would have increased operational flexibility for planned maintenance, but the extensive increase in facility requirements under this alternative would add additional constraints to systemwide operational flexibility. Comprehensive and regular repair and maintenance of the regional water system would generally occur without interruption, and the risk of service interruptions due to unplanned facility upsets or outages would be minimal, assuming availability of water from the lower Tuolumne River diversion location.

With respect to water supply reliability, the Lower Tuolumne River Diversion Alternative would increase system firm yield to 256 mgd, thus meeting the level of service goals for water supply during drought and nondrought periods. This assumes that diversions from the lower Tuolumne River are feasible during all water years and all seasons, as proposed under this scenario, and that the water transfer from TID/MID could be implemented.

It is uncertain if the Lower Tuolumne River Diversion Alternative would meet the WSIP sustainability objectives, since there are numerous regulatory and permitting issues to be resolved, including effects on steelhead and Chinook salmon, and would require significant increase in long-term energy use compared to the proposed program. While the system would remain largely gravity-driven, the new source of water under this alternative would increase the pumping requirements of the overall system. This alternative would result in inefficient use of resources and funds compared to the WSIP, and would not meet the WSIP objective for cost-effectiveness. The capital, operation and maintenance cost of the 22 facility improvement projects would be the same as the WSIP, but substantial additional capital, operation and maintenance costs would be incurred from the diversion, pumping, conveyance and treatment facilities needed for this alternative.

Environmental Impacts Compared to those of the WSIP

Facility Construction and Operations Impacts

WSIP Facilities

The Lower Tuolumne River Diversion Alternative would include implementation of all 22 WSIP facility improvement projects. Although implementation of the SJPL System project (SF-3) would be slightly different than under the WSIP, the impacts associated with this project would be about the same under both scenarios. Thus, the environmental impacts of constructing and operating each of the 22 WSIP facility projects would be about the same as those described in Chapter 4 for the proposed program. However, as discussed below, this alternative would require the construction and operation of extensive additional facilities in the San Joaquin Valley; thus, collective impacts in the San Joaquin Region and associated cumulative effects (such as traffic, air quality, noise, and vibration) would be more severe than those of the WSIP, depending on the construction schedule for these facilities.

Other Facilities and Actions Potentially Implemented Under this Alternative

In addition to the impacts related to construction and operation of the 22 WSIP facility improvement projects, implementation of the Lower Tuolumne River Diversion Alternative would also result in substantial additional impacts related to the construction and operation of additional facilities, including an intake structure and pumping plant, a new 55-mgd water treatment plant, a 15-mile pipeline to convey diverted flows from the point of diversion to the water treatment plant, and a new Tesla treated water pumping plant to transmit the treated water to Tesla Portal. These facilities would result in the full range of impacts at the proposed facility locations as those described in Chapter 4 for the WSIP facilities and would increase the construction and operational impacts in the San Joaquin Region. Impacts of these facilities would be similar to and in addition to those identified for the WSIP; construction and operational impacts would include effects on biological resources (described below), water quality, air quality, noise, traffic, visual, and recreation.

A primary concern with respect to these additional facilities is the potential for adverse effects on biological resources. Construction activities could affect wetlands and riparian habitat, alkali grasslands, valley oak woodland, agricultural areas, and grassland/ruderal habitat as well as special-status animal and plant species such as Swainson's hawk, vernal pool invertebrates, California tiger salamander, burrowing owl, Valley elderberry longhorn beetle, San Joaquin kit fox, California red-legged frog, and Delta button-celery. Construction of the intake structure at the Tuolumne River and across the San Joaquin River could adversely affect fishery resources, including Central Valley fall- and late-fall-run Chinook salmon and Central Valley steelhead.

The key operational issues associated with the Lower Tuolumne River Diversion Alternative would center around the effects of withdrawals on the Tuolumne River. Operation of the intake could result in the entrainment or impingement of species of concern (Central Valley steelhead and Chinook salmon). If an intake structure similar to that of the TID Infiltration Gallery Project were found to be inappropriate, the intake would be designed with state-of-the art fish screens. In

addition, implementation of this alternative could potentially cause changes in hydrologic conditions along the lower Tuolumne River. Future evaluations would be required to assess hydrologic regime impacts. When compared to the proposed program, the Lower Tuolumne River Diversion Alternative would result in increased annual energy demand related to the operation of new pumping and treatment facilities, which in turn could result in secondary air quality and greenhouse gas emission, depending on the source of power.

Water Supply and System Operations

Under the Lower Tuolumne River Diversion Alternative, the total average annual diversions from the Tuolumne River would be essentially the same as with the WSIP, based on HH/LSM modeling over the 82-year hydrologic record, as shown in Table 9-5. However, due to the change in the point of diversion, system operations would be modified under this alternative compared to the WSIP. The potential impacts on water resources in the Tuolumne River, Alameda Creek, and Peninsula watersheds associated with this modified operation are described below and compared to the impacts that would occur under the WSIP.

Tuolumne River Watershed

Water demand would increase under the Lower Tuolumne River Diversion Alternative, as it would with the WSIP. The increased demand would be met, as it would be with the WSIP, by a combination of conservation, recycling, and groundwater storage and water from the Tuolumne River. However, with the Lower Tuolumne River Diversion Alternative, most of the increased diversion from the Tuolumne River would occur at a point just upstream of the Tuolumne River's confluence with the San Joaquin River, rather than at Hetch Hetchy Reservoir. This alternative would result in an increase in average annual releases to the Tuolumne River from Hetch Hetchy Reservoir of about 5 percent compared to the existing condition. Most of the time, releases to the river would be increased compared to the existing condition with the Lower Tuolumne River Diversion Alternative. Under the existing condition, the minimum required release would be made from Hetch Hetchy Reservoir 84.2 percent of the time (837 months in the 987-month hydrologic record). With the Lower Tuolumne River Diversion Alternative, the minimum required release would be made in many fewer months. The minimum releases would be supplemented by water released from Hetch Hetchy Reservoir for subsequent diversion near the Tuolumne River's confluence with the San Joaquin River in about half of the months in the 82-year hydrologic record. The increase in flow in the river between O'Shaughnessy Dam and Don Pedro Reservoir would benefit resident fish, riparian vegetation, fauna of the riparian corridor and whitewater recreation.

The Lower Tuolumne River Diversion Alternative would increase the average annual releases of water to the Tuolumne River below La Grange Dam, but would reduce and delay winter/spring releases by essentially the same amount as the WSIP. Under the existing condition, the minimum required release would be made from La Grange Dam 72.6 percent of the time (717 months in the 987-month hydrologic record). With the Lower Tuolumne River Diversion Alternative, the minimum required release would be made in fewer months. The minimum releases would be supplemented by water released from La Grange Dam for subsequent diversion near the

Tuolumne River's confluence with the San Joaquin River in many months. The increase in flow in the river between La Grange Dam and the San Joaquin River confluence would benefit resident and migratory fish, riparian vegetation, fauna of the riparian corridor and recreation. As with the WSIP, the reduction and delay in winter/spring releases would have a significant adverse effect on fisheries in the Tuolumne River and terrestrial resources in the riparian corridor.

Alameda Creek Watershed

The improvements to Calaveras Dam that would occur under the WSIP would also be part of the Lower Tuolumne River Diversion Alternative. Furthermore, under this alternative, the SFPUC would operate its facilities in the Alameda Creek watershed in a similar manner as with the WSIP. Consequently, the environmental impacts of the Lower Tuolumne River Diversion Alternative would be similar to those of the WSIP.

Peninsula Watershed

Water demand would increase with the Lower Tuolumne River Diversion Alternative, as it would with the WSIP. The SFPUC would try to serve increased demand in the Coastside CWD service area from Pilarcitos Creek, exactly as it would with the WSIP. The consequent, more rapid drawdown of Pilarcitos Reservoir and the earlier cessation of stored water releases to Pilarcitos Creek would have a significant adverse effect on water quality, fisheries, and terrestrial biological resources in the reservoir and the creek.

The improvements to Lower Crystal Springs Dam that would occur under the WSIP would also be part of the Lower Tuolumne River Diversion Alternative. As a result of the improvements and associated system operations, the maximum water level in Crystal Springs Reservoir would rise by about 20 feet. The rise in water level would have significant adverse impacts on terrestrial biological resources, as described in Section 5.5.6. Since this alternative would include improvements to Lower Crystal Springs Dam, the SFPUC would generally operate its facilities in the Peninsula watershed in a similar manner as with the WSIP. Consequently, the environmental impacts of the Lower Tuolumne River Diversion Alternative in the Peninsula watershed would be similar to those of the WSIP.

Growth-Inducement Potential and Secondary Effects of Growth

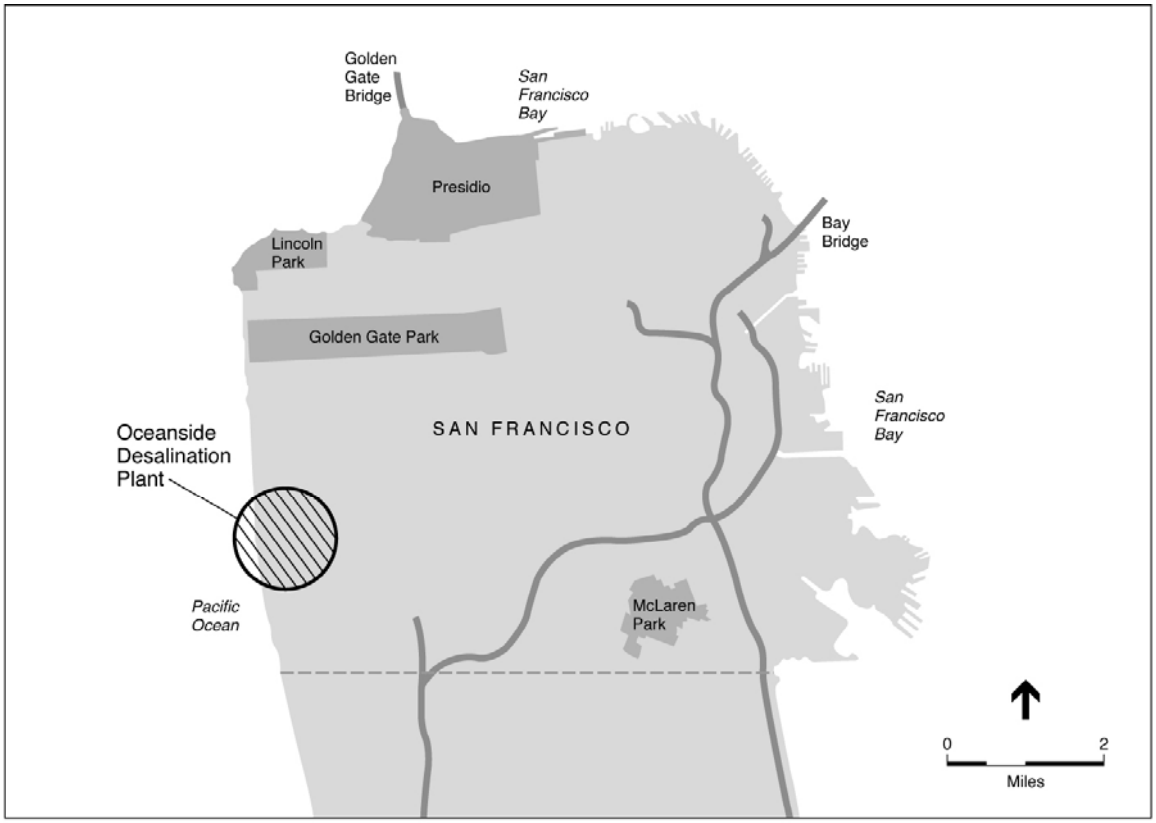
The growth-inducement potential for the Lower Tuolumne River Diversion Alternative would be similar to that of the proposed program, as described in Chapter 7. Since this alternative would meet the WSIP system performance objectives for delivery reliability and water supply, the water service and populations served would be identical. The minor difference in water quality would not affect the growth-inducement potential.

9.2.6 Year-round Desalination at Oceanside Alternative

Under the Year-round Desalination at Oceanside Alternative, the SFPUC would implement all of the proposed facility improvement projects and would construct a 25-mgd desalination plant in San Francisco to serve the projected increase in customer purchase requests. The plant would

provide year-round supplies during all hydrologic year types to blend with the regional system water. This alternative is based on an alternative developed by the SFPUC planning studies conducted for the WSIP water supply option (SFPUC, 2007b). Compared to the WSIP this alternative represents and alternative source of supply and is evaluated to address the impacts to the Tuolumne River, Alameda Creek, and the Peninsula watershed, including Pilcarcitos Creek.

The Year-round Desalination at Oceanside Alternative would involve the construction of the Oceanside Seawater Desalination Plant (OSDP) on the west side of San Francisco near the existing Oceanside Water Pollution Control Plant (WPCP) (see **Figure 9.2**). Under this alternative, 25 mgd of potable water supplies produced by reverse-osmosis technologies would be provided year-round to retail customers in San Francisco during all hydrologic year types to the regional water system. The desalinated water would be introduced into the regional water system at Sunset Reservoir; this reservoir serves only customers in San Francisco and these customers would receive predominantly desalinated water.



SOURCE: ESA+Orion, 2006

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Figure 9.2
Year-Round Desalination at Oceanside Alternative

The Year-round Desalination at Oceanside Alternative assumes that seawater would be pumped through an offshore intake structure and pipeline to the OSDP, which would be designed with a sustainable capacity of 25 mgd. Based on a water recovery rate of approximately 50 percent in modern-day desalination plants, the capacity of the seawater intake structure and pipeline is estimated at 55 mgd. The conceptual process for the desalination plant includes pretreatment using advanced technologies to remove pathogens and suspended solids, a dual-stage reverse-osmosis system to remove salts, and post-treatment to stabilize and disinfect the product water and make it suitable for mixing in drinking water systems. The OSDP would make use of the existing wastewater outfall at the Oceanside WPCP for the discharge of the reverse-osmosis and pretreatment brine.

Description of SFPUC and Wholesale Customer Actions

SFPUC Actions

Table 9-4 summarizes the main characteristics of the Year-round Desalination at Oceanside Alternative in comparison to those of the proposed program. Under this alternative, the SFPUC would accommodate the projected increase of 35 mgd in customer purchase requests through 2030 through construction and operation of the OSDP (25 mgd), increased utilization of Bay Area watershed supplies associated with the restoration of storage in Calaveras Reservoir (SV-2) and Lower Crystal Springs Reservoir (PN-4), and an equivalent of 10 mgd of supply from recycled water, groundwater, and conservation projects in San Francisco. Supplemental drought-year supplies would consist of 25 mgd of desalination water and 6 mgd from implementation of the Westside Groundwater Basin conjunctive-use program.

The Year-round Desalination at Oceanside Alternative would implement all facility improvement projects proposed under the WSIP. However, the design of some of the WSIP facilities would need to reevaluated and sized appropriately to meet the delivery levels and performance objectives under this alternative. In addition, the SFPUC would proceed with implementation of other capital improvement projects and related activities not considered part of the program analyzed in this PEIR (as described in Chapter 3, Sections 3.13 and 3.4.6). The SFPUC would also implement the same system maintenance program and similar operational changes in the regional system as those proposed under the WSIP with the addition of operation and maintenance of the additional facilities described below.

Additional facilities that would be required under this alternative are summarized below:

- *55-mgd Concrete Seawater Intake Structure*. The new concrete intake structure would be located southwest of the desalination plant, approximately one to two miles offshore, at a depth of approximately 40 to 50 feet, depending on the extent of the existing sandbar. The intake structure would be sited and designed so as to minimize sediment intrusion, minimize the entrainment and/or impingement of marine organisms, and maximize water quality.

- *60-inch-Diameter Intake Pipeline*. The intake pipeline would convey 55 mgd of seawater from the intake structure to a new raw water pump station.

- *Seawater Intake Pump Station*. The seawater intake pump station, located onshore next to the OSDP, would be designed with a pumping capacity of 55 mgd and would pump raw water to pretreatment facilities.

- *Oceanside Seawater Desalination Plant*. The OSDP would be located near the existing Oceanside WPCP and would use the existing ocean outfall pipeline for brine disposal. The new plant would include pretreatment facilities, reverse-osmosis modules, and post-treatment facilities, as well as pipelines and pumps needed to convey the brine to the ocean outfall. There are feasibility issues associated with siting of the plant at this location due to space constraints for this plant as well as the proposed WSIP recycled water treatment facilities for the Recycled Water projects (SF-3).

- *25-mgd Treated Water Pump Station*. The treated water pump station would pump the treated water to the Sunset Reservoir for distribution via a new treated water pipeline.

- *48-Inch-Diameter Treated Water Pipeline*. A 2.4-mile 48-inch-diameter pipeline would convey the treated water through city streets to the Sunset Reservoir.

Implementation of the Year-round Desalination at Oceanside Alternative would require numerous additional permits and approvals, including preparation of a watershed sanitary survey in accordance with California Department of Health's safety regulations, approval by the U.S. Army Corps of Engineers for construction of structures in coastal areas, and approval by the Regional Water Quality Control Board for brine disposal. In addition, as required by Clean Water Act Section 316(b), the SFPUC would be required to submit a study to the California Coastal Commission describing the potential impingement and entrainment impacts on aquatic resources.

Wholesale Customer Actions

Like the proposed program, the Year-round Desalination at Oceanside Alternative would fully meet the WSIP delivery reliability and water supply level of service goals. Therefore, the SFPUC would serve the projected 2030 purchase requests for all customers, and wholesale customers would not be required to implement any additional conservation and/or recycled water projects or develop supplemental water supplies from other sources beyond what is identified in their respective urban water management plans.

Feasibility Issues

The major technical feasibility issue of implementing a year-round desalination plant at the Oceanside Water Pollution Control Plant site is due to the limited space available at this location. The site was selected to take advantage of the existing ocean outfall structure at this location, but there are other competing uses for this space, including the recycled water treatment facilities proposed as one of the WSIP facility improvement projects and recreational uses at and near the San Francisco Zoo. While there would be no restrictions on the availability of seawater, there remain site-specific uncertainties regarding the permit conditions for brine disposal and for minimizing impacts on aquatic resources. This alternative would also result in a direct impact on residents on the westside of San Francisco who are served from Sunset Reservoir and would essentially receive desalinated water instead of regional system water. Other public acceptance issues include potential conflicts with nearshore recreational uses in the Ocean Beach area. In

addition, this alternative would add substantial cost to overall program as a result of having to build and operate a new intake structures, pump station, treatment plant, transmission pipelines, and any associated mitigation measures in addition to the costs of the 22 facility improvement projects included in the WSIP. This substantial additional cost raises questions about cost and financing feasibility and customer rate impacts.

Ability to Meet Program Objectives

Table 9-6 shows how the Year-round Desalination at Oceanside Alternative would perform in terms of meeting the WSIP level of service goals and performance objectives compared to the proposed program. Because there are no restrictions on the amount of seawater taken from the Pacific Ocean, this alternative does not have the same supply availability and reliability constraints as the surface water options.

The Year-round Desalination at Oceanside Alternative would increase system firm yield to approximately 256 mgd, thus meeting the level of service goals for water supply during drought and nondrought periods. This alternative would include implementation of all key projects needed to meet the seismic reliability and delivery reliability objectives of the WSIP, although the increase in facility maintenance and operational requirements associated with the desalination facilities would add additional constraints to systemwide operational flexibility. Although the Year-round Desalination at Oceanside Alternative would also meet the level of service objectives related to water quality, assuming the desalinated water would be treated to meet drinking water standards. As discussed above, this alternative would require that the SFPUC conduct a watershed sanitary survey and an impingement/entrainment study to comply with the requirements of the California Department of Health Services and the California Coastal Commission, respectively.

It is uncertain if the Year-round Desalination at Oceanside Alternative would meet the WSIP sustainability objectives, since there are numerous regulatory and permitting issues to be resolved associated with the desalination process, including protection of aquatic resources, water quality, and brine disposal issues, and it would require significant increase in long-term energy use compared to the proposed program. While the system would remain largely gravity-driven, the new source of water under this alternative would increase the pumping requirements of the overall system. This alternative would result in inefficient use of resources and funds compared to the WSIP, and would not meet the WSIP objective for cost-effectiveness. The capital, operation and maintenance cost of the 22 facility improvement projects would be the same as the WSIP, but substantial additional capital, operation and maintenance costs would be incurred from the intake, pumping, conveyance, treatment, and brine disposal facilities needed for this alternative.

Environmental Impacts Compared to those of the WSIP

Facility Construction and Operations Impacts

WSIP Facilities

The Year-round Desalination at Oceanside Alternative would include implementation of all 22 WSIP facility improvement projects. Although depending on a reevaluation of facilities sizing, some of the facilities could be slightly different than as proposed under the WSIP; however, the facilities impacts would be about the same under both scenarios. Thus, the environmental impacts of constructing and operating each of the 22 WSIP facility projects would be about the same as those of the proposed program. However, as discussed below, this alternative would require the construction and operation of extensive additional facilities on the west side of San Francisco; thus, collective impacts in the San Francisco Region and associated cumulative effects (such as traffic, air quality, noise, and vibration) would be more severe than those of the WSIP.

Other Facilities and Actions Potentially Implemented Under this Alternative

The Year-round Desalination at Oceanside Alternative would involve the construction of the OSDP, an intake structure and pipeline, intake pump station, a treated water pump station, and a treated water pipeline. A project-specific EIR would be required for the desalination plant and associated infrastructure. These facilities would result in a full range of construction and operations impacts at the proposed facility locations, similar to those described in Chapter 4 for the WSIP facilities, and would increase the construction and operational impacts in the San Francisco Region.

Construction Impacts. The primary environmental concerns during construction of the desalination plant and transmission pipelines are adverse impacts on sensitive receptors at the San Francisco Zoo and in nearby residential neighborhoods. Dust, noise and traffic generated during construction could affect nearby sensitive receptors, including animals and patrons at the zoo and residents who live along the pipeline routes. Depending on the location of the desalination plant, construction could also result in the displacement of parking at the San Francisco Zoo, result in temporary traffic impacts along pipeline alignments, and/or adversely affect recreational users at Fort Funston. In addition, the construction of the intake structure and pipeline would have a localized impact on marine organisms. Other potential construction-related effects would include cultural resources, hazardous materials, solid waste disposal impacts.

Operational Impacts. The primary concerns related to operation of the OSDP and related transmission facilities are potential impacts on aquatic resources, water quality, energy consumption, air quality, visual resources, geology and soils, land use and planning, traffic, and greenhouse gas emissions related to both traffic and energy use.

With respect to aquatic resources and water quality, operation of the OSDP could result in the entrainment and/or impingement of marine organisms in the intake pipeline and the discharge of potentially toxic substances into the Pacific Ocean from the existing outfall structure, including high-salinity discharges related to brine disposal as well as discharges of chemical and cleaning

compounds. It is expected that significant entrainment and/or impingement impacts could be addressed by installing fine screens at the intake structure and by reducing the velocity of water intake. Discharge toxicity could be reduced by minimizing the use of chemicals during filter backwashing. Dilution modeling would be required to determine whether the new discharge, which would be a mixture of brine and wastewater from the Oceanside WPCP, would meet National Pollutant Discharge Elimination System discharge requirements and whether modifications to the outfall would be required. In addition, although blending of desalinated water with the regional system water would continue to meet all federal and state drinking water standards, there would be a noticeable change in water quality, particular residents in the westside of San Francisco who would receive predominantly desalinated water.

The energy consumption of desalination depends on the quality of the water produced and the feed water composition. The amount of electric power needed to produce potable water is proportional to the salinity of the source water. For this reason, when compared to the proposed program, operation of the Year-round Desalination at Oceanside Alternative would result in substantial increases in energy consumption and greenhouse gas emissions.

Potential impacts on cultural resources would result if the OSDP were sited at the Fleishhacker site or the National Guard Armory site. Construction of the OSDP at the Fleishhacker site would require the removal or modification of the Fleishhacker Bathhouse, which was constructed in the 1920s and thus potentially eligible for historic status. It is uncertain whether the National Guard Armory site has been evaluated for inclusion in the National Register of Historic Places. Cultural resource surveys would be completed during CEQA review and any identified cultural resources would be avoided to the extent feasible.

With respect to geology and soils, the proposed intake structure and pipeline would terminate in or near the surface rupture zone of the active San Andreas fault, which is located on the ocean floor about two miles west of the Oceanside WPCP. In addition, areas along the coast (such as ocean bluffs) can be unstable and are subject to erosion. Geotechnical studies would be conducted to characterize potential geologic and seismic hazards and to develop appropriate design measures.

Operation of the OSDP could also result in land use and planning issues related to the siting of the desalination plant near the coastal zone and potential land use conflicts with the San Francisco Zoo, the Oceanside WPCP, and/or the National Guard Armory.

Water Supply and System Operations

Under the Year-round Desalination at Oceanside Alternative, the total average annual diversions from the Tuolumne River would be essentially the same as the existing condition, based on HH/LSM modeling over the 82-year hydrologic record, as shown in Table 9-5. However, system operations would be modified under this alternative to accommodate the year-round addition of desalinated water to the regional water supply sources as well as to provide for regular system inspection and maintenance, similar to the WSIP. The potential impacts on water resources in the

Tuolumne River, Alameda Creek, and Peninsula watersheds associated with this modified operation are described below and compared to the impacts that would occur under the WSIP.

Tuolumne River Watershed

Water demand would increase under the Year-round Desalination at Oceanside Alternative by the same amount as with the WSIP. The increase in demand would be met with water from a new desalination plant. This alternative would not result in changes in average annual releases to the Tuolumne River from Hetch Hetchy Reservoir compared to the existing condition but changes could occur due to changes in operations attributed to conveyance system maintenance. The changes in spring releases would occur because of storage changes accumulating in Hetch Hetchy Reservoir leading to the delay or earlier initiation in spring releases. These changes would be less than with the WSIP and typically result in greater releases. Compared to current conditions, there could be a delay or an earlier initiation of the day of excess release. The delay would still be enough to have a potentially significant adverse effect on terrestrial biological resources because of the ecological sensitivity of riverside meadows and their flora and fauna.

Similarly, the Year-round Desalination at Oceanside Alternative would result in an occasional difference in the winter/spring releases from La Grange Dam compared to current conditions, sometimes greater and sometimes less year to year with no difference in the average annual releases to the Tuolumne River. In those years when the WSIP resulted in a delay in winter/spring releases it would have an adverse effect on fisheries in the Tuolumne River and on terrestrial biological resources in the riparian corridor, but the impact would be less than significant because this delay represents a minor variation in the flow release pattern.

Alameda Creek Watershed

The improvements to Calaveras Dam that would occur under the WSIP would also be part of the Year-round Desalination at Oceanside Alternative. Furthermore, under this alternative, the SFPUC would operate its facilities in the Alameda Creek watershed in a similar manner as with the WSIP. Consequently, the environmental impacts of the Year-round Desalination at Oceanside Alternative would be similar to those of the WSIP.

Peninsula Watershed

Water demand would increase with the Year-round Desalination at Oceanside Alternative, as it would with the WSIP. The SFPUC would try to serve increased demand in the Coastside CWD service area from Pilarcitos Creek, exactly as it would with the WSIP. The consequent, more rapid drawdown of Pilarcitos Reservoir and the earlier cessation of stored water releases to Pilarcitos Creek would have a significant adverse effect on water quality, fisheries, and terrestrial biological resources in the reservoir and the creek.

The improvements to Lower Crystal Springs Dam that would occur under the WSIP would also be part of the Year-round Desalination at Oceanside Alternative. As a result of the improvements and associated modifications in system operations, the maximum water level in Crystal Springs Reservoir would rise by about 20 feet. The rise in water level would have significant adverse impacts on terrestrial biological resources, as described in Section 5.5.6. Since the Year-round

Desalination at Oceanside Alternative would include improvements to Lower Crystal Springs Dam, the SFPUC would generally operate its facilities in the Peninsula watershed in a similar manner as with the WSIP. Consequently, the environmental impacts of the Year-round Desalination at Oceanside Alternative would be similar to those of the WSIP.

Growth-Inducement Potential and Secondary Effects of Growth

The growth-inducement potential for the Year-round Desalination at Oceanside Alternative would be similar to that of the proposed program, as described in Chapter 7. Since this alternative would meet the WSIP level of service goals for delivery reliability and water supply, the water service and populations served would be identical. The minor difference in water quality would not affect the growth-inducement potential.

9.2.7 Regional Desalination for Drought Alternative (Variant 2)

Under the Regional Desalination for Drought Alternative, the SFPUC would implement all of the proposed WSIP facility improvement projects and would partner with other Bay Area water agencies to construct and operate a proposed regional desalination plant. The SFPUC would receive supplemental supply from the regional desalination plant during drought years. This scenario is the same as WSIP Variant 2, as described in Chapter 8, Section 8.3, and is repeated here as a CEQA alternative because it would reduce impacts associated with increased diversions from the Tuolumne River.

The Regional Desalination for Drought Alternative (WSIP Variant 2) is similar to the WSIP, except that the SFPUC would receive supplemental drought-year supplies from a proposed regional desalination plant instead of from water transfers from TID and MID. The SFPUC, through its participation in the Bay Area Regional Desalination Project (BARDP), would receive additional water supply of up to 26 mgd during drought periods (an average annual yield of 23 mgd over the 8.5-year design drought). The SFPUC would not need to develop water transfer agreements with TID and MID for supplemental dry-year water, and, as a result, the overall increase in average annual water diversions from the Tuolumne River under this alternative would be less than that required for the proposed program. On an average annual basis, over the 82-year period of hydrologic record, this alternative would result in a 20-mgd increase in diversions from the Tuolumne River over existing conditions, compared to an increase of 27 mgd for the proposed program.

The BARDP involves a partnership among regional water agencies, including the SFPUC, Contra Costa Water District, East Bay Municipal Utility District, and Santa Clara Valley Water District, for the purpose of developing desalination as a regional water supply to improve supply reliability for over 5 million people served by the four agencies. The BARDP would develop and implement one or two desalination plants and associated facilities capable of producing about 65 to 71 mgd of potable water from ocean water, seawater, or brackish water. Participating agencies would either directly receive desalination product water into their water systems or would receive transfers from other agencies that directly receive desalination product water. A more detailed description of the BARDP is provided in Chapter 8, Section 8.3.

At the time of PEIR preparation, the institutional commitments and arrangements to implement a full-scale desalination plant as well as the necessary technical and feasibility studies had not been completed. However, in 2005, participating agencies received a grant from the California Department of Water Resources to complete a feasibility study to evaluate the institutional feasibility of the BARDP, and, in 2006, participating agencies received a second grant from the California Department of Water Resources to construct a desalination pilot plant. The pilot plant and related studies are scheduled to be implemented from 2007 to 2009.

Description of SFPUC and Wholesale Customer Actions

SFPUC Actions

Table 9-4 summarizes the main characteristics of the Regional Desalination for Drought Alternative in comparison to those of proposed program. As previously discussed, with the exception of supplemental drought-year supply sources, this alternative is similar to the proposed program in that the SFPUC would accommodate the projected increase of 35 mgd in customer purchase requests through an increase in average annual diversions from the Tuolumne River (20 mgd), increased utilization of Bay Area watershed supplies associated with the restoration of Calaveras Reservoir (SV-2) and Lower Crystal Springs Reservoir (PN-4), and an equivalent of 10 mgd of supply from recycled water, groundwater, and conservation projects in San Francisco. Unlike the proposed program, however, supplemental drought-year supplies would consist of up to 26 mgd (average annual yield of 23 mgd over the 8.5-year design drought) of desalination water from the BARDP and 6 mgd from implementation of the Westside Groundwater Basin conjunctive-use program.

The Regional Desalination for Drought Alternative would include implementation of all of the 22 facility improvement projects proposed in the WSIP. In addition, the SFPUC would proceed with implementation of other capital improvement projects and related activities not considered part of the program analyzed in this PEIR (as described in Chapter 3, Sections 3.13 and 3.4.6). The SFPUC would also implement the same system maintenance program and similar operational changes in the regional system as those proposed under the WSIP with the addition of participation in the operation and maintenance of the BARDP and related facilities.

The SFPUC is currently participating in the development of feasibility studies and pilot testing to determine the viability of the BARDP. If the project is found to be feasible, the SFPUC would contribute funds towards environmental review, project construction, and operation of the BARDP. Depending on the site(s) selected for development of the full-scale BARDP, the desalination project could require multiple components, including raw water supply/intake facilities, process and treatment facilities, and concentrate disposal facilities/outfall structures. To convey the product water from the desalination plant to the regional water agencies, transmission pipelines and pump station(s) would also be required. It is assumed that the BARDP would use or modify existing distribution and transmission facilities to the extent possible. Under the Regional Desalination for Drought Alternative, the SFPUC would receive transfer water from other participating water agencies, unless the facility were sited in San Francisco.

Wholesale Customer Actions

Like the proposed program, the Regional Desalination for Drought Alternative would fully meet the WSIP delivery reliability and water supply level of service goals. Therefore, the SFPUC would serve the projected 2030 purchase requests for all customers, and wholesale customers would not be required to implement any additional conservation and/or recycled water projects or develop supplemental water supplies from other sources beyond what is identified in their respective urban water management plans.

Feasibility Issues

A feasibility study is currently underway to refine the institutional, technical, environmental and scientific merits of a regional desalination facility. A pilot plant is proposed to test pretreatment options, membrane performance, and approaches for brine disposal. The technical feasibility of this alternative is dependent upon the outcome of these studies and pilot testing, and if determined to be fully feasible, implementation of a full-size regional desalination facility will require institutional arrangements to be formalized among the four partnering agencies as well as completion of environmental studies and permitting negotiations with numerous jurisdictions and resource agencies. In addition, this alternative would add costs to the overall program as a result of having to build and operate a new intake, treatment plant, transmission pipelines, and associated mitigation measures in addition to the costs of the 22 facility improvement projects included in the WSIP. Depending on the institutional and financial arrangements between the partnering agencies, this additional cost raises questions about cost and financing feasibility and customer rate impacts.

Ability to Meet Program Objectives

The Regional Desalination for Drought Alternative would include implementation of the same 22 regional system facility improvement projects as proposed under the WSIP needed to meet the water quality, seismic reliability, and delivery reliability performance objectives of the WSIP. Although this alternative would meet the level of service goals related to water quality, the desalinated water would require treatment to produce potable water supplies and would site-specific regulatory and permitting conditions for the desalination process. This alternative would increase system firm yield to 256 mgd, thus meeting the level of service goals for water supply during drought and nondrought periods.

However, it is uncertain if the Regional Desalination for Drought Alternative would meet the WSIP sustainability objectives, since there are numerous regulatory and permitting issues to be resolved associated with the desalination process, including protection of aquatic resources, water quality, and brine disposal issues, and it would require significant increase in long-term energy use compared to the proposed program. While the system would remain largely gravity-driven, the new source of water under this alternative would increase the pumping requirements of the overall system. This alternative would result in higher costs compared to the WSIP. The capital, operation and maintenance cost of the 22 facility improvement projects would be the same as the WSIP, but substantial additional capital, operation and maintenance costs—to be shared among

the partnering agencies—would be incurred from the intake, pumping, conveyance, treatment, and brine disposal facilities needed for this alternative.

Environmental Impacts Compared to those of the WSIP

Facility Construction and Operations Impacts

WSIP Facilities

Potential impacts related to construction and operation of the WSIP facilities would be the same as those of the proposed program described in Chapter 4. However, as discussed below and in Chapter 8, this alternative would require the construction and operation of extensive additional facilities, and, depending on their location, could contribute to collective and cumulative effects (such as traffic, air quality, noise, and vibration), resulting in more severe collective and cumulative impacts than those of the WSIP.

Other Facilities and Actions Potentially Implemented Under this Alternative

As discussed in Chapter 8, Section 8.3.3, potential impacts resulting from the construction of desalination facilities and appurtenances include temporary conflicts with established uses during construction, temporary degradation of scenic resources, geologic and/or seismic hazards associated with facility siting, short-term impacts on water quality and the potential for short-term depletion of groundwater resources from construction dewatering, impacts on biological resources during construction and/or associated with facility siting, construction-related traffic impacts, increased air quality emissions and odors, construction-related noise, temporary impacts on agricultural resources, and potential impacts associated with encountering hazardous materials in soil and groundwater during construction.

The primary operational concerns would be the entrainment and/or impingement of special-status aquatic organisms in the intake pipeline, the discharge of potentially toxic substances from the outfall structure, and potential impacts on wetlands, marshlands, and other sensitive habitats. In addition, implementation of the BARDP would result in the substantial use of nonrenewable energy resources during construction and operation as well as the generation of greenhouse gases. Additional impacts associated with operation of the desalination plant and facilities include permanent conflicts with existing land uses or permanent degradation of visual resources/scenic views, operational air quality emissions and odors, and permanent increases in noise and vibration. A more detailed discussion of construction and operational impacts related to the BARDP is provided in Chapter 8, Section 8.3.3.

Water Supply and System Operations Impacts

As described in Chapter 8, the Regional Desalination for Drought Alternative would essentially have all the same water supply and system operations impacts as the WSIP. In the Tuolumne River, Alameda Creek, and Peninsula watersheds, all the same impacts would occur as with the proposed program and all the same mitigation measures would apply. During drought, SFPUC would supplement supplies with the desalination supply. However, in nondrought years the SFPUC would serve the customer requests with additional diversions from the Tuolumne River.

While impacts on Tuolumne River resources would be somewhat reduced compared to the proposed program, the significance determination of the impacts would remain the same as those for the proposed program. Refer to Chapter 8, Section 8.5 for further discussion of the water supply and system operations impacts of this alternative.

Growth-Inducement Potential and Secondary Effects of Growth

As described in Chapter 8, the growth-inducement potential under the Regional Desalination for Drought Alternative would be essentially the same as that for the WSIP insofar as the SFPUC's component of the BARDP would be used to serve the 2030 purchase requests of SFPUC customers. Any growth-inducement effects associated with the BARDP beyond this component would be determined as part of the CEQA review of the BARDP.

9.2.8 Modified WSIP Alternative

The Modified WSIP Alternative incorporates changes in the proposed WSIP primarily to modify the proposed water supply and system operations so as to minimize environmental effects. Most of these changes are also proposed as mitigation measures for potentially significant or significant impacts identified in Chapter 5 – Water Supply and System Operations. In addition, the Modified WSIP Alternative includes other supply and operational modifications and actions that would further reduce impacts identified in Chapter 5. As discussed below under Ability to Meet Program Objectives, these supply and system operation modifications could, in some cases, compromise the level of service goals and system performance objectives established for the WSIP.

Description of SFPUC and Wholesale Customer Actions

SFPUC Actions

Under the Modified WSIP Alternative, the SFPUC would implement the identical facility improvement projects as those proposed under the WSIP. In addition, the SFPUC would proceed with implementation of other capital improvement projects and related activities not considered part of the program analyzed in this PEIR (as described in Chapter 3, Sections 3.13 and 3.4.6). The SFPUC would also implement the same system maintenance program and similar operational changes in the regional system as those proposed under the WSIP. The SFPUC would also implement largely the same water supply option package as proposed under the WSIP, but would endeavor to increase the amount of recycled water, conservation, and local groundwater contributing to meeting the regional system demand. Under this alternative, the SFPUC would also implement the following changes in the proposed system operations and supply options:

- *Dry-year water transfer*. The proposed WSIP includes acquisition of a water transfer from TID/MID to provide supplemental dry-year water for the regional system. The specific terms of this water transfer have not been established. Under this alternative, the terms of any water transfer from TID, MID or other agency(ies) would be conditioned such that it involves a transfer of conserved water only, rather than a transfer of stored water. This proposed condition is explained in Measure 5.3.6-4a. Under this alternative, a transfer of conserved water would be acquired for use every year, not only as a dry-year supplement,

and doing so would avoid the WSIP impacts on the lower Tuolumne River below La Grange that result from the SFPUC increasing its diversions from the Tuolumne River.

- *Alameda Creek minimum flow requirement for trout between the Alameda Creek Diversion Dam and the confluence with Calaveras Creek*. To support trout spawning and egg incubation following the replacement of Calaveras Dam and the resumption of flow diversion from Alameda Creek, the SFPUC will meet a minimum flow requirement in the creek reach below the Alameda Creek Diversion Dam to the confluence with Calaveras Creek between December 1 and April 30 at times when precipitation would naturally generate unimpaired flow in this reach. The SFPUC will conduct the necessary site-specific studies to determine the specific minimum flow requirement. Allowing flow to bypass the diversion dam in order to meet this minimum flow requirement would result in some reduction in supply that would otherwise be available to the regional system, and this could compromise the system firm yield level of service objective under the WSIP's water supply goal. This proposed condition is explained in Measure 5.4.5-3a.

- *Water Delivery to Coastside County Water District – modified operations for Pilarcitos Reservoir*. Under the WSIP, the SFPUC would meet increased 2030 demand from Coastside CWD by drawing the additional water from Pilarcitos Reservoir. This would result in a variety of significant or potentially significant impacts on the water quality and fish, aquatic, and terrestrial resources associated with the reservoir and Pilarcitos Creek downstream of the reservoir (see Section 5.5 for a discussion of these impacts). Under this alternative, the SFPUC would serve Coastside CWD's increase in demand from Crystal Springs Reservoir rather than from Pilarcitos Reservoir, which would allow the SFPUC to continue to operate Pilarcitos Reservoir in a manner similar to existing conditions. Under this alternative approach, the SFPUC and Coastside CWD would need to work together to expand conveyance capacity to Coastside CWD to accommodate increased supply delivery from Crystal Springs Reservoir. Serving Coastside CWD from Crystal Springs Reservoir instead of Pilarcitos Reservoir, as proposed under the WSIP, would require additional water from the Hetch Hetchy system (combined Alameda watershed, Crystal Springs watershed, and Tuolumne River supplies) to substitute for the local Pilarcitos watershed supply that would have been used. This proposed condition is explained in Measure 5.5.3-2.

- *Crystal Springs Reservoir – modified operation to manage inundation levels*. As discussed in Section 5.5, the WSIP would result in significant effects on the biological resources associated with and surrounding Crystal Springs Reservoir as a result of increasing water storage levels within the reservoir and maintaining these higher water levels in the reservoir for a longer period each year than was the case under historic operations. The oak woodland habitat that occurs in the proposed reservoir inundation zone would not survive the extended period of inundation each year. The PEIR identifies mitigation measures to reduce these effects to a less-than-significant level, primarily through habitat compensation. One strategy that could substantially lessen these environmental effects would be to operate the regional system such that the water storage levels in Crystal Springs Reservoir would not be increased over existing levels for prolonged periods during the year. Although reservoir water levels still would be increased to the historical maximum under this Modified WSIP Alternative, modifying the proposed future reservoir operation to ensure that the water level fluctuates seasonally and is lowered for some period each year to create conditions that the oak woodland habitat could survive. The proposed modified operations would be similar to the operating conditions in effect prior to 1983, which the oak woodland was apparently able to survive. Because with this modification the water level in the reservoir would not be maintained as full for as long each year as proposed under the WSIP, this modified operation would reduce the amount of water in storage on the Peninsula and could compromise the

system firm yield level of service objective under the WSIP's water supply goal. This is a new operation that SFPUC would implement under this alternative.

- *Increased Recycled Water, Conservation, and Local Groundwater*. Under this alternative, the SFPUC would institute a program to work with the wholesale customers to develop approximately 5 to 10 mgd of supply contribution, as feasible, from recycled water, conservation, and local groundwater projects within the regional wholesale service area. While the analysis of the Aggressive Conservation / Water Recycling and Local Groundwater Alternative in Section 9.2.4 indicates that it does not appear feasible to develop enough additional recycled water, water conservation and local groundwater to serve all or even a majority of the 25 mgd needed to meet the projected 2030 delivery demand for the regional system, it does appear feasible to develop at least some additional increment of supply / supply offset through these types of local projects. Based on the list of potential projects provided by the wholesale customers (see Table 9-11), a target goal of 5 to 10 mgd is proposed under this Modified WSIP Alternative. This is a new program that SFPUC would implement under this alternative.

  Developing additional water supply/ supply offset for the regional system through local water conservation, water recycling and groundwater projects would reduce the amount of additional Tuolumne River diversion required. At a minimum, it is expected that developing this level of additional local supply / supply offset could compensate for the reduction in available system supply resulting from the following operation modifications incorporated into this alternative to lessen or avoid environmental impacts: the Alameda minimum flow requirement, providing water delivery to Coastside CWD from Crystal Springs Reservoir, and the modified operation of Crystal Springs Reservoir. As a result, this alternative is not expected to require increases in Tuolumne River diversion that are greater than those proposed under the WSIP, and it is possible that the diversion increase would be less under this alternative than the WSIP.

  The SFPUC together with its wholesale customers have identified opportunities to expand supply contributions from water recycling, conservation and groundwater. While some of these projects are not cost-effective to pursue at the local level by a single agency or community, they may be more economically viable if developed and funded as regional projects contributing to the overall regional system. This alternative calls for the SFPUC to establish and fund, in conjunction with BAWSCA and the wholesale customers, a proactive regional program that will be supported by the SFPUC and its customers, promotes customer participation, and ultimately benefits the SFPUC regional water system. Based on a review of regional programs being implemented by other water agencies and consideration that the SFPUC provides water to both retail and wholesale customers, the SFPUC has identified several potential approaches for the program, shown in the bullet list below. One of these approaches, or a hybrid alternative featuring a combination of approaches, may best suit the SFPUC, its customers and the set of potential projects. The approaches include:

  – *Regional Entity Provides Financial Incentives.* This approach is structured such that the regional entity provides financial incentives for customers to apply for implementing their projects through the program. This financial assistance may include staff and material support.

  – *Regional Entity Implements Programs Directly.* This approach is structured such that the regional entity directly implements those projects or programs selected.

– *Regional Entity Implements Programs in Cooperation with Local Customers.* This approach is structured such that the regional entity implements those projects or programs selected in cooperation with the individual wholesale customer.

– *Regional Entity Implements a Grant Program.* This approach is structured such that the regional entity provides grants to individual wholesale customers, which are used by the individual wholesale customers to implement the projects.

Wholesale Customer Actions

Like the proposed program, the Modified WSIP Alternative would fully meet the WSIP delivery reliability and water supply level of service goals during nondrought years, and the SFPUC would serve the projected 2030 purchase requests for all customers. The wholesale customers would need to participate with the SFPUC in developing more recycled water, conservation, and local groundwater to contribute to meeting the needs of the regional system. The types of projects that would need to be pursued are discussed above under the Aggressive Conservation/Water Recycling and Local Groundwater Alternative.

Feasibility Issues

The Modified WSIP Alternative would have few feasibility issues, since in large part, this alternative represents the same actions and elements as the WSIP, for which the SFPUC has resolved major feasibility issues. Technical issues would be the same as the WSIP except for the design and implementation of facilities to permit bypass flows on Alameda Creek past the diversion dam. The institutional issues would be essentially the same as under the WSIP, including establishing agreements with local agencies for the regional groundwater conjunctive-use program in Northern San Mateo County and with TID, MID or other agency for water transfer agreements. The only difference would be that the water transfer agreement with TID, MID or other agency(ies) specify *conserved* water. Under this alternative the SFPUC would actively engage in developing regional recycled water, conservation, and local groundwater programs with the wholesale customers. While there remain feasibility issues associated with each specific water recycling, conservation and groundwater project (as discussed in Section 9.2.4, above), pursuing a goal of developing 5 to 10 mgd over time through a coordinated regional program appears achievable. Developing this additional increment of conservation, water recycling, and groundwater projects requires agreement between BAWSCA, the wholesale customers and the SFPUC as well as cooperation from several local agencies including wastewater agencies, stormwater management agencies, and planning departments, among others. Each project also will have its own feasibility questions, such as cost, facility siting, permitting and public acceptance, to resolve.

Ability to Meet Program Objectives

The Modified WSIP Alternative would include implementation of all of the proposed facility improvement projects needed to meet the water quality, seismic reliability, and delivery reliability goals of the WSIP, and would meet these objectives similar to the proposed program. Although the modified operation under this alternative would include actions that would affect the water

supply and system firm yield (i.e., minimum flow requirements on Alameda Creek, reduced use of Pilarcitos Reservoir, and managed inundation levels in Crystal Springs Reservoir), the Modified WSIP Alternative also includes 5 to 10 mgd of regional recycled water / groundwater / conservation that is not part of the proposed program. Long-term implementation of these regional recycled water/local groundwater/conservation projects would offset impacts of the operational modifications proposed under the Modified WSIP Alternative on the Tuolumne River such that it is expected that this alternative would meet all of the water supply level of service goals and system performance objectives of the WSIP.

The Modified WSIP Alternative would meet the WSIP sustainability objective, and would be expected to have slightly greater costs than the WSIP, since there would be additional conservation, water recycling and local groundwater projects within the regional service area than under the WSIP. The water recycling and groundwater elements would add some pumping requirements to the overall regional system. However, it is assumed that planning and implementation of regional recycled water/groundwater/conservation projects in partnership with the wholesale customers would be conducted to incorporate the WSIP objectives for cost-effective use of funds.

Environmental Impacts Compared to those of the WSIP

Facility Construction and Operations Impacts

WSIP Facilities

Potential impacts related to construction and operation of the WSIP facilities would be the same as those of the proposed program, as described in Chapter 4.

Other Facilities Potentially Implemented Under this Alternative

No significant environmental impacts would be expected from implementation of water conservation measures. Implementation of recycled water and groundwater projects would result in a full range of construction and operational impacts in the South Bay and Peninsula areas, similar to those described in Chapter 4 for the WSIP facilities. The types of impacts associated with implementation of the local recycled water and groundwater projects are summarized in Table 9-12, above, and generally relate to construction of new infrastructure, water quality, and groundwater resources.

Water Supply and System Operations Impacts

This alternative incorporates mitigation measures to address some of the impacts identified for the WSIP, namely the effects on fish and riparian habitat in the lower Tuolumne River (Impacts 5.3.6-4 and 5.3.7-6), the effects on trout in Alameda Creek below the diversion dam (Impact 5.4.5-3), the effects on Pilarcitos Reservoir and Creek and associated resources (Impacts 5.5.3-2, 5.5.5-4, 5.5.5-5, 5.5.6-4, and 5.5.6-5), and the effects on fish and terrestrial biological resources around Crystal Springs Reservoir (Impacts 5.5.5-1 and 5.5.6-1). Otherwise, this alternative would have the same water supply and system operations impacts as the WSIP in

the Tuolumne River, Alameda Creek, and Peninsula watersheds and would require the same mitigation measures.

The proposal to modify the proposed operations of Crystal Springs Reservoir would allow storage levels to be returned to their historical maximum; however, the reservoir would have to be operated to allow water levels to fluctuate annually and to provide for a seasonal lowering of the water level so that the oak woodland and other habitat on the periphery of the reservoir would not be inundated throughout the year. Historical vegetation mapping and accounts of habitat in the vicinity of Upper and Lower Crystal Springs Reservoirs (Oberlander, 1952) indicate that the prevailing reservoir levels in the 1950s resulted in more extensive freshwater marsh than at present. An increase in freshwater marsh habitat would benefit San Francisco garter snake and California red-legged frog. Although the overall increase in reservoir elevation under this alternative could still affect the populations of fountain thistle and other sensitive plants that now exist below the proposed maximum reservoir level, the habitat around the reservoir would return to conditions that existed before 1983, and these plant populations would therefore be expected to regain their former extent and distribution. Maintaining reservoir levels similar to historical patterns prior to 1983—and without the more lengthy periods when the reservoir is nearly full as proposed under the WSIP—would reduce or eliminate the adverse impacts on upland habitats such as oak woodland, which could experience extensive mortality if inundated for long periods of time.

With the WSIP, average monthly water levels would rise by 2 to 8 feet compared with existing conditions. Except for periodic drawdowns, all areas below the current maximum reservoir elevation of 283 feet would be permanently inundated, resulting in the loss of all existing freshwater marsh and riparian vegetation below this elevation. The maximum reservoir elevation of 291 feet would be maintained for several weeks longer than maximum elevations under existing and pre-1983 operations. Upland vegetation growing below 291 feet along the reservoir shoreline could not tolerate these longer periods of inundation and would be lost, including oak woodland, mixed evergreen forest, serpentine grassland, valley needlegrass grassland, and exotic forest.

The “bathtub ring” that is a trademark of reservoirs occurs because water remains high enough, for long enough, to exceed the flood tolerance of most woody and shrubby perennial vegetation and is not present long enough for emergent aquatic vegetation to persist. Inundation replaces the air-filled pores in the soil, which limits the amount of oxygen roots can obtain, resulting in increased stress, reduced growth, and eventually mortality. This PEIR predicts that implementation of the WSIP would result in a bathtub ring at some regional water system reservoirs, but this outcome is not inevitable. Most woody plants have some tolerance to flooding, which is a natural phenomenon. It would therefore be possible for the SFPUC to “manage” the inundation zone to allow selected species to survive, while still utilizing the restored historical reservoir capacity. Flood tolerance has been studied for several species. For example, 70 percent of valley oak (*Quercus lobata*) have been shown to survive inundation of over 40 days during the growing season (Walters, 1980). Under a managed inundation scenario, the maximum reservoir elevation would be periodically adjusted to limit inundation to the maximum tolerance of the least flood-tolerant species that are considered to provide valuable habitat components. Since these

tolerances are not known for all of the species currently present, the Modified WSIP Alternative would require a period of adaptive management, during which growth and stress would be studied for a number of years to establish a balance between woody vegetation vigor and diversity and the needs of the proposed program for storage. Although this alternative would not likely avoid impacts on grasslands, much of the biological productivity of the area between 283 and 291 feet elevation would be retained.

Growth-Inducement Potential and Secondary Effects of Growth

The growth-inducement potential for this alternative would be identical to that of the proposed program, as described in Chapter 7.

9.3 Comparison of Alternatives

Based on the information presented in Section 9.2, the following discussion highlights the key similarities and differences between the WSIP and the eight alternatives evaluated in detail in this PEIR with respect to their ability to meet the program objectives and to lessen the severity of the WSIP's environmental impacts. The environmentally superior alternative is also identified from among the proposed WSIP and the alternatives.

9.3.1 Comparison of Alternatives

Ability to Meet Program Objectives

As summarized in Table 9-6, above, three alternatives to the WSIP appear to meet most of the basic project objectives: the Lower Tuolumne River Diversion Alternative, Year-round Desalination at Oceanside Alternative, and Regional Desalination for Drought Alternative. Each of these three alternatives develops additional water supplies to meet the 2030 average annual increase in delivery demand, drought-year needs, and support the 20 percent maximum systemwide rationing goal. There are questions associated with each of these alternatives, including questions of technical and institutional feasibility, cost, and public support as well as regulatory permit challenges; however, assuming these alternatives could be implemented, it appears that they could each largely meet the program objectives. All of them would cost more than the WSIP because each would require implementation of all 22 WSIP facility improvement projects as well as construction and operation of additional major facilities for water diversion, transmission, treatment and distribution. Costs for these alternatives would include all the WSIP facility improvement project costs plus the substantial additional costs for planning, environmental review, design, construction, operation, and mitigation of the additional facilities. All of these alternatives would also require an incremental increase in treatment and pumping facilities to the regional system; they would introduce a water source with different water quality into the system and would involve additions to the system that are not gravity-driven.

Four alternatives – the No Program Alternative, No Purchase Request Increase Alternative, and the Aggressive Conservation / Water Recycling and Local Groundwater Alternative (without and with supplemental Tuolumne River water), would each fail to meet one or more key program

objectives. The No Program Alternative would meet the fewest of the program objectives. Under the No Program Alternative only those facility improvement projects required by current regulation or agreement with regulatory agencies would be implemented, thus, only a few of the many needed repairs and improvements would be made to the regional system. Many other facility improvement projects and supply development actions needed to improve seismic and delivery reliability, and provide adequate supplies to meet both average annual delivery demand and drought-year needs would not be implemented, leaving these objectives wholly or substantially unmet under the No Program Alternative.

The No Program Alternative leaves the SFPUC and its customers at significant risk of supply reduction or disruption during an earthquake or other emergency, or during a drought. This is not a feasible or acceptable alternative for the SFPUC. The SFPUC is responsible for maintaining and upgrading the regional system as needed to meet, at a minimum, the public health and safety needs of its customers. If the SFPUC cannot repair and improve its water system in a planned, comprehensive program like the WSIP, then it will be forced to do so in a piecemeal, reactive, emergency response manner, repairing parts of an aging system as facilities reach the end of their useful life or fail. This alternative is analyzed as required by CEQA to disclose the potential environmental impacts of not implementing the WSIP compared to implementation of the program but is not a practical alternative for the SFPUC.

The No Purchase Request Increase Alternative is designed to serve wholesale customers only the amount of water required under the existing Master Water Sales Agreement; therefore it would not fully meet the purchase request increase by the SFPUC wholesale customers for additional supply through the year 2030. Under this alternative, the SFPUC would choose not to meet the future water requests from its current customers – one of its key program objectives. This alternative was included in this alternatives analysis to evaluate the consequences of the SFPUC not meeting the future increase requested by its customers in an effort to avoid or minimize the potential growth-inducing effects and secondary effects of growth associated with providing more water to the regional customers. Neither BAWSCA nor its member agencies is expected to allow their customer needs to go unmet. Therefore, under this alternative, while the SFPUC would not achieve the program objective of meeting customer water delivery needs in 2030, it is expected that customer needs would nonetheless be met through other efforts by BAWSCA and/or the wholesale customers. Likely action by BAWSCA and wholesale customers would be to pursue a water transfer from another agency, similar to that proposed by the SFPUC as part of the WSIP. Consequently, the No Purchase Request Increase Alternative would not avoid the potential growth inducement effects of meeting the 2030 customer purchase requests.

The Aggressive Conservation / Water Recycling and Local Groundwater Alternatives (without and with supplemental Tuolumne River water) appear to meet, or almost meet the supply delivery and reliability objectives. This alternative, without supplemental Tuolumne River water, appears to almost meet the average annual 2030 delivery target of 300 mgd. With supplemental Tuolumne River water (5 mgd) it would meet the 300 mgd target. However, there are significant questions about the feasibility of producing up to 19 mgd of supply / supply offset with this alternative. As discussed in Section 9.2.4, while projects that might produce up to 19 mgd of potential

supply/supply offset were identified within the wholesale customer service area, there are many steps still required to confirm the actual potential yield of each of the projects and assess the technical, cost, and permitting feasibility in addition to public acceptance associated with specific conservation, recycled water and groundwater projects within the wholesale customer service area.

As shown on Table 9-11, above, producing up to 19 mgd of supply/supply offset under this alternative could involve implementation of more than 14 separate conservation/water recycling/ groundwater projects in the wholesale customer service area. This requires coordinated action by the SFPUC and multiple partner agencies to plan, evaluate, design, permit, finance, construct and operate these projects. It also requires community approval and fairly extensive public participation. Of the 19 mgd of potential supply/supply offset shown on Table 9-11, 8.35 mgd or almost half could be recycled water, and conservation represents another 7 mgd; thus the majority would come from increased water recycling and conservation. These two water supply management approaches, perhaps more than any other, require significant community support and participation to implement. Water recycling is becoming more and more common throughout the Bay Area, yet it is not universally accepted by all communities and for all permitted uses. Community support for increasing the recycled water supply and using it primarily for non-potable uses throughout the SFPUC service areas is a critical component for implementing this alternative.

Similarly, implementing aggressive additional conservation actions, beyond existing conservation levels and the planned conservation efforts (already factored into the future water demand estimates by each wholesale customer), also requires widespread community support, participation and compliance. Further, if an aggressive level of conservation can be implemented to reduce the average day water demands, then the question arises, will the community also be able to further reduce its water use enough to achieve the WSIP goal of 20 percent rationing during a drought? As discussed in Section 9.2.2 under the discussion of feasibility for the No Program Alternative, effective, lasting water conservation leads to demand “hardening” such that there may be little flexibility remaining for customers to further reduce water use during a drought without experiencing substantial economic and personal hardship.

From the information gathered by the SFPUC and the wholesale customers to develop and assess this potential alternative it is apparent that there is the potential to implement additional conservation, recycled water projects, and local groundwater projects within the regional service area. However, given the uncertainties in implementing many of the projects assumed under this alternative, it is also apparent that there is not sufficient, reasonably foreseeable potential for these types of projects to fully meet the program objectives for 2030 supply and delivery reliability and drought reliability. As shown on Figure 5.1-2, based on the wholesale customers water demand projections and purchase request increase, planning estimates indicate about half of the total 35 mgd requested increase in water delivery would be needed by 2015. It is unlikely that this much additional supply/supply offset could be developed under this alternative in this short a time. Consequently, the Aggressive Conservation/Water Recycling and Local Groundwater Alternative, as a stand-alone program, would not meet the key program objectives. However,

developing some more conservation, recycled water and local groundwater within the regional service area than is proposed under the WSIP does appear possible and this possibility has been incorporated into the proposed Modified WSIP Alternative. Developing more local conservation efforts, recycled water and local groundwater projects would also contribute to meeting the objective of diversifying the water supply and demand management portfolio for the regional system.

The Modified WSIP Alternative would meet all the program objectives, similar to the WSIP. This alternative was developed to avoid or substantially lessen some of the significant impacts of water system operations under the WSIP. Some of the operational changes included in this alternative would also be implemented if the WSIP and all mitigation measures presented in this PEIR are approved. This alternative also proposes that the SFPUC, in partnership with its wholesale customers, implement more conservation, water recycling and local groundwater projects than are proposed as part of the WSIP. The additional conservation, recycling, and local groundwater projects would offset the increase in diversion from the Tuolumne River made necessary by the operational modifications included in the Modified WSIP Alternative. While there remain feasibility issues associated with each specific water recycling, conservation and groundwater project (as discussed in Section 9.2.4, above), pursuing a goal of developing 5 to 10 mgd over time through a coordinated regional program appears achievable. Developing this additional increment of conservation, water recycling, and groundwater projects requires agreement between BAWSCA, the wholesale customers and the SFPUC as well as cooperation from several local agencies including wastewater agencies, stormwater management agencies, and planning departments, among others. Each project also will have its own feasibility questions, such as cost facility siting, permitting and public acceptance, to resolve.

Environmental Impacts Compared to Those of the WSIP

The following summarizes the chief differences between the WSIP and the alternatives with respect to potential environmental impacts. In some cases an alternative would result in more or less impacts on a particular environmental resource compared to the WSIP, and in other cases an alternative would affect an altogether different geography and environmental resource than the WSIP. This section frames the environmental impact trade-offs raised by each of the alternatives in comparison to the WSIP.

Water Resources Impacts

As summarized below some alternatives would lessen significant impacts of the program on the Tuolumne River, but all alternatives would continue to have significant impacts within the Alameda Creek and Peninsula watersheds because these impacts would result primarily from implementation of two facility improvement projects (Calaveras Dam Replacement Project (SV-2) and Lower Crystal Springs Dam Improvement Project (PN-4)) that are included in each alternative since they must be completed in order to meet regulatory requirements for public safety reasons. In addition, three alternatives would impact other water bodies not affected by the WSIP and three other alternatives might affect other water bodies depending on how they are implemented.

Tuolumne River Watershed

Under the WSIP, the SFPUC would increase average annual diversions from the Tuolumne River by 27 mgd to meet 2030 service area needs; this increase can be served from the CCSF's existing water rights on the Tuolumne River. Six of the eight alternatives considered also involve some level of increased average annual diversion from the Tuolumne River. Two alternatives, the Lower Tuolumne River Diversion Alternative and the Modified WSIP Alternative would require the same or greater increase in average annual Tuolumne River diversions compared to the WSIP. Under four alternatives the increase in average annual Tuolumne River diversion would be less then the WSIP, ranging from an increase of 20 mgd down to an increase of 3 mgd (in descending order): Regional Desalination for Drought Alternative, No Program Alternative, Aggressive Conservation / Water Recycling and Local Groundwater Alternative with supplemental Tuolumne River water, and the No Purchase Request Increase Alternative (see Table 9-5, above). Two alternatives, Aggressive Conservation / Water Recycling and Local Groundwater Alternative without supplemental Tuolumne River water and the Year-round Desalination at Oceanside Alternative, would not require an increase in average annual diversion from the Tuolumne River over the existing condition.

Table 9-7 summarizes the potentially significant impacts on the Tuolumne River and its associated environmental resources that would result from implementation of the WSIP and from each of the alternatives in comparison to the WSIP. Although some alternatives would result in less increase in Tuolumne River diversion than the WSIP (in some cases notably less), none of them would substantially lessen the potential impact on meadows between O'Shaughnessy Dam and Don Pedro Reservoir. All of the alternatives could still result in a potentially significant impact on meadows, in particular in the Poopenaut Valley, as a result of delaying the higher volume spring releases from Hetch Hetchy Reservoir (see Impact 5.3.7-2), similar to the WSIP. Three alternatives — Regional Desalination for Drought, Lower Tuolumne River Diversion, and the Modified WSIP – would involve increasing the average annual diversions by 20 mgd or more, similar to the WSIP and thus would have a similar impact to that described for the WSIP, requiring mitigation. Five other alternatives – No Program, No Purchase Request Increase, Year-round Desalination at Oceanside and the two Aggressive Conservation/Water Recycling and Local Groundwater Alternatives (without and with Supplemental Tuolumne River Water) – would involve either a diversion increase of less than 10 mgd or no increase in average annual diversion (see Table 9.5) and would result in shorter delays that occur less frequently than with the WSIP. Nonetheless, in order to meet the delivery reliability level of service goals, these alternatives would involve a change in system operations that would still result in a delay in spring releases due to the change in diversion patterns. For all but the No Program Alternative and the two Aggressive Conservation/Water Recycling and Local Groundwater Alternatives, the implementation of the Westside Basin Project would also affect the year to year diversions from the Tuolumne River thus potentially affecting spring flow releases. This delay in spring releases was deemed to still result in a significant adverse impact on mountain meadows and associated resources (i.e., sensitive habitats and species). As a result, the analysis determined that the impact would be potentially significant and that mitigation would still be required for these alternatives.

Although the Lower Tuolumne River Diversion Alternative would provide environmental benefits to water quality, habitat, fish, and recreation during most summers, winters and early spring as a result of flow being released to the river below O'Shaughnessy Dam for diversion further downstream, this alternative would still result in delays in the late spring (May and June) releases from O'Shaughnessy Dam, the same as and possibly greater than the WSIP. Therefore, despite the benefits at other times of the year, this delay was deemed to still result in a significant adverse impact on mountain meadows and associated resources (i.e., sensitive habitats and species). As a result, the analysis determined that the impact would be potentially significant and that mitigation would still be required for this alternative.

On the lower reach of the Tuolumne River below La Grange Dam, the WSIP would result in significant impacts on fisheries and riparian habitat, again as a result of reducing the volume and delaying the release of the higher spring flows from Don Pedro Reservoir (see Impacts 5.3.6-4 and 5.3.7-6). Most alternatives would have less impact on these resources in this river reach than the WSIP, except for the Lower Tuolumne River Diversion Alternative. The Lower Tuolumne Diversion Alternative would also result in additional fisheries impacts, including potential impacts on listed Chinook salmon and steelhead, as a consequence of constructing a new water intake facility in the lower river and diverting flow in the reach where listed Chinook salmon and steelhead occur, and would require supplemental mitigation for those effects in addition to the mitigation required under the WSIP. Four alternatives – the Aggressive Conservation / Water Recycling and Local Groundwater Alternative Without Supplemental Tuolumne River Water, the No Purchase Request Increase, the Year-round Desalination at Oceanside, and the Modified WSIP, would avoid this significant impact associated with the delay in spring releases.

Alameda Creek Watershed

In the Alameda Creek Watershed, all alternatives but the Modified WSIP Alternative would have the same significant impacts on fisheries in Alameda Creek below the diversion dam as the WSIP. This is because the impacts in this watershed are associated primarily with the replacement of Calaveras Dam (SV-2), as required by DSOD, and the subsequent revised system operations associated with restoration of storage capacity in the reservoir and are not related to which supply source(s) is selected to meet future customer delivery needs. The Calaveras Dam Replacement Project is required by DSOD to meet regulatory requirements, therefore it would occur under every alternative. Impacts would occur once the SFPUC resumes normal operation of that reservoir. The Modified WSIP Alternative would incorporate, as part of its description, the provision of a minimum flow in Alameda Creek below the Alameda Creek Diversion Dam to support resident trout spawning and egg incubation. (This minimum flow requirement is also proposed as mitigation for the WSIP.) Implementing the minimum flow requires the SFPUC to relinquish some of its supply that otherwise would have been available to customers. This supply reduction would have to be made up through more Tuolumne River diversion or more conservation, recycled water and local groundwater projects. The Modified WSIP Alternative proposes that the SFPUC develop more conservation, recycled water and local groundwater projects to both compensate for operational modifications that reduce supply for customers and reduce the amount of additional diversion required from the Tuolumne River to fully meet the WSIP program objectives, if possible.

Peninsula Watershed

In the Peninsula Watershed all alternatives but the No Purchase Request Increase Alternative and the Modified WSIP Alternative would have the same significant environmental impacts as the WSIP. This is because the impacts in this watershed are not a result of which water supply source is selected but are primarily associated with two actions proposed under the WSIP. The first is increased service to Coastside County Water District (Coastside CWD) to serve its 2030 purchase request and the second is implementation of the Lower Crystal Springs Dam Replacement Project (PN-4).

Coastside CWD assessed its future water supply needs and developed its 2030 customer purchase request from the SFPUC regional system. Coastside CWD requests a supply increase of 1.22 mgd by 2030. Coastside CWD serves Half Moon Bay and surrounding communities on the San Mateo County coast. The SFPUC currently serves Coastside CWD primarily from the Pilarcitos Reservoir. In order to meet Coastside's purchase request increase, under the WSIP the SFPUC would use more water from the Pilarcitos Creek watershed. However, as discussed in Section 5.5, this could result in significant environmental impacts on resources in and around Pilarcitos Reservoir and Creek. Two alternatives address these impacts; the other six alternatives would have the same impacts on Pilarcitos Reservoir and Creek resources. Under the No Purchase Request Increase Alternative, the SFPUC would not serve Coastside's 2030 purchase request increase and therefore this alternative would lessen the impacts on Pilarcitos Reservoir and Creek identified for the WSIP. Under the Modified WSIP Alternative, the SFPUC would serve Coastside's 2030 purchase request increase but it would modify its proposed system operation within the Peninsula Watershed to provide additional supply to Coastside CWD from Crystal Springs Reservoir instead of the Pilarcitos Creek watershed. As a result, under this alternative Pilarcitos Reservoir would be operated similarly to the way it is under existing conditions and none of the significant impacts associated with the WSIP would occur. However, this operational modification would require the SFPUC to provide Coastside CWD with some additional increment of supply from outside of the Pilarcitos Reservoir watershed from the rest of the regional water system. As discussed under the Alameda Creek Watershed above, this additional supply requirement would have to be made up through either more Tuolumne River diversion or more conservation, recycled water and local groundwater projects. The Modified WSIP Alternative proposes that the SFPUC develop more conservation, recycled water and local groundwater projects to both compensate for operational modifications that increase use of Crystal Springs Reservoir to serve Coastside CWD customers and to reduce the amount of additional diversion required from the Tuolumne River to fully meet the WSIP program objectives, if possible.

With respect to the significant environmental impacts associated with the Lower Crystal Dam Replacement Project and subsequent operation of Crystal Springs Reservoir to utilize the restored historical storage capacity, these impacts would occur under all alternatives because this project must be implemented under all alternatives in order to meet DSOD regulatory requirements. However, the Modified WSIP Alternative includes a modification to the proposed operation of this reservoir that would lessen the significant effects of increasing the reservoir water level on the oak woodland habitat and associated species. With this modification, the reservoir water

levels would be allowed to fluctuate to a greater degree over the year than proposed under the WSIP such that the woodland trees would be able to survive the annual increase in inundation. This operational modification may require that the SFPUC sacrifice some of the increases in system delivery and drought reliability it would gain under the WSIP because it would not be able to store as much water in Crystal Springs Reservoir for as long each year. Additional modeling of this alternative would be needed to determine how it would specifically perform against the WSIP goals and objectives and if other system modifications could compensate for this change.

Westside Groundwater Basin

Three alternatives—No Program Alternative and the two Aggressive Conservation/Water Recycling and Local Groundwater Alternatives—would not include the Westside Basin conjunctive use program as a dry-year supplemental supply. Therefore, these alternatives would not result in potential overdraft or seawater intrusion in the North Westside Groundwater Basin or in the potential to affect Lake Merced levels due to implementation of the WSIP as proposed; however, as stated above, these three alternatives could all result in increased local groundwater pumping within the wholesale customer service area, with similar impacts as the WSIP. The remaining five alternatives would include the conjunctive use program, so groundwater impacts would be the same as for the WSIP.

Other Water Bodies

Three alternatives would affect other water bodies and their associated environmental resources in addition to those affected by the WSIP. The Lower Tuolumne River Diversion Alternative would result in direct impacts on the lower Tuolumne River from construction and operation of a new diversion facility. At the same time, compared to the WSIP this alternative would provide some benefit to both the upstream reach of the Tuolumne River below Hetch Hetchy Reservoir to Don Pedro Reservoir and the downstream reach below La Grange as a result of more water being released from Hetch Hetchy Reservoir for subsequent diversion downstream. However, while the upstream reach of the Tuolumne River supports a resident trout fishery, the downstream reach in the lower Tuolumne supports listed Chinook salmon and steelhead. This alternative would trade-off environmental benefits to both reaches of the river with adverse environmental impacts on the lower Tuolumne River.

The Regional Desalination for Drought Alternative would result in impacts on upper San Francisco Bay (along the eastern Contra Costa County shoreline based on the proposed plant location in the Pittsburg-Antioch area) in addition to the same water bodies affected by the WSIP. Under this alternative, water would be diverted from the bay, treated for use and the brine concentrate would then be discharged back to the Bay. The SFPUC has partnered with other Bay Area water agencies to evaluate the feasibility of this project which will include the ability to mitigate potential impacts to the Bay to a level that is less than significant. Alameda County Water District has successfully implemented a brackish groundwater desalination project to supplement its supply. Marin Municipal Water District is currently evaluating a potential desalination facility and has proceeded with a pilot project. Thus, several agencies are pursuing this type of water supply project. It may be possible to design and operate the proposed regional desalination facility in a manner that does not have significant, unavoidable effects on the Bay,

but additional detailed pilot testing and environmental study are required to assess the site-specific feasibility and environmental effects of the proposed regional desalination facility. This alternative represents a trade-off in terms of environmental effects; it would slightly reduce the amount of additional Tuolumne River to be diverted compared to the WSIP and thus lessen the impact on the river, but it would introduce impacts on San Francisco Bay that would not occur under the WSIP.

Under the Year-round Desalination at Oceanside Alternative, seawater from the Pacific Ocean offshore of the City and County of San Francisco would be diverted for treatment and use in a portion of San Francisco on a year-round basis and the concentrated brine byproduct would be discharged back into the ocean. As described above for the Regional Desalination for Drought Alternative, many water agencies are currently studying potential seawater desalination facilities along the coast of California. It may be possible to design and operate the proposed seawater desalination facility required under this alternative in a manner that does not have significant, unavoidable effects on the ocean, but additional detailed feasibility and environmental study is required to assess whether this is possible. This alternative represents a trade-off in terms of environmental effects; it would substantially reduce the amount of additional Tuolumne River to be diverted compared to the WSIP and thus lessen the impact to the river, but it would introduce impacts on the offshore waters of the Pacific Ocean that would not occur under the WSIP.

The four alternatives that do not fully meet the supply reliability and/or drought reliability objectives - the No Program Alternative, the No Purchase Request Increase Alternative and the Aggressive Conservation / Water Recycling and Local Groundwater Alternative, with and without supplemental Tuolumne River water, would each likely prompt BAWSCA and/or the wholesale customers to pursue alternative supplies to meet their communities' needs through 2030. Actions taken by BAWSCA and/or individual wholesale customers could result in impacts to other water bodies including more pumping of local groundwater supplies, or water transfers from other surface water sources. BAWSCA and/or the wholesale customers would likely pursue water transfers from other water agencies. If BAWSCA and/or wholesale customers were to pursue a water transfer from Modesto Irrigation District or Turlock Irrigation District, it would affect the Tuolumne River and associated resources much as the WSIP (though there would be institutional complexities associated with wheeling water through third party facilities). If BAWSCA and/or wholesale customers were to pursue a water transfer from other entities, this could result in environmental effect on other rivers north or south of the Delta as well as the Delta, itself. Alternatives that result in water transfers from water sources other than as proposed under the WSIP also present environmental impact trade-offs; they could potentially lessen the effects of the WSIP on the Tuolumne River and, in one case to Pilarcitos Reservoir and Creek, but they introduce potential impacts on other water bodies and their associated resources and require additional mitigation.

Under the Aggressive Conservation / Water Recycling and Local Groundwater Alternatives (both without supplement supply and with supplemental Tuolumne River water) and possibly under the No Program and No Purchase Request Increase Alternatives, the wholesale customers would implement groundwater projects, which could result in overdraft and associated impacts to local

groundwater basins, including seawater intrusion, similar to the effects described in Section 5.6 for the Westside Groundwater Basin. These alternatives also present environmental impact trade-offs; they could potentially lessen the effects of the WSIP on the Tuolumne River but they could introduce potential impacts to other water bodies and their associated resources and require additional mitigation.

Facility Impacts

Seven alternatives, except for the No Program Alternative, would involve the construction of all the same 22 facility projects on the SFPUC regional system as proposed under the WSIP. These projects are needed to repair and improve the system to meet the supply delivery and seismic reliability objectives regardless of target delivery demand level or source of supply. The sizing of some facilities would need to be evaluated under the various alternatives and might be revised / reduced from that proposed under the WSIP, but no facility project would be eliminated from the program. As a result all alternatives but the No Program Alternative would have, at a minimum, the same facility construction and operation impacts as the WSIP.

Under the No Program Alternative only five projects required to meet regulatory requirements are assumed to be implemented. Because far fewer facility improvement projects would be built under this alternative there would be much less facility construction and operation impact compared to the WSIP. However, it is expected that there would be much more emergency facility repair under this alternative as the system continued to age without proactive improvement and thus, ultimately, through required repair and rehabilitation efforts, a similar level of facility improvement projects might have to be carried out, resulting in much of the same facility impacts as the WSIP but possibly occurring over a longer period of time and in a less planned and comprehensive manner.

All eight alternatives would require construction and operation of other new facilities in additional to all the WSIP facility improvement projects. The two Aggressive Conservation / Water Recycling and Local Groundwater Alternatives (without and with Tuolumne River supplement), and to a lesser extent the Modified WSIP Alternative, would require the SFPUC and/or the wholesale customers to construct and operate additional water recycling treatment plants and distribution pipelines along with groundwater wells and distribution lines throughout the wholesale customer service area. The number and location of these facilities is not known but several new and/or expanded facilities would be required. Similarly, under the No Program and No Purchase Request Increase alternatives, the wholesale customers might decide to develop additional water recycling and/or groundwater facilities and, in addition, might pursue other surface water supplies that could require new treatment, storage or transmission facilities.

Both desalination alternatives require construction and operation of a new treatment plant, a water intake structure, transmission and distribution pipelines and possible storage. The Lower Tuolumne River Diversion Alternative requires construction and operation of a new water diversion structure on the river, a new water treatment plant and new pipelines. These alternatives would involve substantial additional facility construction and operation impacts, including impacts on land use, traffic, air quality, noise, energy and others. In addition, these alternatives

would use greater amounts of energy than the WSIP and, as a consequence, could contribute additional greenhouse gas emissions along with other air pollutant emissions. The desalination process is particularly energy intensive; thus, the two alternatives that include desalination plants would make a more substantial contribution to increasing energy use and associated greenhouse gas emissions than the other alternatives.

Growth Inducement and Secondary Effects of Growth

As discussed in Chapter 7, the WSIP would provide water supply to some customers to use in supporting additional growth within their communities and, as such, water supply would be less of a potential constraint to growth. The communities within the regional system service area have evaluated their growth plans (i.e., through General Plans and Urban Water Management Plans) and found that there are some significant and, in some cases, significant and unavoidable impacts that could or would occur as a result of planned growth. One alternative, the No Purchase Request Increase Alternative, specifically attempts to reduce or avoid the growth inducing effects of the WSIP and two other alternatives (the No Program Alternative and the Aggressive Conservation, Recycled Water and Local Groundwater Alternative) also appear to have less growth inducement potential than the WSIP

The No Purchase Request Increase Alternative was included in the range of alternatives evaluated in the PEIR specifically to consider the consequences of the SFPUC not fully providing for future water supply needs of its customers in an attempt to avoid or minimize the significant secondary effects associated with planned growth in the service area. As discussed above, while the SFPUC would plan not to fully meet the future 2030 water purchase request from its wholesale customers under this alternative, it is expected that the customers would pursue and secure the additional supplies they require. Thus, with respect to the SFPUC's actions, this alternative would have less growth inducement potential than the WSIP but combined with the wholesale customers actions, the same planned growth is ultimately expected to occur resulting in largely the same secondary effects of growth as would occur with the WSIP. While it is possible that approval of additional development and growth within the wholesale customer service area might be slowed somewhat in some communities as wholesale customers require more time to pursue other water supply and reliability projects, it is not expected that this would deter communities from ultimately taking the actions needed to support planned growth. As a result, this alternative is not an effective approach to avoiding or reducing the significant secondary effects of growth.

The No Program Alternative and the Aggressive Conservation, Recycled Water and Local Groundwater Alternative would both provide additional supplies to partially meet the 2030 average annual delivery demand and drought year needs but the supply would not be as reliable as that provided by the WSIP. As a result, as with the No Purchase Request Alternative, it is expected that the SFPUC wholesale customers and/or BAWSCA would pursue other projects and actions to provide the desired level of supply and supply reliability. While the need to develop additional projects beyond the WSIP might have some slowing effect on development approvals in some communities, it is not expected to impeded growth from continuing in accordance with adopted plans. As a result, this alternative would have similar secondary effects of growth as those described for the proposed program.

The other four alternatives would each have the same growth inducement potential and associated secondary effects of growth as the WSIP.

9.3.2 Environmentally Superior Alternative

CEQA requires the identification of an environmentally superior alternative from among the proposed project and the set of alternatives evaluated. The CEQA Guidelines further state that if the No Program Alternative is the environmentally superior alternative, then the EIR must also identify which of the action alternatives is the environmentally superior alternative. In this case, the No Program Alternative is not the environmentally superior alternative.

Although it appears that fewer facility improvement projects would be implemented under the No Program Alternative and that, as a result, there would be fewer facility and construction impacts, it is expected that there would be much more emergency facility repair and replacement projects under this alternative as the system continues to age without proactive improvement. Ultimately, through required repair and replacement efforts, a similar level of facility improvement projects as that proposed under the WSIP might have to be conducted under the No Program Alternative, resulting in much of the same facility impacts as the WSIP; however, these repair and replacement projects would likely occur over a longer period of time and in a less coordinated and comprehensive manner. In addition, implementing system improvements through a piecemeal and largely emergency response approach could result in greater environmental impacts and less mitigation for such impacts; when projects are implemented under emergency conditions, they often require little or no environmental review and thus could be implemented without the same level of mitigation and mitigation compliance monitoring that would be required for the WSIP. Furthermore, piecemeal implementation could also increase the cumulative effects of multiple, sequential facility repair and replacement projects throughout the system.

With respect to impacts on water resources, the No Program Alternative's effects on the Tuolumne River would be similar to but less than those of the WSIP because river diversions would not increase quite as much as with the WSIP; however, the No Program Alternative would result in the same significant impacts on the Tuolumne River as the WSIP and would require the same mitigation. As summarized above, the No Program Alternative would also have the same impacts as the WSIP on the Alameda Creek / Alameda watershed resources and on the Peninsula watersheds (including Pilarcitos Creek) resources. The No Program Alternative would have the same growth-inducement potential and associated secondary effects of growth as the WSIP because BAWSCA and the wholesale customers would be expected to secure supplemental supplies to meet any supply delivery and reliability shortfall from the regional system that would result under the No Program Alternative.

Finally, under this alternative, the SFPUC, BAWSCA and/or the wholesale customers might have to construct and operate additional facilities in order to develop supplemental surface water supplies, recycled water, or groundwater. Required facilities could include new treatment plants, storage and transmission facilities, and groundwater wells. The impacts of constructing and operating these facilities would be in addition to those resulting from improvement and repair of

the regional system. Thus, the No Program Alternative could result in greater facility impacts than the WSIP. Because the No Program Alternative would not appreciably lessen the environmental impacts of the WSIP, might result in additional impacts due to the need for supplemental supply development and associated facility construction, and would not meet most of the basic program objectives, it is not considered the environmentally superior alternative.

In addition to having many of the same environmental impacts as the WSIP, under the No Program Alternative, the SFPUC would be unable to meet most of the program objectives. The No Program Alternative would leave the SFPUC and its customers at significant risk of supply reduction or disruption during an earthquake or other emergency, or during a drought. This is not a feasible or acceptable alternative for the SFPUC.

The Modified WSIP Alternative is considered to be the environmentally superior alternative. It would reduce key impacts of the proposed WSIP on natural resources along the lower Tuolumne River, along Alameda Creek below the diversion dam, at Pilarcitos Reservoir and along Pilarcitos Creek, and in Crystal Springs Reservoir, but it would continue to meet the WSIP's primary goals and objectives. Like the WSIP, this alternative would maximize the use of existing facilities and the largely gravity-driven system without also requiring the construction of additional major facilities called for under many other alternatives, or substantially increasing the energy demand of the system or need for pumping. While some of the other alternatives would avoid or lessen certain WSIP impacts, they would also result in substantial additional impacts that the WSIP would not generate, because these alternatives would require substantial additional major facilities and affect other environmental resources in different geographic locations in addition to those affected by the WSIP. For example, while the Year-round Desalination at Oceanside Alternative would meet the program objectives and lessen some of the impacts associated with the WSIP, it would also cause impacts to the marine environment associated with brine disposal, potential land use compatibility impacts due to space limitations in the vicinity of the proposed shoreline site, and require substantial energy use for the desalination process which would likely make a greater contribution to greenhouse gas and other pollutant emissions than the WSIP or other alternatives.

The Modified WSIP Alternative includes implementation of more conservation, water recycling and local groundwater projects within the regional service area than under the WSIP, which would require construction of some additional facilities in some areas not affected by the WSIP. However, while construction of these facilities would cause temporary construction disruption and related environmental impacts, long-term implementation of these regional conservation, water recycling, and local groundwater projects would offset impacts of the operational modifications proposed under the Modified WSIP Alternative on the Tuolumne River. Depending on the extent of these projects implemented by wholesale customers in collaboration with the SFPUC, they could also help reduce the amount of additional diversion required from the Tuolumne River to serve the 2030 customer purchase requests.

9.4 Alternatives Identification and Screening

This section presents the process and results of identifying and screening alternative concepts and strategies in order to develop the range of alternatives analyzed in Section 9.2.

9.4.1 Process for Identifying Alternative Concepts

Alternatives to be considered under CEQA are those that can avoid or substantially lessen one or more of the significant environmental effects identified for the proposed program. Many of the adverse environmental impacts of the WSIP described in Chapters 4 and 5 were judged to be less than significant. Other adverse impacts were judged to be significant or potentially significant but could be reduced to a less-than-significant level through the application of mitigation measures. Still others were judged to be significant and unavoidable, even with the application of mitigation measures described in Chapter 6. This section summarizes the chief significant environmental impacts identified for the WSIP and discusses potential strategies to avoid or lessen these significant effects. It also describes the process used to develop and identify the alternatives analyzed above in Section 9.2 and includes descriptions of preliminary alternatives as well as the concepts, strategies, and other elements used to develop the alternatives. The basic process is described below:

1. Review potentially significant/significant mitigable (PSM/SM) and potentially significant/significant unavoidable (PSU/SU) impacts identified in Chapters 4 and 5 of this PEIR and identify strategies to lessen or avoid impacts.

2. Review ideas and alternative concepts suggested during PEIR scoping.

3. Conduct preliminary screening of identified strategies and alternative concepts by determining if the strategy/concept meets both of the following criteria:

   - Does it meet any of the basic WSIP goals and objectives?
   - Would it lessen or reduce identified significant impacts?

   If the answer to either question was “no,” the concept was eliminated from further consideration. If the answer to both questions was “yes,” the concept was retained for further consideration.

4. Develop preliminary alternatives based on strategies and concepts retained for further consideration. Review feasibility issues with respect to technical, institutional, and regulatory concerns. If the preliminary alternative was determined to be infeasible, the conceptual alternative was eliminated from further consideration.

5. Develop and refine final alternatives for CEQA analysis in Section 9.2 and identify preliminary feasibility issues to be considered as part of the alternatives analysis.

Each step in this process is further described below. Section 9.5 provides a more detailed description of the concepts and strategies that were eliminated from further consideration and the reasons for their elimination.

9.4.2 Identified Impacts and Potential Strategies to Avoid or Lessen Significant Effects

Significant Facilities-Related Impacts and Strategies to Avoid or Lessen Effects

As described throughout Chapter 4, implementation of the WSIP would have potentially significant construction and/or operations impacts associated with the 22 facility improvement projects in the five regions analyzed in this PEIR. Chapter 4 identifies potentially significant construction impacts for individual facility improvement projects at and near individual project sites; potentially significant collective effects due to concurrent construction of WSIP facilities in the same and multiple regions (overlapping and multi-regional); and potentially significant impacts related to the WSIP facilities' contribution to cumulative impacts. Potentially significant mitigable (PSM) and potentially significant unavoidable (PSU) impacts were identified for one or more facility improvement project(s), as described below.

Significant Facilities Construction Impacts

- Land Use – temporary disruption of existing land uses, including PSU impact for New Irvington Tunnel (SV-4); and PSU impact for collective, overlapping effects in the Bay Division Region
- Geology – slope instability, squeezing ground/subsidence during tunneling, expansive or corrosive soils
- Hydrology – short-term depletion of groundwater resources
- Biological Resources – impacts on wetlands, aquatic resources, sensitive habitats, common habitats, heritage trees, special-status species, including PSU collective impacts in the Sunol Valley and Peninsula Regions
- Traffic – impacts related to roadway capacity, traffic delays, impaired access, parking, and safety hazards, including PSU collective and cumulative impacts
- Air Quality – emission of air pollutants, and exposure to diesel particulate matter, including PSU collective and cumulative impacts
- Noise and Vibration – disturbance adjacent to sites and haul routes, including PSU construction noise impacts for all projects, PSU vibration impacts for multiple projects, as well as PSU and PSM collective impacts in all regions and PSU cumulative impact
- Public Services and Utilities – impacts related to utility disruption, landfill capacity, compliance with solid waste regulations
- Recreational and Agricultural Resources – temporary conflicts with established uses
- Hazards – temporary exposure to hazardous materials
- Energy – construction energy use

Significant Facilities Siting/Design Impacts

- Land Use – permanent displacement or long-term disruption of existing land uses, including PSU impacts for SJPL System (SJ-3), 40-mgd Treated Water (SV-3), SABUP (SV-6), BDPL Reliability Upgrade (BD-1), CS/SA Transmission (PN-2), Groundwater Projects (SF-2), and Recycled Water Projects (SF-3)
- Visual Quality – effects on scenic vistas or visual character, including PSU impact for Calaveras Dam (SV-2); new sources of light and glare
- Hydrology and Water Quality – flooding impacts, increases in impervious surfaces
- Biological Resources – conflicts with adopted conservation plans
- Cultural Resources – impacts on paleontological resources, archaeological resources, and historic resources, including PSU impacts for Calaveras Dam (SV-2), New Irvington Tunnel (SV-4), CS/SA Transmission (PN-2), and Lower Crystal Springs Dam (PN-4), and PSU collective impacts in the Sunol Valley and Peninsula Regions, and PSU cumulative impacts
- Public Services and Utilities – relocation of utilities
- Recreational and Agricultural Resources – long-term conflicts with established uses

Significant Facilities Operational Impacts

- Biological Resources – water discharge effects on riparian/aquatic resources
- Energy – operational energy use

Strategies to Avoid or Lessen Significant Facilities-Related Impacts

Mitigation measures identified in Chapter 4 and described in Chapter 6 would reduce most of the facilities-related impacts listed above to a less-than-significant level, and include measures that would be implemented at the project level, such as construction controls or footprint or project design features. However, this PEIR identifies many impacts as PSU. Although SFPUC construction measures and additional mitigation measures would be applied to these impacts, the remaining environmental impacts would remain significant or potentially significant and therefore unavoidable. However, in many cases, the PSM and PSU impacts were identified as such because there was not enough site-specific information at this program level of analysis to determine definitively whether the impact would be less than significant or whether the identified mitigation measures could reduce the severity of the impact to a less-than-significant level. Separate, project-level CEQA evaluation of the WSIP projects could either confirm that the impact is less than significant or that mitigation is available to reduce the impact to a less-than-significant level. For the purpose of the PEIR analysis, a conservative determination regarding the level of impact has been made, and the designation of PSU is applied to disclose the potential for such effects.

Regardless of mitigation measures, programmatic strategies that would meet one or more of the basic WSIP objectives and might avoid or lessen the significant facilities impacts include:

- Reduce the number and/or extent of facility improvement projects to avoid construction, siting, or operational impacts associated with one or more project (possibly reducing the ability of the WSIP to fully meet the level of service goals for water quality, seismic reliability, delivery reliability, or water supply). This strategy could also lessen the collective and overlapping effects of multiple WSIP projects.

- Phase/extend the WSIP construction schedule such that fewer projects, especially those with geographic overlap, occur concurrently to lessen the collective regional and multi-regional impacts associated with the effects of multiple WSIP projects.

- Refine project site selections and/or facility layout designs to avoid or minimize impacts on sensitive resources (e.g., biological resources, cultural resources, land use, or agricultural lands).

Significant Water Supply/System Operations Impacts and Strategies to Lessen or Avoid Effects

As described in Chapter 5, implementation of the WSIP would have potentially significant impacts on water bodies and associated resources due to the changes in water supply and system operations. Chapter 5 identifies potentially significant impacts that would occur in the Tuolumne River, Alameda Creek, Peninsula watersheds (San Mateo and Pilarcitos Creeks) and in the Westside Groundwater Basin. Potentially significant water supply and system operations impacts, both mitigable and unavoidable, were identified, as described below.

Significant Tuolumne River Watershed and Downstream Impacts

- Effects on fishery resources below La Grange Dam

- Effects on alluvial features that support montane meadow and riparian habitat between Hetch Hetchy and Don Pedro Reservoirs and on riparian resources below La Grange Dam

Significant Alameda Creek Watershed Impacts

- Changes in flow in Alameda Creek below the diversion dam (significant and unavoidable)

- Effects on fishery resources in Alameda Creek below the diversion dam

- Effects on biological resources in Calaveras Reservoir, Calaveras Creek, and Alameda Creek

- Effects on recreational and visual resources in the Sunol Regional Wilderness near Alameda Creek below the diversion dam

Significant Peninsula Watershed Impacts

- Effects related to water quality, fisheries, and biological resources in Pilarcitos Reservoir and along Pilarcitos Creek

- Effects on fishery resources in tributaries to Crystal Springs Reservoir (PSU)

- Effects on biological resources around Upper and Lower Crystal Springs Reservoirs

Significant Westside Groundwater Basin Impacts

- Potential overdraft in the North Westside Groundwater Basin and related effects, including changes in Lake Merced water levels and seawater intrusion

- Water quality effects on drinking water due to groundwater pumping in the North and South Westside Groundwater Basin

Strategies to Avoid or Lessen Significant Water Supply and System Operations Impacts

Mitigation measures identified in Chapter 5 and described in Chapter 6 would reduce most of the effects listed above to a less-than-significant level, although a few of the impacts were identified as PSU. As an alternative to mitigation measures, programmatic strategies that would meet one or more of the basic WSIP objectives that might avoid or lessen the significant water supply and system operations impacts are presented below.

Reducing the amount of additional water diverted from the Tuolumne River could avoid or substantially lessen the significant impacts of the WSIP on the Tuolumne River watershed. Strategies include:

- Use an alternative supplemental supply source instead of the Tuolumne River to meet future purchase requests and/or dry-year water supply reliability needs.

- Use Tuolumne River water to meet additional water supply needs, but alter the point of diversion to a location downstream from the potentially affected fisheries and biological resources.

- Reduce service, thereby reducing the ability to fully meet the level of service goals for water supply. Specifically, do not meet some or all of the future purchase requests and/or dry-year water supply reliability needs.

- Implement demand management to meet increased purchase requests and dry-year water supply reliability needs through aggressive conservation and water recycling only.

Strategies to avoid or lessen impacts in the Alameda Creek watershed include:

- Do not resume diversions from Alameda Creek above the diversion dam to Calaveras Reservoir after Calaveras Dam is restored (possibly reducing the ability of the WSIP to fully meet the level of service goals for water supply and delivery reliability).

- Do not resume diversions from Alameda Creek above the diversion dam to Calaveras Reservoir to historical (pre-2002) levels after Calaveras Dam is restored, but recapture the flows at a location downstream from the potentially affected resources and pump the recaptured water to the regional system.

Strategies to avoid or lessen impacts in the Peninsula watershed include:

- Do not increase water storage in Crystal Springs Reservoir over existing levels for prolonged periods.
- Do not fully meet the 2030 increased purchase requests from wholesale customers served from Pilarcitos Reservoir.

Strategies to avoid or lessen impacts in the Westside Groundwater Basin include:

- Use an alternative supplemental supply instead of groundwater.
- Implement demand management, including conservation and/or water recycling, to reduce demand for additional potable water and thereby avoid or reduce the need to use groundwater.

Growth-Inducement Impacts and Strategies to Avoid or Lessen Effects

As discussed in Chapter 7, the WSIP would support some additional growth within the SFPUC service area—primarily the planned growth reflected in the adopted general plans of the local communities. This growth would result in potentially significant secondary environmental effects such as increased traffic, air pollution, greenhouse gas emissions, noise, and demand for public services and utilities; loss of open space; and effects on water quality, cultural resources, and habitat and associated biological resources. Local land use jurisdictions have prepared CEQA documents on their general plans to assess the secondary effects of growth; as part of that process, these jurisdictions have adopted mitigation measures for the secondary effects of planned growth and have also adopted statements of overriding considerations in cases where they approved growth that could result in significant and unavoidable impacts.

Strategies to Avoid or Lessen Growth-Inducement Impacts

The secondary effects of growth supported by the WSIP would meet one or more of the basic WSIP objectives that could be avoided or substantially reduced by the following strategy:

- Reduce service, thereby reducing the ability to meet the 2030 customer purchase request increase; meet only purchase request levels reflected in the existing Master Water Sales Agreement with the wholesale customers.

9.4.3 Preliminary Screening of Alternative Strategies and Concepts

This section summarizes the overall alternative strategies and concepts considered in the CEQA alternatives analysis, and it provides a preliminary screening based on the ability of each alternative to meet the WSIP level of service goals. The preliminary screening includes both the strategies identified in Section 9.4.2 as well as the concepts raised during the public scoping period. All of the strategies and concepts are grouped into one of the following four main

categories: strategies/concepts that affect facilities; strategies/concepts that affect system operations; strategies/concepts that affect water supply sources; and other strategies/concepts.

Summary of Strategies to Avoid or Lessen Significant Impacts

Table 9-13 summarizes and categorizes the strategies identified in Section 9.4.2 to avoid or lessen significant impacts of the proposed program. The table also indicates the ability of each strategy to meet the basic WSIP performance objectives and level of service goals as a preliminary screening of alternative strategies.

Alternative Concepts Raised During PEIR Scoping

The WSIP PEIR Scoping Report (see Appendix A) summarizes the comments made during the public scoping process for this PEIR for consideration during the environmental review process. Participants in the scoping process presented numerous suggestions for reducing potential impacts as well as possible alternatives to one or more aspect of the proposed WSIP. **Table 9-14** summarizes the alternative concepts raised during the public scoping process and indicates the ability of each idea to meet the basic WSIP performance objectives and level of service goals as a preliminary screening of these ideas.

9.4.4 Alternative Screening

Tables 9-13 and 9-14 list alternative strategies and concepts that were either developed to reduce significant impacts or suggested during the public scoping period, and indicate the ability of each strategy or concept to meet the basic WSIP objectives. All of the strategies listed in Table 9-13 would meet one or more of the basic objectives and would avoid or lessen at least one significant impact. Many of the concepts in Table 9-14 would meet one or more of the basic objectives; however, some of the concepts would meet none of the basic WSIP objectives, and those concepts were eliminated from further consideration, as indicated in the table. In a few cases where extensive scoping comments were made on a concept, further discussion of the concepts and reasons for elimination is provided in Section 9.5.

This section further develops the strategies and remaining concepts, addresses feasibility issues of each strategy and concept, and provides screening for the alternatives and concepts that were either retained for detailed study in this PEIR, or eliminated from, further consideration as CEQA alternatives. Strategies and concepts were considered in the formulation of the range of alternatives evaluated in Section 9.2 if they were determined to be both feasible to implement and potentially effective in avoiding or reducing the environmental impacts associated with the WSIP. The range of alternatives identified for further evaluation and comparison to the WSIP is presented in Section 9.2.

In this section, alternative concepts or strategies were eliminated from further consideration for one or more of the following reasons: (a) they are a variation on an alternative that is evaluated in this PEIR in detail and thus are already represented in the range of alternatives selected for evaluation, (b) they do not meet the CEQA criteria for an alternative (i.e., meet most of the basic

TABLE 9-13
STRATEGIES TO AVOID OR LESSEN SIGNIFICANT IMPACTS AND PRELIMINARY SCREENING

Strategies to Avoid or Lessen Significant Impacts	Does the Strategy Meet the WSIP Performance Objectives and Level of Service Goals?				Preliminary Screening
	Water Quality	Seismic Reliability	Delivery Reliability	Water Supply	
Strategies that Affect Facilities and Could Reduce Facilities Impacts					
Reduce the number and/or extent of facility improvement projects.	No to partially (depends on which projects)	No to partially (depends on which projects)	No to partially (depends on which projects)	No to partially (depends on which projects)	Concept is addressed under No Program Alternative and analyzed in Section 9.2.
Phase/extend the WSIP construction schedule such that fewer projects, especially those with geographic overlap, occur concurrently to lessen the collective regional and multi-regional impacts associated with the effects of multiple WSIP projects.	Partially (could delay ability to meet water quality requirements)	Yes (but would prolong period of time system is subject to seismic risks)	Yes (but may delay regular maintenance program and ability to keep local reservoirs full)	Yes	Concept is discussed in Section 9.4.4 and screened from further consideration, as described in more detail in Section 9.5.
Refine project site selections and/or facility layout designs that avoid or minimize impacts on sensitive resources (e.g., biological, cultural, land use, or agricultural lands).	Yes	Yes	Yes	Yes	Concept is discussed in Section 9.4.4 and screened from further consideration, as described in more detail in Section 9.5.
Strategies that Affect System Operations and Could Reduce Growth or System Operations Impacts					
Reduced service – do not fully meet the WSIP project objectives for water supply. Specifically, do not meet some or all of the future purchase requests and/or dry-year water supply reliability needs. ▪ Meet purchase request levels reflected in the existing Master Water Sales Agreement with the wholesale customers only ▪ Do not fully meet 2030 purchase requests from customers served from Pilarcitos Reservoir	Yes	Yes	Yes	No	Concept is further developed under No Purchase Request Increase Alternative and analyzed in Section 9.2.
Alter the point of diversion for additional Tuolumne River water needed to meet future water supply needs to a location downstream from the potentially affected fisheries and biological resources.	No, would require treatment prior to mixing with Hetch Hetchy supplies	Yes	Yes	Yes	Concept is further developed under Lower Tuolumne River Diversion Alternative and analyzed in Section 9.2.
Do not resume diversions from Alameda Creek above the diversion dam to Calaveras Reservoir after Calaveras Dam is restored.	Yes	Yes	No	No	Concept is discussed in Section 9.4.4 and screened from further consideration, as described in more detail in Section 9.5.

TABLE 9-13 (Continued)
STRATEGIES TO AVOID OR LESSEN SIGNIFICANT IMPACTS AND PRELIMINARY SCREENING

Strategies to Avoid or Lessen Significant Impacts	Does the Strategy Meet the WSIP Performance Objectives and Level of Service Goals?				Preliminary Screening
	Water Quality	Seismic Reliability	Delivery Reliability	Water Supply	
Strategies that Affect System Operations (cont.)					
Do not resume diversions from Alameda Creek above the diversion dam to Calaveras Reservoir to historical (pre-2002) levels after Calaveras Dam is restored, but recapture the flows at a location downstream from the potentially affected resources and pump the recaptured water to the regional system.	Yes	Yes	No	No	Concept is discussed in Section 9.4.4 and screened from further consideration, as described in more detail in Section 9.5.
Do not increase water storage in Crystal Springs Reservoir over existing levels for prolonged periods.	Yes	Yes	No	No	Concept is further developed under Modified WSIP Alternative and analyzed in Section 9.2.
Strategies that Affect Water Supply Sources and Could Reduce Water Supply Impacts					
Use an alternative supplemental supply source to meet future purchase requests and/or dry-year water supply reliability needs. ▪ Use an alternative supply source instead of additional Tuolumne River water ▪ Use an alternative supply source instead of additional pumping from the North Westside Groundwater Basin	Yes	Yes	Yes	Yes	Concept of alternative supply sources is addressed under Aggressive Conservation/Water Recycling and Local Groundwater Alternative and Year-round Desalination at Oceanside Alternative and analyzed in Section 9.2.
Implement demand management to meet increased purchase requests and dry-year water supply reliability needs through aggressive conservation and water recycling only.	Yes	Yes	Yes	Yes	Concept is addressed under Aggressive Conservation/Water Recycling and Local Groundwater Alternative and analyzed in Section 9.2.

TABLE 9-14
ALTERNATIVE CONCEPTS RAISED DURING PEIR SCOPING PROCESS AND PRELIMINARY SCREENING

Alternative Concept	Does the Concept Meet the WSIP Objective and Level of Service in the following areas?				Preliminary Screening
	Water Quality	Seismic Reliability	Delivery Reliability	Water Supply	
Concepts that Affect Facilities					
Do not expand the capacity of the system to withdraw water.	Yes	No	No	No	Concept does not meet three of the basic program objectives but is discussed under the No Program Alternative – analyzed in Section 9.2.
Enlarge Calaveras Reservoir to increase storage.	Yes	No	No	Possibly	Concept is discussed in Section 9.4.4 and screened from further consideration, as described in more detail in Section 9.5.
Remove O'Shaughnessy Dam and restore Hetch Hetchy Valley and use alternative water and power supplies / Use available storage capacity at New Melones Reservoir.	No	No	No	No	Concept does not meet any of the basic program objectives – eliminated from further consideration but discussed further in Section 9.5.
Build a pump station downstream of Holm Powerhouse to pump water from Cherry Creek to Mountain Tunnel / Larger intertie to Cherry Creek / Cherry Reservoir to Mountain Tunnel.	No	No	No	Possibly	Concept is discussed in Section 9.4.4 and screened from further consideration, as described in more detail in Section 9.5.
Expand downstream and off-stream storage.	No	No	No	Possibly	Concept is discussed in Section 9.4.4 and screened from further consideration, as described in more detail in Section 9.5.
Convey water from Don Pedro Reservoir to San Joaquin Pipelines.	No	No	No	Possibly	Concept is further developed under Lower Tuolumne River Diversion Alternative and analyzed in Section 9.2.
Do not build San Joaquin Pipeline (SJPL) No. 4 / Alternative without SJPL No. 4 / Advantages, disadvantages, and impacts of cross connections among SJPLs Nos. 1, 2, and 3 / Status of crossover on the San Joaquin Pipeline system at Albers Road.	No	No	No	No	Concept does not meet any of the basic program objectives – eliminated from further consideration and not discussed further in this PEIR. The SFPUC removed the SJPL No. 4 project from the WSIP and replaced it with the SJPL System project (SJ-3), which would include improvements to the San Joaquin Pipeline system without installation of a completely new SJPL No. 4. Programmatic impacts of the SJPL System project are evaluated as part of the proposed program and as part of all alternatives analyzed in Section 9.2.
Build pump station near Tesla Portal to reduce need for fourth San Joaquin Pipeline.	No	No	No	No	Concept does not meet any of the basic program objectives – eliminated from further consideration and not discussed further in this PEIR. When compared to the proposed program, the addition of a pump station at Tesla Portal would result in increased construction and operational impacts without reducing any of the impacts identified for the WSIP. This concept was considered during development of the SJPL System project (SJ-3) and may be considered in the project-level alternatives analysis if warranted.
Repair leaky pipelines.	No	No	No	No	Concept does not meet any of the basic program objectives – eliminated from further consideration and not discussed further in this PEIR. This concept is part of the SFPUC's ongoing repair and rehabilitation activities, and while it would improve the efficiency of the existing water supply, it would not be sufficient to meet the delivery reliability or water supply objectives.

TABLE 9-14 (Continued)
ALTERNATIVE CONCEPTS RAISED DURING PEIR SCOPING PROCESS AND PRELIMINARY SCREENING

Alternative Concept	Does the Concept Meet the WSIP Objective and Level of Service in the following areas?				Preliminary Screening
	Water Quality	Seismic Reliability	Delivery Reliability	Water Supply	
Concepts that Affect System Operations					
Filtration of Sierra source water / Expansion of filtration capacity in the SFPUC system / Alternative locations for filtration equipment.	No	No	No	No	Concept does not meet any of the basic program objectives – eliminated from further consideration but discussed further in Section 9.5.
Use of water stored in other reservoirs – Lake Lloyd, Lake Eleanor, Don Pedro Reservoir.	No	No	Possibly	Possibly	Concept is incorporated into the existing conditions as well as the proposed program; under both scenarios, the SFPUC maximizes use of water stored in Lake Lloyd and Lake Eleanor as part of Hetch Hetchy Reservoir operations. Use of water stored in Don Pedro Reservoir is part of the existing condition through the water bank described in Chapter 2; it is also assumed under the WSIP for the proposed water transfers with TID and MID for a supplemental drought supply. See Chapter 3, Program Description, Section 3.6, Proposed Water Supply Sources, and analysis in Chapter 5, Section 5.3. This concept is also incorporated and evaluated as part of all alternatives selected for detailed analysis in Section 9.2.
Assume the maximum releases identified in the 1987 Agreement as the required minimum flows for the Tuolumne River.	No	No	No	No	There is presently no basis for assigning the maximum releases to particular time periods, and the concept does not meet any of the basic program objectives – eliminated from further consideration as an alternative. However, concept is considered in the cumulative impact analysis of water supply and system operations and analyzed in Chapter 5, Section 5.7.
Extend the duration of releases into Pilarcitos Creek from Pilarcitos Reservoir to create a more natural flow regime in the creek.	No	No	No	No	Concept does not meet any of the basic program objectives – eliminated from further consideration and not discussed further in this PEIR. This concept is being considered under the SFPUC's Watershed and Environmental Improvement Program, described in Chapter 3, Section 3.12.
Alternative that will provide increased amount and duration of releases from Holm Powerhouse that can be used for whitewater recreation.	No	No	No	No	Concept does not meet any of the basic program objectives – eliminated from further consideration and not discussed further in this PEIR. Releases from SFPUC facilities for whitewater recreation under the proposed program are described in Chapter 3, Section 3.7.1.
Improve freshwater flows for streams.	No	No	No	No	Concept does not meet any of the basic program objectives – eliminated from further consideration and not discussed further in this PEIR. This concept is being considered under the SFPUC's Watershed and Environmental Improvement Program, described in Chapter 3, Section 3.12.
Alternative that analyzes the maximum conveyance capacity.	No	No	Possibly	No	Operation of the regional system under existing conditions, the proposed program, and all alternatives and variants considers the maximum conveyance capacity of the transmission system in terms of optimizing system reliability at the same time as meeting customer water demands. Under the WSIP, CEQA alternatives, and WSIP variants, the maximum conveyance capacity is

TABLE 9-14 (Continued)
ALTERNATIVE CONCEPTS RAISED DURING PEIR SCOPING PROCESS AND PRELIMINARY SCREENING

Alternative Concept	Does the Concept Meet the WSIP Objective and Level of Service in the following areas?				Preliminary Screening
	Water Quality	Seismic Reliability	Delivery Reliability	Water Supply	
Concepts that Affect System Operations (cont.)					
					evaluated in terms of delivery reliability, which includes provisions for maintenance, replenishment of local reservoirs, and minimizing risk of service interruption. Therefore, this concept is incorporated and analyzed as part of the delivery reliability level of service for the proposed program and all alternatives.
Concepts that Affect Water Supply Sources					
Increased conservation, demand-side management.	No	No	Possibly	Possibly	All three concepts are incorporated into the proposed program as described in Chapter 3 and are analyzed as part of the WSIP. In addition, these concepts are further developed under the Aggressive Conservation/Water Recycling and Local Groundwater Alternative and analyzed in Section 9.2.
Increased recycling to meet demand.	No	No	Possibly	Possibly	
Local and regional groundwater.	No	No	Possibly	Possibly	
Infiltration of groundwater into Mountain Tunnel.	No	No	No	No	Concept does not meet any of the basic program objectives – eliminated from further consideration and not discussed further in this PEIR. Current operations of the regional water system account for groundwater accretions to tunnels, and there would be no change in future operations under the WSIP in this regard.
Conjunctive use / Groundwater banking options.	No	No	No	Possibly	This concept is already incorporated in the proposed program and analyzed in Chapter 5. As described in Chapter 3, the proposed program includes a conjunctive-use program in the Westside Groundwater Basin in northern San Mateo County as a supplemental dry-year water source.
Groundwater banking in Kern County	No	No	No	Possibly	The concept of groundwater banking in Kern County in the Semitropic groundwater bank is discussed in Section 9.4.4 and screened from further consideration, as described in more detail in Section 9.5.
Purchase groundwater storage rights in foothills east of and outside of MID/Central Valley.	No	No	No	Possibly	Concept is discussed in Section 9.4.4 and screened from further consideration, as described in more detail in Section 9.5.
Zero increase in imports from the Tuolumne River / No further depletions from the Tuolumne River.	No	No	No	No	Concept alone does not meet any of the basic program objectives. However, this concept is further developed in combination with other alternative water sources under the Aggressive Conservation/Water Recycling and Local Groundwater Alternative and analyzed in Section 9.2.
Supply from Delta / More interties to other water sources, such as the Delta / Connect to the State Water Project at the California Aqueduct or Central Valley Project at the Delta-Mendota Canal.	No	No	Possibly	Possibly	Concept is discussed in Section 9.4.4 and screened from further consideration, as described in more detail in Section 9.5.

TABLE 9-14 (Continued)
ALTERNATIVE CONCEPTS RAISED DURING PEIR SCOPING PROCESS AND PRELIMINARY SCREENING

Alternative Concept	Does the Concept Meet the WSIP Objective and Level of Service in the following areas?				Preliminary Screening
	Water Quality	Seismic Reliability	Delivery Reliability	Water Supply	
Concepts that Affect Water Supply Sources (cont.)					
Additional intertie with Santa Clara Valley Water District.	No	No	Possibly	Possibly	Concept is discussed in Section 9.4.4 and screened from further consideration, as described in more detail in Section 9.5.
Desalination as water supply source.	No	No	Yes	Yes	Concept is developed and analyzed as Variant 2, Regional Desalination for Drought, in Chapter 8, as well as under the Year-round Desalination at Oceanside Alternative in Section 9.2. The Aggressive Conservation/Water Recycling and Local Groundwater Alternative also includes a component of desalination and is analyzed in Section 9.2.
Purchase water from TID and MID.	No	No	Yes	Yes	Concepts are incorporated into the proposed program, which would include water transfers with TID and MID for a supplemental drought supply. See Chapter 3, Program Description, Section 3.6, Proposed Water Supply Sources, and the Modified Alternative, analyzed in Section 9.2, considers water transfers from other agencies.
Water transfers.	No	No	Yes	Yes	
Different combinations of water sources.	No	No	Yes	Yes	Concept is incorporated into the proposed program, which would augment existing supply sources with conservation, recycled water, and groundwater projects in San Francisco; water transfers with TID and MID; and conjunctive-use program in northern San Mateo County. See Chapter 3, Section 3.6, Proposed Water Supply Sources, and analysis in Chapter 5. The concept is also incorporated into the No Purchase Request Increase and Aggressive Conservation/Water Recycling and Local Groundwater Alternatives analyzed in Section 9.2 as well as WSIP Variant 2 – Regional Desalination for Drought, analyzed in Chapter 8.
Urban stormwater.	No	No	No	No	Concept does not meet any of the basic program objectives – eliminated from further consideration and not discussed further in this PEIR. This concept is considered under one component of the Groundwater Projects (SF-2) to use treated urban stormwater to maintain water levels in Lake Merced as well as under the Recycled Water Projects (SF-3), since San Francisco's combined sewer system captures urban stormwater which would be treated as part of the recycled water. This concept alone would not be sufficient to meet the delivery reliability or water supply objectives.
Other Concepts					
No Program.	No	No	No	No	Concept does not meet any of the basic program objectives but is further analyzed in Section 9.2 as required by CEQA.
Meet only seismic and water quality objectives.	Yes	Yes	No	No	Concept is further developed under the No Purchase Request Increase Alternative and analyzed in Section 9.2.

TABLE 9-14 (Continued)
ALTERNATIVE CONCEPTS RAISED DURING PEIR SCOPING PROCESS AND PRELIMINARY SCREENING

Alternative Concept	Does the Concept Meet the WSIP Objective and Level of Service in the following areas?				Preliminary Screening
	Water Quality	Seismic Reliability	Delivery Reliability	Water Supply	
Other Concepts (cont.)					
Meet only sustainability objective / Provide projects that meet the sustainability objective.	No	No	No	No	Concept does not meet any of the basic program objectives – eliminated from further consideration and not discussed further in this PEIR. However, the SFPUC would meet the sustainability objective through implementation of mitigation measures incorporated into the WSIP. This concept is being implemented through the SFPUC's Watershed and Environmental Improvement Program, described in Chapter 3, Section 3.12, as well as through the Alameda and Peninsula Watershed Management Plans.
Meet goals and objectives without a gravity-driven system.	Not defined	Not defined	Not defined	Not defined	Concept is not sufficiently defined to determine if it could meet program objectives or for it to be analyzed. At a minimum, if any alternative to the WSIP were developed that relied on pumping rather than gravity to convey water supplies from the Sierra to San Francisco, it would result in greater long-term air quality and energy impacts than the WSIP, without reducing any impacts of the WSIP. It would also require construction of additional pumping and transmission facilities, resulting in additional construction impacts. Therefore, this concept is eliminated from further consideration and is not discussed further in this PEIR.
Reduce regional per capita daily consumption / Do not fully meet all of the 2030 customer purchase requests.	Not defined	Not defined	Not defined	Not defined	Concept is further developed under No Purchase Request Increase Alternative and analyzed in Section 9.2.
Alternative rationing objectives / scenarios.	No	No	No	No	Concept alone does not meet any of the basic program objectives. However, an alternative rationing objective is developed under Variant 3, 10% Rationing, and analyzed in Chapter 8. In addition, the No Program Alternative does not define a maximum drought rationing policy, but the analysis in Section 9.2 assumes incidental rationing up to 30 percent.
Provide watershed and fish-passage projects aimed at improving habitat and restoring steelhead in the Pilarcitos Creek watershed, such as through the removal or bypass of Old Stone Dam.	No	No	No	No	Concept does not meet any of the basic program objectives – eliminated from further consideration and not discussed further in this PEIR. This concept is being considered under the SFPUC's Watershed and Environmental Improvement Program, described in Chapter 3, Section 3.12.

project objectives *and* avoid or lessen the impacts of the proposed project), or (c) they are not considered feasible to implement. However, it should be noted that SFPUC decision-makers will ultimately determine whether an alternative is feasible or infeasible at the time of program approval. At that time, decision-makers may consider, among other things, whether the alternatives are desirable from a public policy standpoint in light of the program's objectives and whether they provide a reasonable balance of relevant economic, environmental, social, and technological factors.

Strategies/Concepts that Affect Facilities and Could Reduce Facilities Impacts

Reduce the Number and/or Extent of Facility Improvement Projects

The concept of reducing the number or extent of facility improvement projects implemented as part of the WSIP is addressed under the No Program Alternative. This strategy might avoid or lessen the significant construction effects of individual and/or multiple WSIP projects (such as short-term construction traffic, noise, air quality) and still meet most of the WSIP objectives to some degree, depending on which projects would be removed from the WSIP. However, the SFPUC has a limited ability to reduce the number of facility projects and/or the extent of work proposed as part of the WSIP. Each of the proposed facility improvement projects is an important part of repairing and upgrading the regional system, and all of the projects are needed to assure the program objectives can be met. The No Program Alternative describes the effects of a greatly reduced facilities improvement program. Under this alternative, the SFPUC would still proceed with certain projects in order to comply with future water quality regulations. The No Program Alternative, which is discussed in more detail in Section 9.2, assumes that at least five projects required for current regulatory compliance would be implemented in the near term by the SFPUC, even if the SFPUC did not approve the entire program considered in this PEIR. While the No Program Alternative would reduce overall construction impacts, including avoiding some PSU impacts, this alternative would fail to meet the WSIP level of service goals for seismic, delivery, and water supply reliability.

Among the remaining WSIP PEIR projects (beyond those required for immediate regulatory compliance), the SFPUC has determined that all are critical to achieving the WSIP level of service goals. As shown in Chapter 3, Table 3.10, each of the WSIP projects would be required in order to meet some combination of the water quality, seismic reliability, delivery reliability, water supply, and sustainability objectives. The SFPUC has identified most of the WSIP projects as *key* projects for seismic and/or delivery reliability (SFPUC, 2006), but a few projects not listed as key still represent needed facilities that are critical for long-term maintenance and asset management, such as the Pulgas Balancing Reservoir project (PN-5). It might be possible to delay the few maintenance projects not identified as key, but they would ultimately be needed to ensure responsible and adequate maintenance of the system, or, if deferred too long, would possibly have to be conducted as emergency repair projects.

In some cases, a WSIP project would definitively have a significant unavoidable impact, such as the New Irvington Tunnel project (SV-4), even at this programmatic level of environmental review. Potentially significant, unavoidable impacts related to land use, visual quality, historic

resources, and construction noise were identified for individual WSIP projects, but the only clear strategy to avoiding or substantially reducing the significant and unavoidable construction and siting effects would be to not implement those projects. However, this strategy would not be reasonable. As described above, each of the WSIP projects is needed to meet the proposed level of service goals, and those that are not urgent in terms of regulatory or public safety concerns would still be needed for long-term maintenance and asset management of the regional system.

Since all of the projects would eventually be required, delaying implementation of any one project would only defer rather than avoid the identified construction effects. Eliminating the few maintenance-type projects would not substantially reduce the overall construction impacts of the multiple-project WSIP and could potentially prolong the construction impacts. As a result, this PEIR does not evaluate a "reduced project" alternative beyond that represented by the No Program Alternative.

Phase/Extend the WSIP Construction Schedule

Phasing or extending the WSIP construction schedule so that fewer projects, especially those with geographic overlap, would occur concurrently is one approach that could lessen the collective regional and multi-regional impacts associated with multiple WSIP projects. However, this concept would prolong the duration of construction impacts as a trade-off for reducing impact intensity, which is not considered effective as an alternative to avoid or substantially lessen impacts associated multiple and overlapping construction projects. Therefore, this concept was eliminated from further consideration, as discussed in Section 9.5, below. To some degree, like the refinement of site and facility layouts (see immediately below), the feasibility of minimizing impacts due to concurrent construction of projects in the same geographic area would be examined as part of project-level environmental review. Detailed siting studies and construction requirements for each facility would be needed to identify further opportunities to avoid or minimize these environmental effects, and site-specific evaluations will be conducted as part of project-level CEQA review of each WSIP project. When more project-specific information becomes available, it is expected that the SFPUC would coordinate the phasing of construction schedules to minimize impacts where feasible. These project-specific issues are not evaluated in this PEIR, since these actions affect individual groups of projects only and not the WSIP as a whole and would be best addressed during project-level CEQA review. No further analysis in this PEIR is warranted.

Refine Project Site Selection or Facility Layouts

Refining the individual project site selection and/or the facility layout designs could avoid or minimize impacts on sensitive resources (e.g., biological resources, cultural resources, land use, or agricultural lands) associated with construction of individual facility improvement projects. This concept is deferred to the project-level environmental review of individual WSIP projects and was eliminated from further consideration in the PEIR.

A strategy to avoid or lessen footprint impacts associated with siting a project at a specific location would be to revise and refine individual site selection and/or facility layout designs. As this is a program EIR that provides a program-level review of the overall WSIP, detailed project

siting and layout information, while in development, is not yet available for many WSIP projects. In most cases, the proposed facility improvement projects would be constructed on existing SFPUC property, at or adjacent to existing water system facilities. This basic siting approach has helped reduce the potential footprint effects of the proposed projects, but detailed siting and design studies for each facility would be needed to identify further opportunities to avoid or minimize these environmental effects. Site-specific evaluations will be conducted as part of project-level CEQA review of each WSIP project. During detailed project design and subsequent CEQA review, facility siting and layout designs will be considered. Where appropriate, project-level CEQA review will consider site and design alternatives to avoid or lessen the effects of individual projects. These specific site alternatives are not evaluated in this PEIR, since these actions affect individual projects only and not the WSIP as a whole. In addition, the SFPUC's construction measures along with the mitigation measures identified in this PEIR establish procedures and performance measures to be implemented during siting and design of WSIP projects to minimize environmental impacts where feasible. Therefore, alternatives and refinements to individual site selection would be best addressed during project-level CEQA review. No further analysis in this PEIR is warranted.

Strategies/Concepts that Affect Facilities and Could Reduce Water Supply Impacts

Enlarge Calaveras Reservoir

Enlarging Calaveras Reservoir to increase storage beyond the historical capacity could result in the capture of more water within the upper Alameda Creek watershed and could increase local water supplies. This concept also included the potential to provide pumping facilities and to store Tuolumne River water in an enlarged Calaveras Reservoir, thereby increasing local storage for use during droughts, planned or unplanned outages, or other emergencies. However, this concept would not avoid or reduce identified environmental effects associated with increased diversions from the Tuolumne River and would result in more severe environmental impacts on Alameda Creek than the proposed program; therefore, this concept was eliminated from further consideration, as discussed in Section 9.5, below.

Connect Cherry Creek Directly to Regional Water System

The Cherry Creek water supply could be connected directly to the regional water system by building a pump station downstream of Holm Powerhouse to pump water from Cherry Creek to Mountain Tunnel; this would augment supplies to the regional system to serve increased customer demand instead of increasing diversions from Hetch Hetchy Reservoir. However, this concept was eliminated from further consideration because it would result in far greater environmental effects than the proposed program, as discussed in Section 9.5, below.

Expand Downstream and Off-stream Storage

Expanding downstream and off-stream storage within the regional system could possibly augment regional system supplies to help meet increased customer demand. The SFPUC has a limited ability to develop or expand storage within the existing system beyond the facility improvement projects already incorporated into the WSIP, which are designed to restore

historical storage capacity rather than expand storage (i.e., Calaveras Dam, SV-2, and Lower Crystal Springs Dam, PN-4). The concept to expand storage is incorporated into other strategies discussed below, including Enlarge Calaveras Reservoir and Recapture Upper Alameda Creek Flows Downstream, using the infiltration galleries, quarries, or Alameda County Water District (ACWD) facilities. Both concepts were eliminated from further consideration due to institutional constraints or technical infeasibility, as discussed below in Section 9.5.

Strategies/Concepts that Affect System Operations and Could Reduce System Operations Impacts

Revise Alameda Creek Diversion Dam Operations

This concept involves not resuming historical levels of diversions from Alameda Creek above the diversion dam to Calaveras Reservoir after Calaveras Dam is restored. However, this concept was eliminated from further consideration since it would not meet two fundamental WSIP objectives—water supply and delivery reliability—and would make the system more vulnerable to water supply shortages in the event of drought or Hetch Hetchy system emergency outages because Alameda Creek is a local water supply source. This concept could affect the CCSF's water rights to Alameda Creek drainage, as discussed in Section 9.5, below.

Recapture Upper Alameda Creek Flows Downstream

This concept involves not resuming the historical pattern of diversions from Alameda Creek above the diversion dam to Calaveras Reservoir, recapturing the flows downstream from the potentially affected resources, and pumping the recaptured water to the regional system. The SFPUC explored the possibility of recapturing flows downstream at the Sunol infiltration galleries, the quarries, and ACWD facilities. This concept was eliminated from further consideration because of technical infeasibility, as discussed in Section 9.5, below.

Strategies/Concepts that Affect Water Supply Sources and Could Reduce Water Supply Impacts

Both Tables 9-13 and 9-14 indicate that alternative water supply sources would be a possible strategy to meet future purchase requests and to reduce identified impacts of the WSIP. Possible water supply sources shown in these tables include increased conservation (i.e., demand management), increased water recycling, local and regional groundwater, desalination, Delta groundwater banking/conjunctive use, and interties with other agencies. Conservation, increased water recycling, local groundwater, and desalination are incorporated into alternatives discussed and analyzed in Section 9.2. The overall approach of other water supply sources reviewed are discussed below.

As described in Chapter 3, Section 3.4, the SFPUC has conducted numerous water supply studies over the last 20 years to explore strategies and options for meeting future water purchase requests and dry-year water supply reliability needs. These studies have considered a broad range of water supply alternatives. Appendix C of the *Water Supply Options* report (SFPUC, 2007b), referred to as the WSIP Option 3 study, reviewed three previous water supply reports that considered among

them a total of 28 potential water supply alternative projects to meet the growing water supply needs for the SFPUC system:

- *Alternative Means of Providing Additional Water to the San Francisco Water Department* (Kennedy/Jenks Engineers, 1986) – 12 alternatives evaluated.
- *Water Supply Master Plan* (SFPUC, 2000) – 19 alternatives evaluated.
- *Bay Area Water Quality and Supply Reliability Program – Final Report* (CDM, 2005) – Seven Bay Area water agencies evaluated potential regional projects for improvement of water quality and water supply reliability. A set of 69 concepts was screened, 35 of which were selected for further evaluation.

For the WSIP Option 3 study, the SFPUC screened numerous alternatives identified in previous studies for compatibility with the current WSIP goals and levels of service performance objectives. Alternative water supply sources considered include the following: Sacramento–San Joaquin Delta, direct purchase from neighboring water agencies, desalination of seawater or brackish water, recycled water, and water conservation. In addition, the SFPUC evaluated alternative locations for future Tuolumne River diversions (one location is discussed in Section 9.2). Conservation and water recycling options were addressed separately as part of the WSIP planning process (discussed in Section 9.2.4). The 28 alternative concepts were evaluated for the following major issues:

- Environmental issues – major impacts that have a high risk of not being resolved
- Institutional issues – contractual, jurisdiction authority issues or other permitting requirements that have a high risk of not being resolved
- Operational issues – perceived operation problems, either with the SFPUC system or state/federal water systems, that have a high risk of not being resolved
- Water quality issues – water treatment issues that have a high risk of requiring costly treatment or incurring unnecessary health risks

In addition, the SFPUC's initial screening process considered the following criteria specifically related to its system needs and WSIP level of service goals:

1. Secure a reliable and sustainable 25-mgd supplemental water supply.
2. No additional flows to be diverted from the Tuolumne River above historical levels; however, for this study, additional Tuolumne River diversions could be considered at the downstream end of the lower Tuolumne River near the confluence with the San Joaquin River.
3. Corollary to Criterion 2, no additional infrastructure requirements beyond the those of the proposed program (such as a complete fourth San Joaquin Pipeline extending from Oakdale Portal to Tesla Portal or second Coast Range Tunnel).
4. Maintain "filtration avoidance" for water diverted from Hetch Hetchy Reservoir.

The SFPUC's initial screening process identified 10 alternative concepts for further evaluation. Some of these concepts represented variations rather than distinct alternatives. After further review of the remaining 10 alternative concepts, the SFPUC selected three alternatives for more in-depth evaluation: Lower Tuolumne River Diversion, Oceanside Seawater Desalination Plant, and Delta Diversion. The first two are discussed and analyzed in Sections 9.2.5 and 9.2.6, respectively, as potential CEQA alternatives. The last one, Delta Diversion, was considered and rejected as a CEQA alternative, as discussed below. The list below also includes other water sources that were reviewed or suggested during scoping as possible supplemental supplies during nondrought or drought years, but were rejected from further consideration.

Additional Intertie with Santa Clara Valley Water District

The SFPUC investigated several alternatives for an exchange or transfer with the Santa Clara Valley Water District (SCVWD) as part of the WSIP background studies exploring regional water supply opportunities. The SFPUC and SCVWD explored options using the existing intertie, a new intertie, or exchanges through delivery to the eight customers in common to both the SCVWD and SFPUC. This concept was eliminated from further consideration, as described in more detail in Section 9.5, because it would not provide a dependable future water source for the SFPUC regional system. However, the SFPUC considered this concept in combination with supplemental water supply sources, including Groundwater Banking in Kern County and Delta Exchange, as discussed below.

Groundwater Banking in Kern County

As described in Chapter 3, Section 3.4, the SFPUC explored storage in the Semitropic Water Storage District's groundwater bank near Bakersfield as a possible dry-year water supply. Under this option, during wet years, the SFPUC would deliver Tuolumne River water to the Semitropic groundwater bank using the California Aqueduct and, in dry years, would receive water through the Semitropic Water Storage District's allocations of water from the State Water Project via the Delta and South Bay Aqueduct. Direct participation by the SFPUC in this type of water banking program was determined to pose a significant risk of violation of the Raker Act, and this option was therefore eliminated from further consideration, as described further in Section 9.5. The SFPUC also considered indirect participation in this program through current Bay Area partners, including the SCVWD, Alameda County Flood Control and Water Conservation District Zone 7, and ACWD via Delta exchange, but this was determined to be infeasible, as described in Section 9.5.

Delta Exchange

The SFPUC evaluated various alternatives for exchanging water from the SFPUC regional water system for Delta water. It considered the three Bay Area water agencies that are (1) State Water Project contractors receiving Delta water, and (2) agencies to which a means for transferring SFPUC regional water system supplies was identified. The SFPUC, in collaboration with the three potentially participating agencies (ACWD, Zone 7, and SCVWD), determined that this concept is not technically feasible due to timing and capacity issues, as described below in Section 9.5.

Delta Diversion

The SFPUC explored using diversions from the Delta as a supplemental water source. This scenario would involve the following: purchasing water from a water-right holder in the Delta and/or on one of the rivers tributary to the Delta; transporting the water via the State Water Project or Central Valley Project conveyance facilities to the regional system; treating the water at a new treatment plant at Tesla Portal; and blending the treated Delta supply with the Hetch Hetchy supply in the Coast Range Tunnel. This concept was eliminated from further consideration due to uncertainties regarding the availability of water supplies and pumping capacities (which would make consistent year-round diversions highly unlikely), potential water quality issues, and the significant increase in adverse environmental impacts from facility construction and on Delta resources, as discussed in Section 9.5.

Purchase Groundwater Storage Rights in Foothills East of and Outside of MID/Central Valley

This concept was raised during the public scoping period. The SFPUC has not explored this concept because of the limited information on the infiltration rates and potential groundwater quality issues in this basin as well as potential institutional issues. Therefore, due to technical infeasibility, this concept was eliminated from further consideration as a strategy to incorporate into a CEQA alternative, as discussed further in Section 9.5.

9.5 Alternative Concepts Considered But Rejected

9.5.1 Rejected Strategies/Concepts that Affect SFPUC Facilities

Phase/Extend the WSIP Construction Schedule

Phasing or extending the WSIP construction schedule so that fewer projects, especially those with geographic overlap, would occur concurrently is one approach that could lessen the collective regional and multi-regional impacts associated with construction of multiple WSIP projects. However, this concept was eliminated from further consideration, as discussed below.

The SFPUC has a limited ability to revise the phasing or to extend the proposed WSIP multi-project construction schedule. Critical to the phasing of the construction activities is the ability to maintain full service to customers throughout the entire WSIP construction schedule. Certain projects must be completed in the appropriate sequence to provide ongoing service. In addition, the construction of many of the projects requires certain linkages, which necessarily involve overlapping construction activities and schedules between some projects; this overlap would in fact reduce the duration of construction disturbance at some locations.

As described previously, many of the proposed facility improvement projects are urgent in order to meet public health requirements and water quality objectives as well as key to achieving the seismic and delivery reliability level of service goals. As a result, these projects cannot be delayed without compromising the fundamental WSIP goals and objectives and possibly

jeopardizing public health and safety. In addition, lengthening the overall WSIP construction schedule might reduce the intensity of construction impacts from multiple projects in some areas but would, conversely, increase the duration of these impacts as projects are constructed sequentially rather than concurrently. Because phasing project schedules and extending overall construction would trade potential impact intensity for impact duration, this strategy is not considered effective as an alternative to avoid or substantially lessen impacts associated with multiple and overlapping construction projects. Therefore, the concepts of either revising the phasing of the WSIP construction or extending the construction schedule were eliminated from further consideration.

Enlarge Calaveras Reservoir

Enlarging Calaveras Reservoir to increase storage beyond the historical capacity would capture more water within the upper Alameda Creek watershed and could increase local water supplies. This concept also included the potential to provide pumping facilities and to store Tuolumne River water in an enlarged Calaveras Reservoir, thereby increasing local storage for use during droughts, planned or unplanned outages, or other emergencies. However, this concept would not avoid or reduce identified environmental effects associated with increased diversions from the Tuolumne River and would result in more severe environmental impacts on Alameda Creek than the proposed program; therefore, this concept was eliminated from further consideration, as discussed below.

As part of the development of the WSIP, the SFPUC considered an alternative under which Calaveras Reservoir would be enlarged from its historical capacity of 98,800 acre-feet to 256,000 or 409,000 acre-feet. An enlarged Calaveras Reservoir would enable the SFPUC to capture more water from the Alameda Creek watershed and to store more Tuolumne River water in the Bay Area. This alternative would increase the firm yield of the regional water system.

The SFPUC rejected this concept because of uncertainties about the ability to obtain the necessary water rights and environmental permits within the timeframe needed to replace Calaveras Dam to satisfy DSOD requirements. In 2002, the DSOD imposed interim restrictions on Calaveras Dam operations, with the caveat that the SFPUC continue to pursue an aggressive schedule for the remediation of Calaveras Dam. The Calaveras Dam project (SV-2), proposed as a part of the WSIP, includes design features that would technically allow the dam to be raised in the future and the reservoir capacity to be increased if needed, and water-rights and environmental issues can be resolved at that time.

As a potential CEQA alternative, enlarging Calaveras Reservoir to store more than its original 98,800 acre-feet would not help avoid or lessen the effects to the WSIP. It would not reduce the levels of Tuolumne River diversions, if the proposal includes pumping facilities to store Tuolumne River supplies in Calaveras Reservoir. Alternatively, it could replace that supply in whole or in part with increased diversions from upper Alameda Creek, Arroyo Hondo, and Calaveras Creek. This concept would allow increased diversions from upper Alameda Creek through the Alameda Creek Diversion Tunnel compared to the proposed program, which would exacerbate the identified significant, unavoidable impact on stream flow in Alameda Creek below

the diversion dam as well as worsen the potentially significant impact on fishery resources in this reach of Alameda Creek. Therefore, the alternative of enlarging Calaveras Reservoir beyond its historical capacity was eliminated from further consideration in this PEIR.

Connect Cherry Creek Directly to Regional Water System

The Cherry Creek water supply could be connected directly to the regional water system by building a pump station downstream of Holm Powerhouse to pump water from Cherry Creek to Mountain Tunnel; this would augment supplies to the regional system to serve increased customer demand instead of increasing diversions from Hetch Hetchy Reservoir. However, this concept was eliminated from further consideration because it would result in far greater environmental effects than the proposed program, as discussed below.

This concept would use Cherry Creek to augment the regional water supply sources. It could consist of a pump station downstream of Holm Powerhouse to pump water from Cherry Creek to Mountain Tunnel or, alternatively, could consist of a larger intertie to Cherry Creek and Lake Lloyd (Cherry Reservoir) to Mountain Tunnel. This concept would avoid impacts on sensitive terrestrial biological resources downstream of O'Shaughnessy Dam, such as those in the Poopenaut Valley.

To meet federal and state water quality requirements, this concept would necessitate the construction of a filtration plant, since—unlike the Hetch Hetchy watershed—the Cherry Creek watershed does not meet filtration avoidance criteria (see Chapter 2, Section 2.4). This concept would require either filtration of the Cherry Creek source water prior to blending with Hetch Hetchy water in Mountain Tunnel, or filtration of the entire Hetch Hetchy supply after blending with the Cherry Creek water. In either case, construction of a filtration plant would result in numerous additional construction and operational environmental impacts that would not occur under the proposed program. Increased use of Cherry Creek water supplies to serve customer demand would reduce flows available for whitewater rafting. Furthermore, the concept would be contrary to the fundamental operating principle of maintaining filtration avoidance for the Hetch Hetchy system. Therefore, since this concept would not effectively avoid or substantially lessen WSIP impacts without also resulting in a number of other potentially significant environmental impacts, it was eliminated from further consideration.

9.5.2 Rejected Strategies/Concepts that Affect System Operations

Filtration of Sierra Source Water

During scoping, the suggestion was raised to expand the filtration capacity in the SFPUC system and/or to explore alternative locations for necessary filtration equipment, including locating facilities at Brown Adit or Moccasin, or expanding capacity at the Sunol Valley WTP. As a stand-alone alternative, this concept would not meet any of the basic program objectives, would not avoid or lessen any of the impacts of the WSIP, and would result in adverse construction and operational impacts. As described in Chapter 2, the existing quality of Hetch Hetchy water meets

the full requirements of the state and federal Safe Drinking Water Acts, and the water can be consumed without the need for filtration. Therefore, this concept as a stand-alone alternative was eliminated from further consideration.

This suggestion was likely posed in combination with the concept of removing O'Shaughnessy Dam and restoring the Hetch Hetchy Valley. That concept was rejected since it would neither meet any of the program objectives nor avoid or lessen the significance of any of the WSIP impacts, as discussed below in Section 9.5.4.

Revise Alameda Creek Diversion Dam Operations

This concept would involve not resuming historical levels of diversions from Alameda Creek above the diversion dam to Calaveras Reservoir after Calaveras Dam is restored under the WSIP. However, this concept was eliminated from further consideration since it would not meet two fundamental WSIP objectives, would result in the loss of an irreplaceable local source of water needed during droughts and Hetch Hetchy water quality events, and could affect the CCSF's water rights to Alameda Creek drainage.

As discussed in Section 5.4, the WSIP would result in some significant impacts on the Alameda Creek system and its related environmental resources. Most notably, these impacts include a significant and unavoidable reduction of stream flow in Alameda Creek in the reach below the diversion dam to the confluence with Calaveras Creek, and a significant but mitigable effect on the resident trout fishery in this reach. Since the DSOD restricted the storage capacity of Calaveras Reservoir, the SFPUC has substantially reduced the amount of water it routinely diverts each year from Alameda Creek at the diversion dam. This concept would involve proceeding with implementation of the Calaveras Dam project (SV-2), as required by the DSOD, and allowing the reservoir to resume its historical capacity; however, the Alameda Creek Diversion Tunnel would remain as currently managed and would not resume the operations in existence prior to the DSOD restriction. This concept would avoid the significant, unavoidable impact on the hydrology of Alameda Creek below the diversion dam and maintain stream flow in Alameda Creek equivalent to 2005 conditions.

However, this concept would effectively eliminate Alameda Creek drainage as a local water supply source, and only Arroyo Hondo and Calaveras Creek would drain to Calaveras Reservoir. Alameda Creek drainage to Calaveras Reservoir, under historical operating conditions, represents about one-third of the reservoir's capacity and loss of this supply would constitute a substantial reduction in the regional system's total water supply. Without the contribution of Alameda Creek to the total supply, the SFPUC would be unable to meet the delivery reliability and water supply objectives without securing a replacement water supply. Most importantly, under this concept, the regional system would be more vulnerable to water supply shortages in the event of drought or other emergency, since Alameda Creek is a local water supply source. The need for this supply is especially acute during droughts and Hetch Hetchy system emergency outages. This local supply plays a critical role in providing delivery and water supply reliability and cannot be fulfilled through nonlocal supplies (such as the Tuolumne River or the Delta), since it provides local Bay Area storage within the regional water system in proximity to customers. In addition, this concept

could possibly jeopardize the CCSF's pre-1914 appropriative water rights for this supply. Therefore, this concept was eliminated from further consideration.

Recapture Upper Alameda Creek Flows Downstream

This concept involves not resuming the historical pattern of diversions from Alameda Creek above the diversion dam to Calaveras Reservoir, recapturing the flows downstream from the potentially affected resources, and pumping the recaptured water to the regional system. This concept was eliminated from further consideration because of technical infeasibility, as discussed below.

This concept is similar to the previous concept in that it would avoid the significant, unavoidable impact associated with the reduction in stream flow in Alameda Creek below the diversion dam (by not resuming historical operation of the Alameda Creek Diversion Tunnel) and would maintain current stream flow patterns below the diversion dam. However, under this concept, stream flow equivalent to the volume normally diverted to Calaveras Reservoir would be recaptured farther downstream in the creek and then returned to the regional water system. This approach would allow the SFPUC to retain its local water supply source available for use during droughts, Hetch Hetchy water quality events, and other emergency situations.

The SFPUC explored the possibility of recapturing flows downstream at the Sunol infiltration galleries, the quarries, and ACWD facilities, with a focus on recapturing high winter flows rather than low-volume summer releases (SFPUC, 2007a). (The infiltration galleries are described in Section 5.4.4, and the quarries and ACWD facilities are described in Section 5.7.3.) All of these options were determined to be technically infeasible due to physical limitations, as described below. In addition, implementation of any of these concepts would require extensive new construction in sensitive habitats and would result in a host of additional potentially adverse environmental effects. Furthermore, this concept would only avoid the significant, unavoidable impact for the reach of the creek from the Alameda Creek Diversion Dam to the infiltration galleries/quarries/ACWD facilities, but a significant, unavoidable impact on stream flow in the creek below these facilities would remain.

The Sunol infiltration galleries, built in 1901, were designed to intercept surface water from Alameda Creek into the shallow alluvium of the Sunol Valley and provide a location for temporary aquifer recharge and recovery. Historically, the SFPUC (and its predecessors) operated the Sunol infiltration galleries to divert peak flood flows, to divert releases from Calaveras Reservoir, to divert releases of Hetch Hetchy water to Alameda Creek, and to divert flows from Pleasanton/Arroyo de la Laguna; up to 50 to 60 mgd of water was historically diverted at the infiltration galleries. Use of the galleries historically required installation of seasonal gravel dams to improve percolation rates into the galleries. However, following construction of the Calaveras Pipeline in 1934, and again following construction of San Antonio Dam in 1965, the yield of the infiltration galleries declined. The current capacity of the galleries has been further reduced due to the demolition of Sunol Dam and by aggregate mining upstream. Therefore, it is unknown whether it would be feasible to use the infiltration galleries to capture the flows from upper Alameda Creek that were diverted to Calaveras Reservoir prior to the DSOD restriction. The

physical hydrogeology of the Alameda Creek and groundwater system has altered since the infiltration galleries were used, and it is likely that extensive upstream facilities would be required. This concept would then result in a number of potentially adverse environmental effects downstream of the diversion dam associated with placing new facilities in a sensitive habitat. Due to the extent of additional impacts and unknown feasibility, as well as the limited reduction in adverse effects, use of the infiltration galleries was eliminated from further consideration.

Diversion of Alameda Creek flows to the quarries currently located in the Sunol Valley might be possible when a limited amount of water storage space (approximately 14,000 acre-feet) becomes available at one of the lease sites along the bank of Alameda Creek between Interstate 680 and San Antonio Creek. This diversion would require a surface impounding structure (i.e., a rubber dam) and would also have to be screened to prevent fish entrainment. Use of the quarries for water storage would also require extensive modification of the site. Due to the extent of additional impacts and unknown feasibility, as well as the limited reduction in adverse effects, use of the quarries was eliminated from further consideration.

Similarly, use of ACWD's existing downstream facilities to recapture flows from upper Alameda Creek would be questionably feasible. Flows are currently diverted into streamside intakes behind two rubber dams, and, during the winter, the ACWD must lower its rubber dams if flows exceed 200 cubic feet per second. It may not be feasible to capture additional high winter flows from upper Alameda Creek. Due to the extent of additional impacts and unknown feasibility, as well as the limited reduction in adverse effects, use of ACWD facilities was eliminated from further consideration.

9.5.3 Rejected Strategies/Concepts that Affect Water Supply Sources

Additional Intertie with Santa Clara Valley Water District

As described in Chapter 2, the existing SFPUC intertie with the SCVWD has a capacity of 40 mgd and serves as a means to transfer water between the SFPUC and SCVWD during an emergency or during periods of planned maintenance work on critical facilities. The SFPUC investigated several alternatives for an exchange or transfer with the SCVWD as part of the WSIP background studies exploring regional water supply opportunities. The SFPUC and SCVWD explored options using the existing intertie, a new intertie, or exchanges through delivery to the eight customers in common to both the SCVWD and SFPUC. In general, an exchange would involve the SFPUC advancing water in wet years to the SCVWD in exchange for supplies from the SCVWD in dry years. However, it was determined that the SCVWD does not have capacity or need for additional water supplies during wet years. At times when the SFPUC has additional supplies available for delivery to the SCVWD, the SCVWD cannot use the water directly or store it. Additionally, the SCVWD does not have excess water to transfer to the SFPUC in normal or dry years.

Thus, this intertie or any additional intertie with the SCVWD alone would not provide a dependable future water source for the SFPUC regional system, since the SCVWD is faced with similar water supply issues as the SFPUC due to its projected increase in demand and limited water supply sources. However, the SFPUC considered this concept in combination with supplemental water supply sources, including Groundwater Banking in Kern County and Delta Exchange, as discussed below.

Groundwater Banking in Kern County

Hundreds of feet of permeable geologic strata underlie the southern end of the San Joaquin Valley, creating favorable conditions for groundwater storage and recovery. Water applied to the floor of the San Joaquin Valley in Kern County rapidly percolates into the ground and can be readily recovered by pumping from existing groundwater wells.

For many years, water agencies in Kern County have practiced conjunctive use of their surface and groundwater sources; that is, they actively manage their surface and groundwater sources to take advantage of the different characteristics of the two types of water sources. The availability of surface water supplies varies greatly from year to year, but the availability of groundwater supplies typically does not. When surface water is abundant, water agencies supply their customers with surface water and percolate the excess into the ground. When surface water is scarce, water agencies in Kern County supply their customers with groundwater.

Until about 10 years ago, water agencies in Kern County managed the groundwater basin underlying the San Joaquin Valley portion of Kern County exclusively for their own benefit. In 1994, the first of several water banking projects designed to benefit water agencies outside of Kern County came into operation. The Semitropic Water Storage District (Semitropic) provides groundwater storage capacity to multiple partners, including the Metropolitan Water District of Southern California, ACWD, Zone 7, and SCVWD. The total storage capacity of the Phase I basin is nearly 1 million acre-feet. Semitropic has been pursuing development of a Phase II basin (referred to as the "New Unit") with 650,000 acre-feet of new storage capacity. The project is operated as a storage bank; during wet periods, when the project partners do not need all of their water from the State Water Project or other Delta sources to meet current needs, it places the excess in storage in Semitropic's groundwater bank in Kern County. In dry periods, the project partners expect to recover water from the groundwater bank, either through groundwater extraction or Semitropic's Delta entitlements, to supplement their other supplies.

The SFPUC evaluated storing water in the Semitropic groundwater bank in order to increase the firm yield of the regional water system. Specifically, the storage proposal involved an in-lieu groundwater banking concept in which the SFPUC would supply water in non-dry years under its existing Tuolumne River water rights or use another source of non-dry-year supply to irrigators in Semitropic's service area for surface irrigation. In exchange, the farmers would not pump groundwater, which would be credited to the SFPUC's Semitropic groundwater bank account (less the actual losses in delivery, estimated to be 10 percent). When called on by the SFPUC, Semitropic would provide the SFPUC credited amount of water to the California Aqueduct via a proposed New Unit of the Semitropic groundwater bank, which would, in turn, allow the SFPUC

to draw the equal amount of water from the State Water Project South Bay Aqueduct turnout at San Antonio Reservoir or other locations. Finally, other State Water Project contractors located south of Semitropic would use the actual SFPUC banked water delivered by Semitropic.

However, there is uncertainty regarding the ability of the SFPUC to provide water for storage in the Semitropic groundwater bank. The SFPUC determined that there would be a significant risk that conveyance of Hetch Hetchy water to irrigators in the southern San Joaquin Valley would be in violation of the Raker Act, which stipulates that the CCSF not divert any more Hetch Hetchy water beyond the limits of the San Joaquin Valley than is required for its own domestic or municipal purposes. Therefore, due the institutional and legal uncertainties, this option was screened from further consideration.

The SFPUC then evaluated the possibility of purchasing a Delta water supply through a willing seller and delivering it to Semitropic for storage. The SFPUC concluded that delivering a source of Delta water to Semitropic would be subject to extreme competition for pumping capacity, which is already constrained during the winter and spring, the time that excess water is available. Pumping capacity is least constrained during the summer, when there is less water available. In addition to pumping capacity constraints, there may be constraints on the aqueduct capacity required to transport the water south. There may also be capacity issues with the South Bay Aqueduct. Although it appears that summertime capacity is available (when State Water Project deliveries are reduced, which is most likely when the SFPUC would be transporting its return water back), there is no assurance that the SFPUC would have access to that capacity. In addition, the SFPUC would have a lower priority for use of available capacity in the Bank Pumping Facility and in the South Bay Aqueduct than existing State Water Project customers.

In both of the scenarios described above, the SFPUC would receive State Project Water from the Sacramento–San Joaquin Delta in return for the water conveyed to Semitropic. Delta water is of lower quality than Hetch Hetchy water and requires filtration prior to potable use. Use of Delta water during dry periods would create operational difficulties for the SFPUC and would incur substantial additional cost. The SFPUC rejected the alternative of storing water in Semitropic's groundwater bank for a combination of legal, institutional, operational, and cost factors. In an effort to address these issues, the SFPUC also investigated the possibility of participating in Semitropic's groundwater bank through the ACWD, Zone 7, or SCVWD. These options are discussed below under Delta Exchange.

Delta Exchange

The SFPUC evaluated various alternatives for exchanging water from the SFPUC regional water system for Delta water. It considered the three Bay Area water agencies that are (1) State Water Project contractors receiving Delta water, and (2) agencies to which a means for transferring SFPUC regional water system supplies was identified. These three agencies are the ACWD, Zone 7, and SCVWD.

The general concept would be to advance SFPUC regional system water during wet years to the ACWD, Zone 7, or SCVWD via direct connections or interties, or through increased deliveries to

the SFPUC's and SCVWD's common customers to replace demand otherwise met by the SCVWD. This would allow these water agencies to reduce their deliveries from the State Water Project, which could then be stored in Semitropic's groundwater bank (see Groundwater Banking in Kern County, below), used to allow recharge of their local groundwater basins, or use other storage, if available. In dry years, supplies would be returned to the SFPUC either through a reduction in SFPUC demand from SFPUC/SCVWD common customers or through State Water Project deliveries via the State Water Project South Bay Aqueduct turnout at San Antonio Reservoir or other locations.

The SFPUC obtains all of its water from high-quality sources—the Tuolumne River watershed and protected Bay Area watersheds—and therefore is not required to provide the same level of water treatment as water agencies that obtain water from less high-quality sources. It is difficult for the SFPUC to accept lower quality Delta water as a supplementary source of supply during droughts because it is not well equipped to receive, treat, and deliver it to customers. Because the ACWD, Zone 7, and SCVWD already use Delta water, they are better equipped to receive, treat, and deliver it to customers.

The SFPUC, in collaboration with the potentially participating agencies, determined that a Delta Exchange alternative is not technically feasible. The feasibility of this concept is related to the analysis in the discussion above for the Groundwater Banking in Kern County concept. The constraints to feasibility include: (1) inconsistent timing regarding when SFPUC excess water supplies are available and when storage capacity is available; (2) the limited capacity at the State Water Project pumps to move wet-year water to available storage; or (3) the lack of assurance that dry-year supplies could be provided from the State Water Project. These issues are in addition to potential treatment incompatibilities with SFPUC facilities and related water quality issues. Therefore, this concept was eliminated from further consideration.

Delta Diversion

The SFPUC explored using diversions from the Delta as a supplemental water source. This would involve the following: purchasing water from a water-right holder in the Delta and/or on one of the rivers tributary to the Delta; transporting the water via the State Water Project or Central Valley Project conveyance facilities (i.e., the California Aqueduct or the Delta-Mendota Canal) to the regional system; treating the water at a new treatment plant at Tesla Portal; and blending the treated Delta supply with the Hetch Hetchy supply in the Coast Range Tunnel. This concept was eliminated from further consideration due to uncertainties regarding the availability of water supplies and pumping capacities, which would make consistent year-round diversions unlikely, as discussed below.

The SFPUC developed a Delta Diversion alternative and determined that, in addition to construction of all of the WSIP facility improvement projects, a Delta intake and pumping plant, Delta water treatment plant, and associated pipelines would be required. This alternative would be similar in concept to two ideas raised during the scoping period. One included use of the South Bay Aqueduct to convey Delta water directly to San Antonio Reservoir, and the other involved use of the California Aqueduct/Delta-Mendota Canal to convey water to the Hetch Hetchy system.

The SFPUC evaluated the Delta Diversion alternative with respect to water supply availability and reliability from the source; conveyance capacity availability for the Delta supply option; regional water system performance; operations and maintenance requirements; water quality effects; facility siting considerations, including geotechnical, right-of-way, and environmental resources; permitting requirements; and capital, operating, and life-cycle costs. Overall, the SFPUC determined that the feasibility of this alternative would be limited by the availability of Delta water supplies and the pumping capacity of existing State Water Project/Central Valley Project conveyance facilities. In addition, because of numerous institutional and regulatory uncertainties associated with this alternative (largely dependent on how and where the SFPUC would purchase the water), it is unknown if this alternative could achieve the WSIP level of service goals for delivery and water supply reliability. The quality of Delta water supplies would be lower than that of water from the Hetch Hetchy system.

While this alternative could avoid or lessen the impacts on Tuolumne River resources that would occur under the WSIP (as described in Chapter 5), it would result in other, distinct significant environmental impacts on the Delta and associated environmental resources (e.g., fisheries, aquatic habitat and species, riparian habitat, and water quality affecting other beneficial uses). The alternative would substitute one set of significant environmental impacts with another, thus representing trade-offs among environmental resources and impacts without avoiding or necessarily reducing overall environmental impacts.

Regarding impacts associated with facility construction and operation, the Delta Diversion alternative would neither avoid nor lessen the environmental effects that would result from construction and operation of the WSIP facility improvement projects, as all of the key WSIP projects for water quality, seismic reliability, and delivery reliability would still need to be implemented. At the same time, additional facilities beyond those required for the WSIP would need to be constructed and operated. These facilities would be located in a combination of open space, rural settings, and dense urban settings, resulting in a range of additional environmental impacts.

Therefore, since this alternative would have uncertain water supply reliability and an unknown ability to reduce impacts on Tuolumne River resources, as well as significant additional environmental impacts, it was eliminated from further consideration.

Purchase Groundwater Storage Rights in Foothills East of and Outside of MID/Central Valley

As described above in Section 9.4.4, this concept was raised during the public scoping period, but the SFPUC has rejected this concept due to technical infeasibility. The SFPUC did not explore this concept because of the limited information on the infiltration rates in this groundwater basin and potential sources of groundwater quality impairment associated with dibromochloropropane, chlorine, boron, nitrate, iron, and manganese. In addition, there would be institutional issues concerning the SFPUC's ability to use this basin as a drought supply, since the SFPUC would have lowest priority in times of overdraft. Therefore, this concept is not considered as a feasible strategy and was removed from further consideration in this PEIR.

9.5.4 Other Rejected Concepts

Removal of O'Shaughnessy Dam

In 1913, Congress passed and President Woodrow Wilson signed the Raker Act, granting the CCSF the right to dam the Tuolumne River at the mouth of the Hetch Hetchy Valley in Yosemite National Park. O'Shaughnessy Dam was completed in 1923, and water first flowed to the San Francisco Peninsula in 1934.

The decision to permit flooding of the Hetch Hetchy Valley was controversial; when the Raker Act was approved in the Senate, 43 senators voted in favor, 25 were opposed, and 29 abstained (Simpson, 2005). The controversy continues today, and many parties have expressed an interest in removing O'Shaughnessy Dam and restoring the Hetch Hetchy Valley to its condition before the O'Shaughnessy Dam was completed. A number of studies have been performed to determine the feasibility and cost of removing the dam and restoring the valley. Recently, the State of California examined all prior studies and concluded that restoration was feasible, but that the costs would be between $3 and $10 billion (California Department of Water Resources/California Department of Parks and Recreation, 2006).

In 2004, Environmental Defense prepared a planning-level analysis of replacing the water supply and hydropower benefits provided by Hetch Hetchy Reservoir and O'Shaughnessy Dam (Rosekrans et al., 2004). The study was prepared with the objective of restoring the Hetch Hetchy Valley to conditions that existed prior to the construction of O'Shaughnessy Dam; the restored valley would serve as a natural resource available to the public as part of Yosemite National Park. The study proposes alternatives for water storage (such as available storage in New Melones Reservoir), conveyance and treatment, and replacement of lost hydropower, and acknowledges that these alternatives must be in place before restoration of Hetch Hetchy Valley could begin. This study is considered highly speculative in that there are unresolved legal issues inherent in the proposal regarding the Raker Act and the CCSF, TID, and MID water rights, as well as in these water agencies' obligations to their customers.

Regardless of the merits of removing O'Shaughnessy Dam, dam removal is not considered an alternative to the WSIP that must be evaluated to satisfy the requirements of CEQA in this PEIR. The CEQA Guidelines state that an EIR must describe and evaluate a reasonable range of alternatives to the proposed project that would feasibly attain most of the project's basic objectives and would avoid or substantially lessen any significant adverse environmental effects. This proposal is not reasonably related to a reduction or elimination of the significant impacts that would result with implementation of the proposed program, but suggests far greater changes than would be necessary to address any impacts that this proposed program would cause on the Tuolumne River and related resources. To the extent Tuolumne River water continues to be diverted, it is likely to continue to cause or maintain impacts similar to those that resulted from construction of O'Shaughnessy Dam and created the existing condition. The proposal itself is likely to result in numerous, significant environmental impacts associated with construction and operation of unknown new storage, conveyance and treatment facilities at unknown locations, and would likely require increased long-term energy requirements compared to the Hetch Hetchy

system that is gravity-driven and not subject to water filtration requirements. In addition, there would likely be other significant impacts on diversion of Tuolumne River water elsewhere or any other surface water bodies developed to replace any Tuolumne River supply and associated resources.

In addition, removal of O'Shaughnessy Dam would fail to meet any of the WSIP's basic objectives of improving water quality, seismic reliability, delivery reliability, and water supply. The proposal does not attempt to address any of the goals and objectives of the WSIP, but instead suggests a different way to operate the water system without Hetch Hetchy Reservoir. The purpose of the WSIP is to address the inadequacies of the existing system and to provide for reasonably foreseeable future needs. Removal of O'Shaughnessy Dam would require significantly more funding than is available, significant changes in water supply strategy, construction of additional storage and transmission facilities, and operation of a different water system.

This proposal could reduce the existing level of delivery and water supply reliability to regional system customers, since the status and availability of water supplies and transmission methods to replace the existing water system are unknown. Similarly, the proposal would reduce the reliability and jeopardize the power generation facilities associated with O'Shaughnessy Dam, causing impacts on power customers.

Therefore, since this concept does not meet any of the program objectives, nor does it effectively avoid or substantially lessen WSIP impacts without also resulting in a number of other potentially significant environmental impacts, this concept was eliminated from further consideration in this PEIR.

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APPENDIX E
Growth Inducement and Supporting Information

This appendix supplements the information provided in Chapter 7, Growth Inducement Potential and Indirect Effects of Growth, of the WSIP PEIR. In separate subsections it provides information on the following topics:

- E.1 Water Supply Assurances
- E.2 Methodology the SFPUC used to develop 2030 water demand projections and the studies conducted to evaluate potential conservation measures and recycled water projects to help meet future demand, which together provided the basis for the 2030 purchase estimates submitted to the SFPUC.
- E.3 Supplementary information on population, employment, and water demand projections in the SFPUC water service area.
- E.4 Growth trends and policies of a selection of jurisdictions in the service area.
- E.5 Indirect effects of growth and measures identified to mitigate those effects.
- E.6 Project level impacts of growth.

APPENDIX E.1
Water Supply Assurances

Under the terms of the 1984 Settlement Agreement and Master Sales Water Contract (Master Sales Agreement) between the City and County of San Francisco and its suburban water purchasers (the SFPUC wholesale customers) (City and County of San Francisco, et al.,1984), the SFPUC is required to supply up to 184 million gallons per day (mgd) on an annual average basis to the wholesale customers, subject to reductions in the event of a drought, water shortage, earthquake, or other natural disaster, and for rehabilitation and maintenance of the system. In addition, the SFPUC and each of the wholesale customers, except for San Jose and Santa Clara, have negotiated individual supply assurance contracts (individual supply assurances) that cumulatively total 184 mgd. San Jose and Santa Clara do not have supply assurance contracts with the SFPUC.

In most cases, the individual supply assurances specify the amount of water the wholesale customer is entitled to purchase from the SFPUC. The individual supply assurances held by City Hayward and the Estero Municipal Improvement District (MID) are exceptions to this type of contract, as they do not specify a quantified limit on purchases from the SFPUC. A portion of the total 184 mgd (essentially the difference between the subtotal of all the specified individual assurances and 184 mgd, or 28 mgd) is set aside for current usage and growth in consumption by Hayward and Estero MID.[1] If the combined usage by Hayward and Estero exceeds this amount, the Master Sales Agreement provides a method for proportional reduction in the other water customers' supply guarantee (Bay Area Water Users Association [BAWUA], 1993; Bay Area Water Supply and Conservation Association [BAWSCA], 2006). The current individual supply assurance for each wholesale customer is shown in **Table E.1.1**. Table E.1.1 also shows the base year (2001) demand estimate, 2001 purchases, and 2030 purchase estimates for each customer, for comparison purposes. As the table shows, 12 wholesale customers have submitted 2030 purchase estimates that are greater than their existing individual supply assurances, and 11 have submitted purchase estimates that are less than or equal to their existing assurances. Such a comparison does not apply to Estero MID or the City of Hayward, since their individual supply assurances do not specify a limit on SFPUC purchases.

[1] A 1993 memorandum from BAWSCA (then BAWUA) to its member agencies regarding allocation of the 184 mgd supply assurance indicated that the combined usage for Hayward and Estero MID at the time was 21.782 mgd and that an additional 6.2 mgd was set aside to allow for growth in Hayward and Estero MID consumption (BAWUA, 1993). The current BAWSCA annual survey (BAWSCA, 2006) shows a combined usage for Hayward and Estero MID in FY2004-2005 of 24.10 mgd and a reserve amount of 3.9 mgd (together equaling the same combined amount allocated for Hayward and Estero MID [28 mgd] in the 1993 memorandum).

TABLE E.1.1
ALLOCATION OF THE 184 MGD SUPPLY ASSURANCE

Customer	Supply Assurances (mgd[a])	Base-Year (2001) Demand Estimate (mgd[a])	Fiscal Year 2001/2002 Purchases from the SFPUC (mgd[a])	2030 Purchase Estimate (mgd[a])
Alameda County Water District	13.76	51.1	11.99	13.76
City of Brisbane	0.46	0.44	0.39	0.89
City of Burlingame	5.23	4.8	4.64	4.70
California Water Service District	35.5			
CWS - Bear Gulch[b,c]		13.51	11.23	11.76
CWS – Mid-Peninsula District[b]		17.2	16.75	17.24
CWS – South San Francisco District[b]		8.9	7.56	7.97
Coastside County Water District	2.18	2.6	1.8	2.24 – 3.02
City of Daly City	4.29	8.7	5.08	4.90 – 7.32
City of East Palo Alto	1.96	2.5	2.04	4.64
Guadalupe Valley MID[d]	0.52	0.32	0.3	0.71
Town of Hillsborough	4.09	3.7	3.56	3.70
City of Menlo Park	4.46	4.1	3.57	4.54
Mid-Peninsula Water District	3.89	3.7	3.46	3.70
City of Millbrae	3.15	3.1	2.47	3.19
City of Milpitas	9.23	12.0	6.83	8.20
City of Mountain View	13.46	13.3	10.97	13.20
North Coast County Water District	3.84	3.6	3.45	3.61 – 3.80
City of Palo Alto	17.07	14.2	13.19	13.00
Purissima Hills Water District	1.62	2.2	2.2	3.22
City of Redwood City	10.93	11.9	11.64	11.60 – 12.60
City of San Bruno	3.25	4.4	2.7	4.30
City of San Jose (North)[e]	-	5.2	4.42	6.34
City of Santa Clara	-	25.8	3.84	4.90
Skyline County Water District	0.18	0.17	0.17	0.30
Stanford University	3.03	3.9	2.36	4.20
City of Sunnyvale	12.58	24.8	9.69	12.10
Westborough Water District[f]	1.32	0.99	1.02	1.03
Subtotal, customers with specified assurances[g]	156	247	147	170 – 174
Estero MID[d,h]	5.59	5.8	5.62	6.20 – 6.80
City of Hayward[h]	18.51	19.3	17.61	27.95
Estero MID[d] and City of Hayward Reserve[h]	3.90			
Subtotal, Estero MID[d] and City of Hayward	28	25	23	34.15 – 34.75
TOTAL	**184**	**366**	**261**	**204 – 209**

NOTE: Numbers may not sum due to rounding.

a mgd = million gallons per day.
b CWS = California Water Service Company.
c CWS-Bear Gulch District includes the base year demand, 2001/2002 purchases, and 2030 purchase estimate for the former Los Trancos County Water District (now part of CWS-Bear Gulch District) as provided in background documents. The Supply Assurance for CWS-Bear Gulch is based on the BAWSCA 2004-2005 annual survey, which no longer lists Los Trancos as a separate entity.
d MID = Municipal Improvement District.
e Portion of north San Jose only.
f Purchase estimate is based on Westborough Water District's 2005 UWMP.
g Base year demand, base year purchases, and 2030 purchase estimate subtotals also include San Jose and Santa Clara, which do not have supply assurance contracts with the SFPUC.
h Because the supply assurance contracts between SFPUC and Estero MID and SFPUC and Hayward do not specify a limit, the current usage of these wholesale customers (as reported in the BAWSCA FY 2004-05 annual survey) is shown as the "supply assurance;" the amount shown as "Estero MID and City of Hayward Reserve" is the difference between the current supply assurance total (184 mgd) and the specified supply assurances (156 mgd) plus current Estero and Hayward usage (24.1).

SOURCE: BAWSCA, 2006, URS, 2004, Westborough Water District, 2005.

References – Appendix E.1 Water Supply Assurances

Bay Area Water Users Association (BAWUA, now BAWSCA), Memorandum from Douglas M. Short and Brian D. Burns to Member Agencies, RE: Allocation of Supply Assurance Under Section 7.02(b)(1) of the Settlement Agreement, December 6, 1993.

Bay Area Water Supply and Conservation Agency (BAWSCA), *Bay Area Water Supply and Conservation Agency Annual Survey FY2004-05*, April 2006.

City and County of San Francisco, et al., Settlement Agreement and Master Water Sales Contract between the City and County of San Francisco and Certain Suburban Purchasers in San Mateo County, Santa Clara County, and Alameda County; effective May 25, 1984.

URS, *SFPUC 2030 Purchase Estimates Technical Memorandum*, December 2004.

Westborough Water District, *Westborough Water District Urban Water Management Plan 2006-2010*, December 2005.

APPENDIX E.2
Demand Methodology and Purchase Estimates

Water Demand Projections and Purchase Requests

This appendix summarizes the methodology used to develop the water demand projections and the studies undertaken to identify the potential for conservation savings and the use of recycled water within the SFPUC service area, which together provided the basis for the purchase estimates submitted by the water customers to the SFPUC. This summary is based on the following SFPUC technical reports, supplemented by information provided by the SFPUC and BAWSCA staff:

- *SFPUC Wholesale Customer Demand Projections Technical Report* (URS, 2004a) (referred to in this chapter as the wholesale customer demand study)
- *SFPUC 2030 Purchase Estimates Technical Memorandum* (URS, 2004b)
- *SFPUC Wholesale Customer Water Conservation Potential* (URS, 2004c)
- *SFPUC Investigation of Regional Water Supply Option No. 4 Technical Memorandum*, Final (URS, 2006)[1]
- *City and County of San Francisco Retail Water Demands and Conservation Potential* (Hannaford and Hydroconsult, 2004) (referred to in this chapter as the retail customer demand study)
- *SFPUC Wholesale Customer Recycled Water Potential Technical Memorandum* (RMC, 2004)
- *Recycled Water Master Plan for the City and County of San Francisco* (RMC, 2006)[2]

Base-year demand for San Francisco retail customers and the SFPUC's wholesale customers (2000 and 2001, respectively) and projected 2030 demand are shown in **Table E.2.1**. The base-year demand estimate is based on actual consumption data (adjusted for unaccounted-for water) and therefore reflects the implementation of existing conservation programs. The 2030

[1] This report was not used as a basis for the demand estimates, which were developed in 2004. However, it includes customer specific estimates for 2030 recycled water use not included in the 2004 studies.

[2] This is a technical feasibility report that assesses the feasibility of recycled water projects in San Francisco.

TABLE E.2.1
SUMMARY OF BASE-YEAR AND PROJECTED 2030 DEMAND AND PURCHASE ESTIMATES

Customer	Base-Year (2001) Demand Estimate (mgd[a])[b]	Fiscal Year 2001/2002 Purchases from the SFPUC (mgd[a])	Percent of 2001 Demand Met by Purchases from the SFPUC[c]	2030 Projected Demand (with Plumbing Code) (mgd[a])	Projected Change in Demand from 2001 (mgd[a])	Projected Percent Change in Demand from 2001	2030 Purchase Estimates (mgd[a])	Change in Water Purchases from the SFPUC 2001–2030 (mgd[a])	Percent Change in Purchases 2001–2030 (mgd[a])
Alameda County Water District	51.1	11.99	24.3%	59.3	8.20	16%	13.76	1.77	15%
City of Brisbane	0.44	0.39	100%	0.93	0.49	111%	0.89	0.50	128%
City of Burlingame	4.8	4.64	100%	4.9	0.12	3%	4.70	0.06	1%
CWS–Bear Gulch District[d]	13.4	11.12	90.6%	13.9	0.48	4%	11.60	0.48	4%
CWS–Mid-Peninsula District[d]	17.2	16.75	100%	18.1	0.94	5%	17.24	0.49	3%
CWS–South San Francisco District[d]	8.9	7.56	88.9%	9.9	1.00	11%	7.97	0.41	5%
Coastside County Water District	2.6	1.8	70.3%	3.2	0.63	25%	2.24 – 3.02	0.44 – 1.22	24 – 68%
City of Daly City	8.7	5.08	63.6%	9.1	0.44	5%	4.90 – 7.32	-0.18 – 2.24	-4 – 44%
City of East Palo Alto	2.5	2.04	100%	4.8	2.30	92%	4.64	2.60	127%
Estero MID[e]	5.8	5.62	100%	6.8	0.98	17%	6.20 – 6.80	0.58 – 1.18	10 – 21%
Guadalupe Valley MID[e]	0.32	0.3	100%	0.81	0.49	153%	0.71	0.41	138%
City of Hayward	19.3	17.61	100%	28.7	9.40	49%	27.95	10.34	59%
Town of Hillsborough	3.7	3.56	100%	3.9	0.20	5%	3.70	0.14	4%
Los Trancos County Water District[f]	0.11	0.11	100%	0.14	0.03	32%	0.16	0.05	45%
City of Menlo Park	4.1	3.57	96%	4.7	0.61	15%	4.54	0.97	27%
Mid-Peninsula Water District	3.7	3.46	100%	3.8	0.15	4%	3.70	0.24	7%
City of Millbrae	3.1	2.47	100%	3.3	0.17	5%	3.19	0.72	29%
City of Milpitas	12.0	6.83	59.3%	17.7	5.74	48%	8.20	1.37	20%
City of Mountain View	13.3	10.97	89.4%	14.8	1.53	12%	13.20	2.23	20%
North Coast County Water District	3.6	3.45	100%	3.8	0.17	5%	3.61 – 3.80	0.16 – 0.35	5 – 10%
City of Palo Alto[g]	14.2	13.19	99.4%	14.4	0.20	1%	13.00	-0.19	-1%
Purissima Hills Water District	2.2	2.2	100%	3.3	1.12	51%	3.22	1.02	46%
City of Redwood City[h]	11.9	11.64	100%	13.4	1.54	13%	11.60 – 12.60	-0.04 - 0.06	0 – 8%
City of San Bruno	4.4	2.7	64.4%	4.5	0.07	2%	4.30	1.60	59%
City of San Jose (North)[i]	5.2	4.42	96%	6.5	1.31	25%	6.34	1.92	43%
City of Santa Clara	25.8	3.84	16.2%	33.9	8.10	31%	4.90	1.06	28%
Skyline County Water District	0.17	0.17	100%	0.31	0.14	82%	0.30	0.13	76%
Stanford University	3.9	2.36	68%	6.8	2.94	76%	4.20	1.84	78%
City of Sunnyvale	24.8	9.69	43.6%	26.8	1.99	8%	12.10	2.41	25%
Westborough Water District[j]	1.02	1.02	100%	1.03	0.01	1%	1.03	0.01	1%
Total, Wholesale Service Area	**272**	**171**	**63%**	**324**	**52**	**19%**	**204 – 209**	**34 – 39**	**20 – 23%**
SFPUC Retail Service Area	**93.6**	**90**	**96%**	**93.4**	**-0.2**	**-0.2%**	**80 – 91**	**-10 – 1**	**-11 – 1%**
TOTAL	**366**	**261**	**71%**	**417**	**51**	**14%**	**284 – 300**	**24 –40**	**9 – 15%**

NOTE: Numbers may not sum due to rounding.

a mgd = million gallons per day.

b Demand estimates shown here include unaccounted-for water, which is the difference between total water produced and total water billed to customers (water consumed). Unaccounted-for water includes fire fighting use, maintenance requirements, system flushing, leaks, and any unauthorized use.

c Based on URS 2004b.

d CWS = California Water Service Company.

e MID = Municipal Improvement District.

f The former Los Trancos County Water District is now part of CWS–Bear Gulch District; information presented here reflects information in background reports (URS, 2004a, 2004b).

g 2030 demand is based on information provided by the City of Palo Alto to the SFPUC (City of Palo Alto, 2005).

h In November 2005, Redwood City informed the SFPUC that it would be purchasing its low range estimate of 11.6 mgd due to anticipated implementation of 1 mgd of recycled water in 2030 (City of Redwood City, 2005). The high-range purchase estimate total published in URS 2004b of 300 mgd remains the SFPUC 2030 purchase estimate for planning purposes to be consistent with the previous and ongoing WSIP studies.

i Portion of north San Jose only.

j Demand and purchase estimates are based on Westborough Water District's 2005 UWMP, as requested by the district in a letter to the SFPUC (Westborough Water District, 2007). Base year demand shown here is based on 2001 total water production presented in the UWMP (which is equal to 2001-02 purchases from the SFPUC).

SOURCES: URS, 2004a; URS, 2004b; URS, 2006, City of Palo Alto, 2005; City of Redwood City, 2005;SFPUC, 2004; Westborough Water District, 2005; Westborough Water District 2007.

projections take into account expected growth in population and employment, the influence of plumbing codes (which include efficiency requirements), and assumptions about rates of water fixture replacement. Thus, the 2030 demand projections already factor in some "passive" water savings due to plumbing code changes as well as the effects of conservation savings accrued prior to the base year. The purchase estimates in Table E.2.1 include the effects of continuing current conservation programs and new future conservation programs that the SFPUC and/or its wholesale customers plan to implement in the future (discussed below), as well as the use of other water sources.

Projections for both retail and wholesale customers were developed using end-use demand models that break down total water use, by water service account, to specific end uses such as toilets, faucets, and irrigation. Projections for the wholesale service area were developed in close consultation with the wholesale customers, which provided critical inputs to the demand model and subsequently submitted statements concurring with the demand projections. Given the central link between the demand forecasts developed for the SFPUC service area and the amount of growth the WSIP could support, this appendix describes in some detail the methodology used to develop the water demand projections and 2030 purchase requests. Additional information on the demand forecast methodology can be found in the above-referenced reports.

Demand Projections

Wholesale Customer Demand

To develop water demand projections for the wholesale customers, the SFPUC undertook a study using an end-use model called the Demand Side Management Least-Cost Planning Decision Support System (DSS) model. The DSS model uses growth in the number of accounts and a complete breakdown of water end uses, by customer billing category, to forecast water demands. This end-use model was selected over other forecasting approaches because it allows a more accurate representation of changing conditions, such as the future effects of plumbing and appliance codes and implementation of additional conservation measures on demand (URS, 2004a).

For the DSS model, water usage is broken down from total water production[3] in the service area to specific water end uses such as toilets, faucets, and irrigation. Natural fixture replacement (i.e., the replacement of fixtures assumed to occur over time due to failure, aging, or remodeling), the effects of plumbing codes, and effects of past conservation programs are factored in. (The effects of continuing existing conservation programs and of additional conservation and water recycling programs on demand were calculated in separate studies and are factored into the final customer purchase estimates shown in Table E.2.1, as discussed in more detail below.)

[3] Water produced is the total water consumed (including imported water purchased from others, groundwater, or other sources) plus unaccounted-for water.

Establishing Base-Year Conditions

A key to water demand forecasting is accurately determining existing use. Establishing base-year conditions for the DSS model entailed the following steps: selecting the appropriate base year, developing water use data, and calibrating end uses for that year. The SFPUC selected 2001 as a representative base year because water use data in 2001 showed less influence from the recession than did 2002 data, and because 2001 was a normal year in terms of rainfall. (Complete data were not available for 2003 since the wholesale customer demand study was undertaken that year.)

Development of accurate base-year water use data involved the following steps:

- Determination of the percentage of "unaccounted-for" (unmetered) water in the system. A percentage of every water retailer's water is unaccounted for, resulting from, for example, leakage, pipe flushing, and firefighting. Unaccounted-for water is the difference between total water production and total water consumption (i.e., the difference between total water produced and the amount of water billed to customers), and must be considered in demand projections. The five-year average unaccounted-for water was calculated for each wholesale customer based on data published in customers' UWMPs and the 2002 Bay Area Water Users Association's (BAWUA, now BAWSCA) annual surveys. Estimates of unaccounted-for water in the UWMPs varied between 1 percent and 11 percent, and estimates in the annual surveys varied between 5.5 and 5.7 percent. These estimates of unaccounted-for water are low by national standards (which indicate approximately 15 percent unaccounted-for water within a system), according to an American Water Works Association report cited in the demand study, and are lower than the state average (estimated to be 9.3 percent in a 1982 study of state water agencies prepared for the California Department of Water Resources). Unaccounted-for water in a system is expected to increase as pipes and other infrastructure components age. Therefore, the demand projections assumed a minimum value of 7 percent unaccounted-for water, as a conservative estimate for future demands, unless the wholesale customer's five-year average unaccounted-for water was higher, in which case the higher rate was used. The assumed percentage of unaccounted-for water was added to the total water consumed, obtained from billing data, to arrive at the total water produced (the base year [2001] demand estimate in Table E.2.1).

- Determination of the basic split between indoor and outdoor water use, since outdoor use fluctuates seasonally and future water use will be affected by plumbing codes requiring more water-efficient fixtures.

- The further division of indoor and outdoor water usage into specific end uses, by customer billing category, based on published data of industry standards and data from previous water audits.

- Calibration and verification of residential and employment populations and per-capita water use. Once total water production was broken down into end uses ("disaggregated"), these water usage data were calibrated by performing the reverse: end uses and the average number of persons using them were combined to arrive at total water production. The calibration process requires verification of residential and employment population estimates in the service area and the per-capita and per-employee water use estimates. Census data and customer billing data were used to determine the average number of users per account.

- Reconciliation of service area and census area boundaries. The boundaries of many wholesale customer service areas do not exactly coincide with city or town limits. Therefore, the extent

to which service area and census area boundaries conformed needed to be determined and adjustments made where they do not. For example, one water agency may serve all of a city except for a few blocks, which are served (along with other areas) by another agency, or a water agency may serve only a small part of a city. Modelers worked closely with wholesale customers to accurately understand the boundaries. Estimated population and employment projections were verified with wholesale customers and checked through the calibration process.

- Determination of the number of water users per residential account. This involved determining the number of single-family and multifamily buildings in a service area, the number of housing units per multifamily building, and household size. The service area population developed through this process was then checked for reasonableness by comparing it with service area population estimates from the annual survey conducted by BAWSCA.

- Calculation of per-capita water use for residents. This step required determination of total indoor water use for single- and multifamily accounts; usage was divided by average household size to determine per-capita usage.

- Determination of water users per nonresidential account. ABAG employee population figures supplemented by data from the California Department of Finance were used; adjustments were made to account for differences between service area boundaries and those of ABAG jurisdictions.

- Application of fixture models to end uses. Because the efficiency of water fixtures has increased over time, assumptions were required about the model (age) of the fixtures in use. Initial proportions of old, intermediate, and new fixtures were determined based on census age-of-housing data and assumptions about the amount of natural replacement that had occurred prior to the base year.

- Calibration of end uses. The results of the disaggregating and aggregating approaches were then compared and adjusted through a calibration process to match one another.

BAWSCA's annual surveys of wholesale customers since 2001 shows that actual demand for fiscal year (FY) 2001/2002 through FY 2004/2005 has been, for most wholesale customers each year, less than the base-year demand estimate used for the wholesale customer demand projections. As noted above, the SFPUC selected 2001 because it showed less influence from the recession than did 2002 data and was a normal year in terms of rainfall. In addition, as discussed above, the 2001 base year includes adjustments for unaccounted-for water, and therefore is somewhat higher than actual 2001 demand. In FY 2002/2003, total demand was somewhat down from that of the previous year, and only Guadalupe Valley Municipal Improvement District had demand higher than the 2001 base year. Total demand in FY 2003/2004 was greater than that of the two previous years, but slightly less than the 2001 base year. Demand in FY 2004/2005 was lower than that of the previous three years and 8 percent lower than the previous year. According to BAWSCA, the lower-than-normal consumption in FY 2004/2005 reflected expected year-to-year variations and could be explained in part by the combination of higher annual rainfall that year and mild spring temperatures, which extended into late spring and lowered irrigation demand (BAWSCA, 2006).

Forecasting Water Demand

Once the model was calibrated, water demands were forecasted from the base year. The forecasting process entailed the following steps:

- Determination of growth in the number of water accounts and increases in water use in those accounts. Published population and employment projections[4] were used to forecast growth in the number of water accounts. Each customer was asked to select the projections source to be used based on city planning estimates and the most recent general plan, to ensure that the projections were based on land use plans that were relevant to the particular wholesale customer service area. Nineteen of the 30 wholesale customer entities[5] selected ABAG *Projections 2002* as the source of growth rates; others selected BAWSCA's annual surveys,[6] urban water management plans, city planning sources, a service area planning study, a draft general plan,[7] and a water master plan (URS, 2004a). Projections for San Francisco were developed based on information provided by the San Francisco Planning Department.

  Projections 2002 provides forecasts in five year increments only to 2025. Population and employment projections for 2025-2030 were estimated using the 2020-2025 population/employment growth rate, which was applied to the 2025 estimate and carried forward linearly at that rate to 2030.

  To develop yearly projections to 2030 for each source (since none of the selected sources provided yearly projections), the population and employment increase for each five- or ten-year increment was divided evenly and applied yearly throughout the five- or ten-year period (depending on the increment used in the particular projection) to form a linear yearly projection between increments. For each SFPUC customer, the annual demographic projections that were developed through 2030 were used to derive an annual rate of change (annual growth rate) for each of the demographic sources(population and employment).

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4 Employment projections were not developed for Los Trancos County Water District or Stanford University because Los Trancos only has residential accounts and Stanford University uses other parameters (such as increases in building square footage) to forecast growth in nonresidential accounts. (Since the projection studies were conducted, Los Trancos County Water District was purchased by CWS and is now part of the CWS–Bear Gulch District.)

5 There are 27 wholesale customers, but California Water Service Company (CWS) serves three distinct subgroups—Bear Gulch District, Mid-Peninsula District, and South San Francisco District—which are tracked separately in the SFPUC reports. The former Los Trancos County Water District, which was recently purchased by CWS and is now part of the CWS–Bear Gulch District, is also tracked separately in the SFPUC reports. The 30 wholesale customer entities referenced here include the CWS districts and Los Trancos as distinct entities.

6 This organization was called the Bay Area Water Users Association (BAWUA) at the time the cited annual surveys were conducted.

7 The source of the population and employment projections used as the basis for San Bruno's demand forecasts (the City's draft general plan) has not been adopted and is thus potentially subject to change. Therefore, this analysis compared the projections used with the 2030 population and employment projections for San Bruno in ABAG's *Projections 2003* and *Projections 2005*, and the population projection included in the City's 2003 housing element. (*Projections 2002* was not reviewed for this purpose because it does not provide projections to 2030.) The population projections for 2030 in *Projections 2003* and *Projections 2005* are approximately the same as the projections used for the water demand forecasts (1 percent and 5 percent higher, respectively). Employment projections for 2030 in *Projections 2003* and *Projections 2005* were approximately 8 and 10 percent higher, respectively, than those used for the water demand forecasts. San Bruno's 2003 housing element includes a population projection for 2020 of 46,400, which is about 4 percent lower than the population used in the demand forecast for 2030. Based on these comparisons, the projections used for San Bruno in the demand study are reasonably consistent with the growth estimated by the regional planning agency and the City's 2003 housing element. San Bruno's current general plan, adopted in 1984, does not include applicable projections.

These annual growth rates were then input into the demand model, which applied them to the base-year number of water accounts to forecast the future number of water accounts and ultimately future water demand. In general, population projections were used as the source of growth rates for residential, institutional, and other miscellaneous water accounts and employment projections were applied to commercial and industrial accounts.

To reconcile the ABAG projections with those for wholesale customer service areas, a "blend" of ABAG cities was created (refer to Table 7.1 of PEIR Chapter 7). Projections 2002 was used as the source of employment projections for most of the SFPUC wholesale customers.

Based on *Projections 2002*, which showed relatively constant household sizes in the program area over the forecast period, the wholesale customer demand study assumed the average number of users per account would remain constant for all account categories. Based on this assumption, the rate of growth in demand forecast for each demographic category would be expected to correspond directly to the rate of growth in accounts for the customer-billing category to which the forecast is applied. However, data gathered on new accounts in some billing categories revealed higher water use rates by new accounts than by existing (older) accounts. Research into this disparity confirmed that new accounts in certain categories had higher use rates.[8] Therefore, in cases where some categories showed higher water use by new accounts, a category for new accounts, with water use rates consistent with recent customer billing, was incorporated into the DSS model. In other cases, model mechanics required the creation of new categories to estimate actual projected demand using the account growth method. (For example, a commercial building that was only partially occupied would show lower consumption than it would at full occupancy if not adjusted for the full growth potential.) Customers with new account categories incorporated into their DSS model are shown in **Table E.2.2**. In general, the modelers applied population projections to residential, institutional, and other miscellaneous accounts and applied employment projections to commercial and industrial accounts.

In addition to those described in Table E.2.2, a new commercial account for new/renovated commercial use was created for Daly City. This account was not established because of observed trends in new accounts but in order for the DSS model to accommodate additional planned growth (beyond ABAG employment projections for Daly City) of approximately 0.57 mgd estimated by the City to result from established public policy calling for intensification of mixed uses. The City's estimate of changes in demand expected to result from this is intensification of mixed uses is described in a letter from the Daly City director of water and wastewater resources to BAWSCA (Daly City, 2004). This growth reflecting intensified mixed use is expected to occur by the year 2010 and is documented by a number of project reviews that have gone through public processes in Daly City (Daly City, 2004).

- Determination of the average annual rate of fixture replacement and future plumbing code impacts and incorporation of the effects into the fixture models. Water fixtures are replaced over time due to failure, aging, or remodeling and must be replaced by more efficient models, as required by plumbing codes. Modelers considered the age of housing, income levels, fixture saturation study results, and replacement rate estimates by the California

[8] For example, higher use rates were found in areas where redevelopment had replaced paved areas with landscaping. In other cases, higher use was linked to larger lot sizes with larger outdoor areas using irrigation.

TABLE E.2.2
SFPUC WHOLESALE CUSTOMERS WITH DEMAND MODEL CATEGORIES FOR NEW ACCOUNTS[a]

Wholesale Customer	Existing Account Category	Average Water Consumption (gpd/a[b])	New Account Category	Average Water Consumption (gpd/a[b])	Reason for New Category
City of East Palo Alto	Single-Family Residential	314	New Single-Family Residential	340	To represent additional water demand of 0.3 mgd from a new single-family residences in the Ravenswood Business District
	Commercial	1675	New Commercial	5,493	To represent additional water demand of 1.2 mgd from new commercial uses (having an assumed use rate of 5,000 gal /acct/day) in the Ravenswood Business District
Estero MID[c]	Single-Family Residential	320	New Single-Family Residential	450	New homes are assumed to be larger and have a higher outdoor water usage than existing; the per account usage was based on discussion with the wholesale customer. A trend of increasing home prices, based on 1990 and 2000 census information, supports the assumed increase in water usage.
	Commercial/Institutional	2,250	New Commercial/ Institutional	4,000	New commercial users are assumed to be larger and have a higher water usage than existing commercial users. The per account usage was based on discussion with the wholesale customer. Projected new development is expected to consist of large office building complexes.
City of Hayward	Single-Family Residential	275	New Renovated Single-Family Residential	400	Renovation of single family homes is occurring in Hayward where more affordable homes are attracting buyers. Homes are being purchased and remodeled; the remodeled homes have improved landscapes and use a net increase in water (compared to the current average if 275 gpd/a which is lower than most areas of the SFPUC service area). The city expects a 2 percent renovation rate to continue to 2030.
			New High-Use Single-Family Residential	440	To represent 2,200 new higher-use single family homes the City requested be added to the model. These homes have larger lots than existing small-lot homes and are assumed to use 438 gpd/account. At the time the demand modeling was undertaken the City had found that the larger lots being built actually use up to 600 gpd, and estimated the ultimate range for the new homes was 400-600 gpd. Assuming 438 gpd resulted in an overall increase of 0.9 mgd by 2030, which was assumed to be realistic for 2,200 larger homes. This value is slightly higher than the 400 gpd assumed in the City's Water Master Plan and results from the City's field observations showing 600 gpd per new account.
	Commercial/Institutional	1,775	New Commercial / Institutional	8,500	Based on the City's General Plan, which anticipates, and is actively marketing to attract, high technology manufacturing facilities to locate in Hayward. The assumed change for this new industrialization was 400,000 gpd. The new category also includes water for already-approved development of a golf course (170,000 gpd and up to 700,000 in summer, for irrigation), country club (100,000 gpd) and new sports park (45,000 gpd).

TABLE E.2.2 (Continued)
SFPUC WHOLESALE CUSTOMERS WITH DEMAND MODEL CATEGORIES FOR NEW ACCOUNTS[a]

Wholesale Customer	Existing Account Category	Average Water Consumption (gpd/a[b])	New Account Category	Average Water Consumption (gpd/a[b])	Reason for New Category
City of Milpitas	Single-Family Residential	325	New Single-Family Residential	500	All new single family accounts above those existing in 2001 were placed in this category. New homes were assumed to be larger and have higher outdoor water usage. The new single family accounts were assumed to use approximately 50 percent more water than existing accounts (all of which is allocated to outdoor use). Adjustments were based on information provided in the Water Master Plan and conversations with the wholesale customer.
	Commercial	2,164	New Commercial	4,500	All new commercial accounts above those existing in 2001 were placed in this category. These new accounts are assumed to have higher water usage than existing. Assumed to use 4,500 gpd/ acct, based on information in the Water Master Plan and conversations with the wholesale customer.
Purissima Hills Water District	Old Single-Family Residential	716	New/Renovated Single-Family Residential	1,605	The number of old versus new/renovated residential accounts was determined by assuming a 3 percent renovation rate since 1994. This assumption corresponds to a new/renovated water usage of 1,605 gpd/acct in order to reconcile the average water use for all residential accounts with billing data for 2001.
City of Santa Clara	Single-Family Residential	361	New Single-Family Residential	500	A special billing category was added for new single family homes in order to allow higher water usage per account for those future homes at rate provided by the City.

[a] In many of the cases shown here, the new categories were created because the model mechanics required doing so in order to estimate actual projected water demand using the account growth and end-use method. For example, a commercial building that is only 30 percent full has much lower consumption than it would with full occupancy; creation of a new account category provided an adjustment for full growth potential to ensure that consumption for that particular type of account was more accurately forecasted. The average water consumption for the new accounts shown here is not necessarily a reflection of actual use but rather of the adjustments made to more accurately estimate the projected demand using the tools available in the model.

[b] gpd/a = gallons per day per account.

[c] MID = Municipal Improvement District.

SOURCE: URS, 2004a (Appendices B and C).

Urban Water Conservation Council to establish a best estimate of the replacement rates for wholesale customers. The model also incorporated assumptions on the effect of federal legislation regarding high-efficiency clothes washers.

- Incorporation of recycled water use, where appropriate, because the recycled water use represents a demand that would otherwise be served by a potable supply. The cities of Milpitas, Palo Alto, Redwood City, Santa Clara, and Sunnyvale provided information on approved and funded recycled water programs, which was included in base-year and/or future demand projections. Where recycled water information was provided, a new account category for recycled water was added to the wholesale customer's DSS model. Recycled water was assumed to be entirely for outdoor (irrigation) use.

Retail Customer Demand

A separate SFPUC study evaluated retail customer demand (Hannaford and Hydroconsult, 2004). SFPUC retail water customers consist of residents and nonresidential businesses and institutions within the corporate boundaries of San Francisco that receive water from the SFPUC, and several other industrial, governmental, and individual retail customers in the Bay Area and Sierra Nevada foothills (shown in Table 3.1 in Chapter 3, Program Description, of the PEIR). The study evaluated the historical record of San Francisco's retail water demands and projected the future water demands through 2030 based on an estimation of how water uses will change in the future.

The retail customer demand study considered the following factors:

- Historical changes in water use practices that occurred in response to drought-induced water shortages
- Institutional changes, such as the implementation of plumbing fixture retrofit ordinances
- The manner and degree to which the uses of water would change in the future as a result of plumbing code, demographic, and industry changes

In-city customers that receive water hydraulically from the Hetch Hetchy Water and Power system and the SFPUC's Bay Area reservoir system represent more than 90 percent of the SFPUC's retail deliveries. Using an end-use model similar to that employed for the wholesale demand study described above, the retail demand study developed and refined disaggregated water use forecast models for three principal in-city customer categories:

- Nonresidential (representing the commercial, industrial, and service water uses); nonresidential water use was estimated using relationships between employment within San Francisco and employee use of water, segregated by type of business or service enterprise.
- Multifamily residential (representing water use within multiple-family dwellings such as apartments).
- Single-family residential (representing water use within single-family dwellings).

A fourth category (Builders, Contractors, Docks & Shipping) was estimated based on historical water use and maintained constant at the existing level of delivery (based on fiscal years 1997/1998 through 2000/2001) of 0.24 mgd. Unaccounted-for water use, which was based on the historical performance of the SFPUC regional water system, was estimated to be approximately 9 percent of metered water but not less than 7.3 mgd. The year 2000 was used as the base year for the SFPUC retail modeling because this year provided the best available data.

Historical and projected demographic data from the San Francisco Planning Department and ABAG's *Projections 2002* were used in the modeling process to project residential water demand. Data on historical and projected employment figures from the San Francisco Planning Department, the Bureau of the Census, and ABAG were considered in developing the nonresidential demand projections. ABAG's projections (which differed from San Francisco's figures by only 1 percent for 2025) were used because they provided a more comprehensive breakdown by industry type.

Water deliveries to other retail customers, including the U.S. Navy, San Francisco International Airport, and Lawrence Livermore National Laboratory, and nonpotable deliveries to the town of Sunol were assumed to remain constant into the future.[9] Based on a California Department of Water Resources projection for the town of Groveland, the study assumed SFPUC water deliveries to Groveland would also remain constant. The retail demand study also took into account nonpotable water demand within San Francisco that is currently met by groundwater supplies.

As shown in Table E.2.1, retail customer demand is expected to decrease slightly by 2030 to a total demand of 93.4. The net decrease is attributed to an increase in the market penetration of plumbing code changes in the single-family, multifamily, and nonresidential sectors. The total savings due to the plumbing code changes factored into projected retail demand is estimated to be 10.3 mgd by 2030.

Conservation Potential

As discussed above, the end-use demand models factored in water savings that would occur over time (from the base year to 2030) as a result of natural fixture replacement and compliance with plumbing code requirements and effects of past conservation programs. In addition, the SFPUC undertook conservation potential studies in its wholesale and retail service areas to identify conservation potential from feasible conservation measures that could be implemented to partially offset overall growth in water demands. The 2030 purchase estimates (discussed below) factor in projected conservation savings estimated by the individual customers based on these studies.

[9] The study does note, however, that the water demand associated with U.S. Navy sites, such as Treasure Island and Hunters Point Naval Shipyard, should be reevaluated as additional information becomes available regarding the future use of these areas.

Wholesale Customer Conservation Potential

The SFPUC, in conjunction with its 30 wholesale customer entities,[10] conducted a comprehensive study to assess potential conservation savings in the wholesale customers' service areas. An initial list of 75 measures was screened qualitatively, considering the following factors:

- Commercial availability of technology/market maturity
- Service area match (i.e., appropriateness of the measure or technology considering such factors as climate, building stock, and lifestyle)
- Customer acceptance/equity
- Relative effectiveness of the measures available

Thirty-two potential conservation measures emerged from this initial screening. The list of 32 measures included (1) rebate and other incentive programs for installing water-saving devices, (2) city/county ordinances requiring the installation of water-saving devices, and (3) educational outreach and award programs that promote water use reductions in businesses and landscaping. (The list of 32 measures is included at the end of this appendix.) The DSS end-use model was used to estimate water savings and evaluate the cost-effectiveness of implementing the 32 measures. Taking into account the cost-benefit analysis and estimated water savings for each measure, as well as service area water characteristics, retail customer behavior patterns, budgetary considerations, and relative ease of implementation, each wholesale customer compiled three packages of conservation measures, referred to as Programs A, B, and C. Water savings resulting from the natural replacement of fixtures under current plumbing codes was assumed to occur with or without any of the three programs. In general, Program A consists of measures that are currently being implemented; Program B consists of the measures in Program A plus additional measures that were considered to be the most readily implemented; and Program C includes the measures in Programs A and B plus all other measures that appeared to be both feasible and cost-effective to implement. Since there was the potential for water savings from some measures to overlap, once the measures for each program were selected, they were modeled together as a program in order to provide the estimated savings for the program as a whole, accounting for the potential overlap between measures. Projected savings under the three programs for the wholesale customer service area are summarized in **Table E.2.3**, and savings projected for each program by customer are shown in **Table E.2.4**. To gauge the effect of plumbing codes and natural fixture replacement, the DSS model also was run without code-required fixture models in place; plumbing code effects on water savings are also shown in Tables E.2.3 and E.2.4.

[10] As previously noted, there are 27 wholesale customers, and the reference to 30 wholesale customer entities considers the three CWS districts and the former Los Trancos County Water District as distinct entities as they are represented in the conservation potential study.

TABLE E.2.3
CONSERVATION EVALUATION RESULTS
FOR SFPUC WHOLESALE AND RETAIL CUSTOMER SERVICE AREAS
(mgd[a])

Conservation Program[b]	2030 Water Savings due to Conservation Programs, Wholesale Service Area	Total Potential Water Savings, Wholesale Service Area	2030 Water Savings due to Conservation Programs, Retail Service Area	Total Potential Savings, Retail Service Area	Total Potential Savings, Wholesale and Retail Service Areas
(Plumbing Code[c])	–	25.4	–	10.3	35.7
Program/Package A	7.7	33.1[d]	0.64	10.9[g]	44.0
Program/Package B	14.5	40.0[e]	3.93	14.2[h]	54.2
Program/Package C	19.6	45.0[f]	4.45	14.8[i]	59.7

[a] mgd = million gallons per day
[b] The sets of conservation measures (A, B, and C) in the wholesale and retail conservation studies are referred to as programs and packages, respectively.
[c] Plumbing code savings represent savings associated with the natural replacement of plumbing fixtures with more efficient fixture models, and are assumed to occur with or without implementation of the conservation programs.
[d] Includes plumbing code savings plus Program A savings.
[e] Includes plumbing code savings plus Programs A and B savings.
[f] Includes plumbing code savings plus Programs A, B, and C savings.
[g] Includes plumbing code savings plus Package A savings.
[h] Includes plumbing code savings plus Packages A and B savings.
[i] Includes plumbing code savings plus Packages A, B, and C savings.

SOURCES: URS, 2004c; Hannaford and Hydroconsult, 2004.

As shown, a total savings of 25.4 mgd in 2030 is expected to be achieved as a result of natural replacement and plumbing code requirements in the wholesale service area; an additional 7.7 mgd would be saved with implementation of Program A; an additional 6.8 mgd would be saved with Program B over the savings achieved by Program A and the plumbing code; and an additional 5.1 mgd would be saved with implementation of Program C over the savings achieved by Programs A and B and the plumbing code. Multiple rounds of feedback from the wholesale customers were conducted, as needed, until the SFPUC and the wholesale customers were satisfied with the model inputs and results. Once agreement was reached, the wholesale customers submitted forms to the SFPUC indicating their concurrence with the demand projections and the range of conservation potential resulting from their Programs A, B, and C (URS, 2004c).

Following completion of the conservation potential study (and related studies described in this appendix), the wholesale customers submitted estimates of projected purchases for the year 2030, which included the customers' specific estimates of conservation savings as well as their other available sources of supply.

The customers' estimates are, for the most part, similar to the projections for Program B, and indicate savings of approximately 13 - 15 mgd (SFPUC, 2004). It should be noted, however, that because many of the wholesale customers meet their water demand through multiple supply sources, the water savings achieved through implementation of the conservation programs would not necessarily represent commensurate water savings for the SFPUC water system (URS, 2004c).

TABLE E.2.4
PROGRAM-SPECIFIC CONSERVATION POTENTIAL
AND CUSTOMER-PROJECTED CONSERVATION SAVINGS
(mgd[a])

SFPUC Customer	Plumbing Code	Program A	Program B	Program C	2030 Projected Conservation Savings[b]
Wholesale Customers					
Alameda County Water District	4.73	2.020	3.159	3.483	3.16
City of Brisbane	0.16	0.002	0.041	0.050	0.04
City of Burlingame	0.63	0.113	0.245	0.375	0.20
CWS–Bear Gulch District[c]	1.08	0.217	0.930	0.962	0.93
CWS–Mid-Peninsula District[c]	2.08	0.415	0.863	1.166	0.86
CWS–South San Francisco District[c]	0.92	0.208	0.560	0.650	0.56
Coastside County Water District	0.26	0.125	0.183	0.239	0.18
City of Daly City	1.06	0.093	0.448	0.531	0.44
City of East Palo Alto	0.33	0.009	0.092	0.163	0.16
Estero MID[d]	0.42	0.469	0.624	0.720	0.00 - 0.60
Guadalupe Valley MID[d]	0.03	0.001	0.097	0.098	0.10
City of Hayward	1.45	0.195	0.755	1.202	0.76
Town of Hillsborough	0.17	0.056	0.308	0.427	0.20
Los Trancos County Water District[e]	0.01	0.002	0.002	0.003	0.002
City of Menlo Park	0.22	0.014	0.160	0.349	0.16
Mid-Peninsula Water District	0.40	0.048	0.102	0.129	0.10
City of Millbrae	0.34	0.078	0.113	0.236	0.078 - 0.113
City of Milpitas	0.72	0.361	0.601	0.968	0.61
City of Mountain View	1.20	0.241	0.945	1.207	0.24 - 1.21
North Coast County Water District	0.55	0.126	0.185	0.300	0.00 - 0.185
City of Palo Alto	1.24	0.229	0.466	0.592	0.60
Purissima Hills Water District	0.02	0.055	0.077	0.288	0.08
City of Redwood City	1.51	0.593	0.828	1.026	0.59 - 1.02
City of San Bruno	0.68	0.028	0.185	0.266	0.185
City of San Jose (North)[f]	0.17	0.155	0.157	0.595	0.157
City of Santa Clara	1.77	0.647	1.011	1.233	1.00
Skyline County Water District	0.04	0.003	0.009	0.015	0.009
Stanford University	0.42	0.488	0.646	0.663	0.70
City of Sunnyvale	2.72	0.640	0.711	1.596	0.70
Westborough County Water District	0.13	0.015	0.020	0.055	See note g
Subtotal, Wholesale Customers, by Program	25.4	7.65	14.53	19.59	13 - 15
Plus Plumbing Code (Wholesale Customers)		25.4	25.4	25.4	
Total – Wholesale Customers		**33.1**	**40.0**	**45.0**	**13 - 15**
Retail Customers					
Retail Customers, by Program[h]	10.3	0.64	3.93	4.45	0 - 4
Plus Plumbing Code (Retail Customers)		10.3	10.3	10.3	
Total – Retail Customers		**10.9**	**14.2**	**14.8**	**0 - 4**
Total, SFPUC Regional Water System Customers	**35.7**	**44.0**	**54.2**	**59.7**	**13 - 19**

[a] mgd = million gallons per day.
[b] Projected conservation savings represent estimates specified by the wholesale customers and the SFPUC (for retail customers) and were considered when making their 2030 purchase estimates (SFPUC,2004, Popp, 2007).
[c] CWS = California Water Service Company.
[d] MID = Municipal Improvement District.
[e] The former Los Trancos County Water District is now part of the CWS–Bear Gulch District. Information presented here reflects information in the wholesale service area conservation study (URS, 2004c).
[f] Portion of north San Jose only.
[g] The 2030 demand projection and purchase estimate for Westborough Water District is based on the district's 2005 UWMP, based on a request from the district to the SFPUC (Westborough Water District 2007). The UWMP discusses ongoing and planned future demand management programs but does not quantify conservation savings in relation to its 2030 purchase estimate. The purchase estimate originally submitted by Westborough in 2004 assumed conservation savings of 0.02 mgd.
[h] The preferred alternative under the WSIP would result in 4 mgd of conservation savings (SFPUC, 2007).

SOURCES: URS, 2004c, URS, 2006; Hannaford and Hydroconsult, 2004; SFPUC, 2004; SFPUC, 2007, Popp, 2007.

Retail Customer Conservation Potential

A similar approach was taken to determine water conservation potential in the SFPUC's retail service area. The SFPUC initially evaluated the water conservation potential of 48 conservation measures, screening these down to 38 measures using the end-use, disaggregated forecast models employed for the demand projections. (The complete list of measures is included at the end of this appendix.) Market potential, costs, and benefits were identified for the 38 conservation measures.

Using the results of a benefit-cost analysis and professional judgment for each conservation measure, three conservation packages—Packages A, B, and C—were developed. Package A consists of the measures San Francisco is currently implementing. Package B includes all elements of Package A plus additional measures that would expand the current conservation program to an achievable, socially acceptable program that the SFPUC believes it can fund. Package C represents an upper bound of conservation that the SFPUC considers achievable and fundable; Package C includes all elements of Package B plus several additional measures. The additional measures in Package C are based on future improvements in technology (and the information about it) that are assumed to be achievable. For example, dishwasher rebates are included only in Package C because the current models of efficient dishwashers do not show significant water savings; they are included in Package C assuming the market availability of more efficient models will improve.

Projected savings under the three packages for San Francisco are shown in Tables E.2.3 and E.2.4. As shown, a total savings of 0.64 mgd in 2030 is expected to be achieved by implementation of Package A, over the 10.3-mgd savings projected from natural fixture replacement and plumbing codes; an additional 3.29 mgd would be saved with Package B over the savings achieved by Package A and the plumbing code; and an additional 0.52 mgd would be saved with Package C over the savings achieved by Packages A and B and the plumbing code. The 2030 purchase estimate range for the retail service area assumes conservation savings of 0 to 4 mgd (for the high end purchase estimate and for the proposed water supply option, respectively).

Combined Conservation Potential

As shown in Table E.2.3, the potential savings from implementation of plumbing codes and the three identified sets of conservation measures in the combined wholesale and retail service areas range from approximately 36 to 60 mgd. As shown in Table E.2.4, estimates provided by the wholesale customers indicate projected savings from conservation programs (apart from plumbing code savings) in 2030 for the wholesale service area of approximately 13 to 15 mgd. The WSIP proposed water supply option includes 4 mgd of projected savings in 2030 for the retail service area from conservation programs, apart from plumbing code savings.

Recycled Water Potential

Recycled water has the potential to replace potable supplies for such uses as landscape irrigation, toilet flushing, and cooling towers. The SFPUC also evaluated the recycled water potential in the wholesale and retail service areas. In the wholesale service area, the SFPUC identified 14 areas with current and/or planned recycled water projects; 9 areas that currently produce recycled water totaling approximately 12.6 mgd, and additional projects considered relatively certain to be implemented in the near future, as well as those under study.[11] The study estimated that by 2020, the total average annual yield of recycled water projects in the wholesale service area (i.e., current plus new projects, including projects under study) could produce 40 to 46 mgd. Total average annual yield includes water that would be used to meet nonpotable demand not represented in the SFPUC demand estimates. **Table E.2.5** summarizes the results of the study. Information provided by the wholesale customers indicates that by 2030 an estimated 9 mgd would be used in the wholesale service area to offset projected 2030 demand (see Table E.2.5) (URS, 2006).

SFPUC has published a technical feasibility report called the *Recycled Water Master Plan* (RMC, 2006), which assesses the feasibility of recycled water projects in the Westside area of San Francisco. The feasibility analysis identifies projects with the potential to provide approximately 6.2 mgd of recycled water to irrigate Golden Gate Park, Lincoln Park, Harding Park, the San Francisco Zoo, San Francisco State University, and other locations, as well as provide a supplemental water supply for Lake Merced (RMC, 2006). The first phase of projects identified in the report would provide 4.1 mgd recycled water to this area (RMC, 2006).

2030 Purchase Estimates

Following completion of 2030 demand modeling and the conservation potential and recycled water potential studies, the wholesale customers considered conservation potential and other water supply sources and submitted purchase estimates for SFPUC water for 2030 (see **Table E.2.6**). The changes in purchase estimates from 2001 are shown in Table E.2.1. As that table shows, the 2030 estimated purchases represent a total increase of 35 to 39 mgd, or 13 to 15 percent above 2001 purchases. Table E.2.6 also shows the percentage of water supply sources (including recycled water) that is represented by purchases from the SFPUC (i.e., the percentage of demand after conservation savings are taken into account). Purchases from the SFPUC in 2030 represent approximately 72 percent of the total SFPUC service area demand (with plumbing code savings) and about 75 percent of demand adjusted for conservation. (Figure 7.3 of PEIR Chapter 7 depicts historical water deliveries for the wholesale and retail services areas as well as the projected demand on the SFPUC system [i.e., estimated purchases] to 2030.)

[11] These projects, categorized in the technical memorandum as "planned and being implemented," are defined as projects for which agencies have conducted planning studies and may have secured financing, and on which construction had begun or was planned to begin in the coming year. However, the projects in this category are not considered completely certain.

TABLE E.2.5
SUMMARY OF RECYCLED WATER POTENTIAL FOR THE SFPUC SERVICE AREA (mgd[a])

SFPUC Service Area Recycled Water Project Areas	Recycled Water Potential (Total Average Annual Yield)				2030 Projections (Offsets Potable Demand)
	Current (2004) Recycled Water Projects	Planned Recycled Water Projects[b]	Recycled Water Projects Under Study or Previously Studied	Subtotal – Additional Potential Projects	2030 Projected Recycled Water Supply[c]
Alameda County Water District	3.5	0	1.5	1.5	1.40
City of Burlingame	0	0	3.9	3.9	
Coastside County Water District	0	0	0.5	0.5	
City of Hayward	0.2	0	8.3 – 10.3	8.3 – 10.3	
City of Millbrae	0.003	0	1	1	
City of Milpitas					1.77
North San Mateo County Sanitary District (Daly City)[d]	0.001	2.77	0	2.77	
North Coast County Water District	3.4	0.2	0	0.2	
Palo Alto RWQCP – Mountain View Project[e]	0	1.3 – 1.7	0	1.3 – 1.7	
Palo Alto RWQCP – Other[f]	1.5	0	2.26 – 4.18	2.26 – 4.18	
City of Palo Alto					0.76
Redwood City Recycled Water Project/ City of Redwood City[g]	0.1	1.65 – 2.8	0	1.65 – 2.8	0 – 1.00
South Bay Water Recycling Project[h]	3.1	0.19	1.91	2.1	
City of Santa Clara					4.00
Cities of South San Francisco – San Bruno	0	0	TBD	TBD	
Stanford University	0	0	0.06 – 0.98	0.06 – 0.98	
City of Sunnyvale	0.81	0.18	1.3	1.48	1.50
Subtotal – SFPUC Wholesale Customer Service Area[i]	**12.6**	**6.3 – 7.8**	**20.7 – 25.6**	**27.0 – 33.4**	**9 – 10**
SFPUC Retail Service Area	**0**	**0**	**6**	**6**	**0 – 4**
Total, SFPUC Service Area[i]	**12.6**	**6.3 – 7.8**	**26.7 – 31.6**	**33 – 39.4**	**9 – 14**

a mgd = million gallons per day.
b These projects are identified in the *Wholesale Customer Recycled Water Potential Technical Memorandum* as "Planned and Being Implemented." However, they are not considered completely certain, according to the SFPUC. Therefore, they are identified in this table as "Planned."
c The source for this column is URS, 2006, except for SFPUC Retail Service Area, which is based on SFPUC, 2007.
d Wholesale customers served are California Water Service Company (CWS), Daly City, and Westborough Water District.
e Wholesale customers served are Palo Alto and Mountain View; RWQCP = Regional Water Quality Control Plant.
f Wholesale customers served are Palo Alto, Mountain View, and Stanford University; RWQCP = Regional Water Quality Control Plant.
g In November 2005, Redwood City informed the SFPUC of a revised purchase estimate to include 1 mgd of recycled water in lieu of 1 mgd of SFPUC purchases in 2030 (City of Redwood City, 2005). Despite this change, the overall 2030 purchase estimate remains at 300 mgd to be consistent with all the previous and ongoing WSIP studies.
h Wholesale customers served are the Cities of Milpitas, San Jose, and Santa Clara.
i Of the 12.6 mgd produced by current recycled water projects, 4.3 mgd replaces a potable water supply.

SOURCES: SFPUC, 2007; RMC, 2004; RMC, 2006; URS, 2006; City of Redwood City, 2005.

TABLE E.2.6
SUMMARY OF 2030 DEMAND PROJECTIONS, WATER SUPPLY ASSUMPTIONS, AND SFPUC PURCHASE ESTIMATES

Customer	A 2030 Projected Demand (with Plumbing Code Savings) (mgd[a])	B 2030 Projected Conservation Savings (mgd[a])	C 2030 Demand Adjusted for Conservation (mgd[a]) (A - B)	D 2030 Projected Use of Recycled Water (mgd[a])	E 2030 Projected Use of Ground-water Sources (mgd[a])	F 2030 Projected Use of Other Surface Water Sources (mgd[a])	G 2030 Projected Demand Adjusted for Use of Other Sources and Conservation (mgd[a]) (C - D - E - F)	H 2030 Purchase Estimates (mgd[a])	I Percent of Total 2030 Demand (with Plumbing Code Savings) met by SFPUC Purchases (H/A)	J Percent of 2030 Demand Adjusted for Conservation met by SFPUC Purchases (H/C)
Alameda County Water District	59.3	3.16	56.14	1.40	13.98	27.00	13.76	13.76	23%	25%
City of Brisbane	0.93	0.04	0.89				0.89	0.89	96%	100%
City of Burlingame	4.9	0.20	4.7				4.70	4.70	96%	100%
CWS–Bear Gulch District[b,c]	14.06	0.93	13.13			1.37	11.76	11.76	84%	90%
CWS–Mid-Peninsula District[b]	18.1	0.86	17.24				17.24	17.24	95%	100%
CWS–South San Francisco District[b]	9.9	0.56	9.34		1.37		7.97	7.97	81%	85%
Coastside County Water District[d]	3.2	0.18	3.02		0 – 0.30	0 – 0.48	2.24 – 3.02	2.24 – 3.02	70 – 94%	74 – 100%
City of Daly City[e]	9.1	0.44	8.66		1.34 – 3.76		4.90 – 7.32	4.90 – 7.32	54 – 80%	57 – 85%
City of East Palo Alto	4.8	0.16	4.64				4.64	4.64	97%	100%
Estero MID[f]	6.8	0.00 – 0.60	6.2 – 6.8				6.20 – 6.80	6.20 – 6.80	91 – 100%	100%
Guadalupe Valley MID[f]	0.81	0.10	0.71				0.71	0.71	88%	100%
City of Hayward	28.7	0.76	27.95				27.95	27.95	97%	100%
Town of Hillsborough	3.9	0.20	3.7				3.70	3.70	95%	100%
City of Menlo Park	4.7	0.16	4.54				4.54	4.54	97%	100%
Mid-Peninsula Water District	3.8	0.10	3.70				3.70	3.70	97%	100%
City of Millbrae[g]	3.3	0.08 – 0.11	3.19 – 3.27				3.19 – 3.22	3.19	97%	99 – 100%
City of Milpitas	17.7	0.61	17.09	1.77		7.13	8.19	8.20	46%	48%
City of Mountain View	14.8	0.24 – 1.21	13.59 – 14.56		0.05	1.30	12.24 – 13.21	13.20	89%	91 – 97%
North Coast County Water District	3.8	0.00 – 0.19	3.62 – 3.80				3.62 – 3.80	3.61 – 3.80	95 – 100%	100%
City of Palo Alto[h]	14.4	0.60	13.76	0.76			13.00	13.00	91%	94%
Purissima Hills Water District	3.3	0.08	3.22				3.22	3.22	98%	100%
City of Redwood City[i]	13.4	0.59 – 1.02	12.38 – 12.81	0 – 1.00			11.38 – 12.81	11.60 – 12.60	87 – 94%	94 – 98%
City of San Bruno	4.5	0.19	4.32				4.32	4.30	96%	100%
City of San Jose (North)[i]	6.5	0.16	6.34				6.34	6.34	98%	100%
City of Santa Clara	33.9	1.00	32.90	4.00	19.99	4.00	4.91	4.90	14%	15%
Skyline County Water District	0.31	0.01	0.30				0.30	0.30	97%	100%
Stanford University	6.8	0.70	6.10			1.90	4.20	4.20	62%	69%
City of Sunnyvale	26.8	0.70	26.10	1.50	2.60	9.90	12.10	12.10	45%	46%
Westborough Water District[k]	1.03	see note k	1.03				1.03	1.03	100%	100%
Total, Wholesale Service Area	**324**	**13 – 15**	**308 – 311**	**9.4 – 10.4**	**39.3 – 42.1**	**52.6 – 53.1**	**203 – 209**	**204 – 209**	**63 – 65%**	**66 – 67%**
SFPUC Retail Service Area[l]	**93.4**	**0 – 4**	**89.4 – 93.4**	**0 – 4**	**2.5 – 4.5**	**0**	**81 – 91**	**80 – 91**	**86 – 97%**	**89 – 97%**
TOTAL	**417**	**13 – 19**	**398 – 404**	**9.4 – 14.4**	**41.8 – 46.6**	**52.6 – 53.1**	**284 – 300**	**284 – 300**	**68 – 72%**	**71 – 74%**

NOTE: Numbers may not sum due to rounding.

a mgd = million gallons per day.
b CWS = California Water Service Company.
c CWS–Bear Gulch District includes the former Los Trancos County Water District.
d The upper range purchase estimate assumes loss of all local water sources (surface water and groundwater) and the lower range estimate assumes continuation of local sources; both estimates assume Level B water conservation.
e The purchase estimate range reflects a range of potential groundwater usage established under a pilot project, from the sustainable yield (3.76 mgd) to the lowest annual production yield (1.34 mgd), according to Daly City's best estimate of 2030 water purchases (SFPUC, 2004).
f MID = Municipal Improvement District.
g 2030 conservation savings is based on URS 2004c and the City's UWMP as confirmed by the City (Popp, 2007).
h 2030 demand and conservation savings are based on information provided by the City of Palo Alto to the SFPUC (City of Palo Alto, 2005a).
i In November 2005, Redwood City informed the SFPUC that it would be purchasing its low-range estimate of 11.6 mgd due to anticipated implementation of 1 mgd of recycled water in 2030 (City of Redwood City, 2005a). The high-range purchase estimate total of 300 mgd published in URS 2004b remains the SFPUC 2030 purchase estimate total for planning purposes, to be consistent with the previous and ongoing WSIP studies. The purchase estimate range originally submitted apparently reflects the average of the City's estimated conservation savings range plus the originally estimated range of recycled water use.
j Portion of north San Jose only.
k Demand and purchase estimates are based on Westborough Water District's 2005 UWMP, as requested by the District in a letter to the SFPUC (Westborough Water District, 2007). The UWMP discusses ongoing and planned future demand management programs but does not quantify conservation savings in relation to the demand and purchase estimate. The District's original estimate of water purchases indicated conservation savings of 0.020 mgd (SFPUC 2004).
l The low range of the SFPUC retail customer purchase estimate reflects the identified groundwater, recycled water, and conservation programs totaling 10 mgd in San Francisco that are included as part of the WSIP proposed water supply option.

SOURCES: URS, 2004a; URS, 2004b; URS, 2004c; URS, 2006; SFPUC, 2004; SFPUC, 2007; City of Palo Alto, 2005a; Popp, 2007; City of Redwood City, 2005a; Westborough Water District, 2005 ; Westborough Water District 2007.

Conservation Measures

The following two tables are included with this appendix to show the conservation identified in the wholesale and retail conservation studies:

- **Table 2-2** of the *SFPUC Wholesale Customer Water Conservation Potential Technical Report* (URS 2004c), which lists the 32 conservation measures that emerged from 75 initial measures screened by the SFPUC, as described above; and

- **Table 19** of the *City and County of San Francisco Retail Water Demands and Conservation Potential* report (Hannaford and Hydroconsult, 2004), which lists the 48 measure initially identified in the conservation study.

References – Appendix E.2: Demand Methodology and Purchase Estimates

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Table 2-2
Description of Conservation Measures Selected for Further Evaluation

Conservation Measure	Measure Description
1. Residential Water Surveys	Offer indoor and outdoor water surveys to existing Single-Family and Multi-Family residential retail customers with high water use; provide customized report to homeowner.
2. Residential Retrofit	Provide owners of pre-1992 homes with retrofit kits that contain easy-to-install low flow showerheads, faucet aerators, and toilet tank retrofit devices.
3. Large Landscape Conservation Audits	Provide free landscape water audits to all public and private irrigators of landscapes larger than one acre with separate Irrigation accounts upon request.
4. Water Budgets	Provide a monthly irrigation water use budget as information on the water bill for all irrigators of landscapes larger than one acre with separate Irrigation accounts.
5. Clothes Washer Rebate	Provide a rebate on a new water efficient clothes washer for homeowners.
6. Public Information Program	Provide public education to raise awareness of conservation measures available to retail customers. Programs could include poster contests, speakers to community groups, radio and television time, and printed educational material such as bill inserts, etc.
7. Commercial Water Audits	Provide a free water audit to high water use Commercial accounts that evaluates ways for the business to save water and money.
8. ULF Toilet and Urinal Rebates	Provide rebates to pre-1994 businesses with high use fixtures for commercial ULF toilets (1.6 gal/flush) and commercial ULF urinals (1.0 gal/flush).
9. Residential ULF Toilet Rebate	Provide a rebate to homeowners to replace an existing high volume toilet with a new water efficient toilet.
10. Require 1.6 gal per flush toilets to be installed at the time of sale of existing buildings	Work with the real estate industry to require a certificate of compliance be submitted to the water utility verifying that a plumber has inspected the RSF or RMF property and efficient fixtures were either present or installed at the time of sale, before close of escrow.
11. Home Leak Detection and Repair	Use leak detection equipment to determine whether and where leaks are occurring on the premises and provide a plumber to the retail customer to repair leaks for free.
12. Rebates for 6/3 dual flush or 4 liter toilets	Provide a rebate or voucher for the retrofit of a 6/3 dual flush, 4-liter or equivalent very low water use toilet. Rebate amounts would reflect the incremental purchase cost and would be in the range of $50 to $100 per toilet replaced.

Table 2-2
Description of Conservation Measures Selected for Further Evaluation

Conservation Measure	Measure Description
13. ET Controller Rebates	Provide a rebate for the latest state of the art irrigation controllers with on-site temperature sensors or a signal from a central weather station that modifies irrigation times at least weekly (preferably daily) as the weather changes.
14. Xeriscape education and staff training at retail garden/irrigation supply houses	Sponsor training for staff of stores where plants and irrigation equipment is sold to educate sales people about the benefits of native (low water use) plants, efficiently irrigated.
15. Homeowner irrigation classes	Sponsor classes at stores where irrigation equipment is sold or other suitable venues on selection and installation of efficient equipment (drip irrigation, smart controllers, low volume sprinklers, etc.)and proper plant.
16. Promote water efficient plantings at new homes	Provide information for planting water-efficient landscaping, including avoiding strip turf sections that are difficult to water efficiently and using native plants that do not require supplemental watering. Information would be provided in brochures with the water bill, or mailed. Informational displays at Water Utility offices and nurseries could also be provided.
17. Offer incentives for replacement of clothes washers in coin-operated laundries	Offer incentives to apartment and coin-op laundry managers to retrofit or use efficient clothes washers. The rebate would either go to the manager or the washing machine leasing company.
18. Incentives for retrofitting sub-metering	Rescind any regulations that prohibit sub-metering of multi-family buildings and encourage sub-metering through water audits and direct mail promotions, and/or incentives to building owners.
19. Require sub-metering multifamily units	Require all new multi-family units to provide sub-meters on individual units. To help reduce financial impacts on tenants, regulations would be adopted that specify acceptable methods of metering and billing.
20. Rebate efficient clothes washers	Provide a rebate to new apartment complexes over a certain size with a common laundry room equipped with efficient washing machines.
21. Enforce landscape requirements for new landscaping systems (turf limitations / regulations)	Enforce existing requirements on use of native or low-water-using plants for landscaping purposes. Proof of compliance would be necessary to obtain a water connection on all new Multi-Family Residential and commercial projects. Non-compliers would face a surcharge on their water bill until they complied.
22. Restaurant low flow spray rinse nozzles	Provide free installation of 1.6 gpm spray nozzles for the rinse and clean operation in restaurants and other commercial kitchens.

Table 2-2
Description of Conservation Measures Selected for Further Evaluation

Conservation Measure	Measure Description
23. Focused water audits for hotels/motels	Provide free water audits to hotels and motels covering bathrooms, kitchens, ice machines, cooling towers, and irrigation system schedules.
24. WAVE Program (US EPA) for hotels	Provide hotels with information about the US EPA's WAVE program. This program encourages hotels to do their own water audit and then analyze their water use with the software provided. The software identifies water saving projects and computes paybacks. Hotels that agree to participate in the program also agree to install cost-effective water conserving equipment.
25. Hotel retrofit (w/financial assistance)	Following a free water audit offer participating hotels a rebate for identified water saving. Provide a rebate schedule for certain efficient equipment such as air-cooled ice machines for hotels that don't participate in an audit.
26. Award program for water savings by businesses	Sponsor an annual awards program for businesses that significantly reduce water use. Provide a plaque, presented at a lunch with the mayor.
27. Replace inefficient water using equipment	Provide a rebate for a standard list of water efficient equipment including icemakers, efficient dishwashers, cooling towers to replace once through cooling, irrigation controllers, and certain process equipment.
28. Require 0.5 gal/flush urinals in new buildings	Require new buildings be fitted with 0.5 gal/flush urinals.
29. Financial incentives for complying with water use budget	Link a landscape water budget to a rate schedule that penalizes the account holder for exceeding its water budget and rewards them for using less than the budget.
30. Financial incentives for irrigation upgrades	Provide rebates for selected types of irrigation equipment upgrade.
31. Require dedicated irrigation meters for new accounts	Require new accounts with a substantial amount of irrigated landscape have dedicated landscape meters and are charged on a separate rate schedule that recognizes the high peak demand placed on the system by irrigators.
32. Water Utility / City Department water reduction goals	Provide water use reduction goals for metered City and County accounts and offer audits and employee education.

Table 19
Selection of Conservation Measures by Package

				Program		
	Model No.	Meas. No.	Measure	A	B	C
Number	**RESIDENTIAL SINGLE FAMILY**					
1	RSF-1	1a	Clothes Washer Rebate -25 g/l rebate	Yes	Yes	Yes
2		1b	Clothes Washer Rebate -17 g/l rebate	Yes	Yes	Yes
3		1c	Clothes Washer Rebate -17 g/l rebate	Yes	Yes	Yes
4	RSF-2	2	Toilets-6/3 or 4 liter Rebates	No	Yes	Yes
5		3	Toilets-ULF Rebate	Yes	Yes	Yes
6		7	Toilets-Retrofit	No	No	No
7		8	Toilets-1.6 gpf Replace on Sale	No	Yes	Yes
8	RSF-3	4	Public Information	Yes	Yes	Yes
9	RSF-4	5	Leak Detection/Repair	No	No	No
10	RSF-5	6	Water Surveys	Yes	Yes	Yes
11	RSF-6	7	Retrofit: 1.75 gpm showerheads	No	No	No
12	RSF-7	45	Dishwasher Rebate	No	No	Yes
	RESIDENTIAL MULTI FAMILY					
13	RMF-1	9a	Clothes Washer Rebate -25 g/l rebate	Yes	Yes	Yes
14		9b	Clothes Washer Rebate -17 g/l rebate	Yes	Yes	Yes
15		9c	Clothes Washer Rebate -17 g/l rebate	Yes	Yes	Yes
16	RMF-2	2	Toilets-6/3 or 4 liter Rebates	No	Yes	Yes
17		3	Toilets-ULF Rebate	Yes	Yes	Yes
18		7	Toilets-Retrofit	No	No	No
19		8	Toilets-1.6 gpf Replace on Sale	No	Yes	Yes
20	RMF-3	10	Submetering Retrofit Incentives	No	No	No
21	RMF-4	11	Submetering Reqt. for New Units	No	No	Yes
22	RMF-5	6	Water Surveys	Yes	Yes	Yes
23	RSF-6	7	Retrofit: 1.75 gpm showerheads	No	No	No
	NON-RESIDENTIAL MEASURES					
24	NR-1	14	Lscape-Audits	No	Yes	Yes
25	NR-3	16	Water Savings Awards	No	No	Yes
26	NR-4	17	Water Audits	No	Yes	Yes
27	NR-5	19	Urinals-ULF Rebate	No	Yes	Yes
28		37	Urinals-Require 0.5 gpf	No	No	Yes
29	NR-6	19	Toilets-ULF Rebate	No	Yes	Yes
30	NR-7	20	Large Innovative Retrofit Incentives	No	Yes	Yes
31	NR-8	21	Large New Project Incentives	No	Yes	Yes
32	NR-11	24	Audits-Hospitals	No	Yes	Yes
33	NR-12	25	Audits-Laundry SS Rebates	Yes	Yes	Yes
34	NR-13	26	Audits-Schools/Universities	No	Yes	Yes
35	NR-14	27	Audits-School/University Toilets	No	No	No
36	NR-15	28	Audits-School/University Landscaping	No	Yes	Yes
37	NR-16	29	School/University Artificial Turf	No	No	No
38	NR-18	31	Low Flow Sprayers-Grocery/Flower	No	Yes	Yes
39	NR-19	32	Low Flow Sprayers-Restaurants	No	Yes	Yes
40	NR-19a	46	Steamers-Restaurants	No	Yes	Yes
41	NR-20	42	Cooling Towers	No	No	No
42	NR-21	44	City/PUC - Water Broom	No	Yes	Yes
43	NR-21a	14	City/PUC - Landscaping	No	Yes	Yes
44	NR-22	44	Water Broom	No	Yes	Yes
45	NR-23	33	Audits-Hotels/Motels	No	Yes	Yes
46	NR-24	34	WAVE Program	No	No	No
47	NR-25	35	Require Fixture Replacement on Resale	No	No	Yes
48		36	Retrofit with Financial Assistance	No	No	Yes

APPENDIX E.3
Population, Employment, and Water Demand Projections

This appendix provides a more detailed analysis of the population and employment projections and the associated water demand projections discussed in the PEIR Chapter 7, Growth Inducement Potential and Indirect Effects of Growth. This appendix reviews in greater detail the population and employment projections used by the San Francisco Public Utilities Commission (SFPUC) and its wholesale customers to develop their 2030 water demand projections and subsequent water purchase requests to the SFPUC. It also provides more detail on the evolution of the Association of Bay Area Governments (ABAG) regional growth projections for the Bay Area, and compares those growth projections to the projections of population and employment growth that correspond to the water customers' projections of demand growth. Finally, it provides additional discussion of the relationship between the customer growth and demand projections and the growth projections contained in the local general plans as well as ABAG projections.

Organization of Appendix E.3

The analysis presented in this appendix begins by reviewing the water customers' projections of water demand and identifying the population and employment expectations that are the basis for those projections. These expectations establish a basis of comparison with projections prepared by regional and local planning agencies. (The assessment presented in Chapter 7 evaluates the consistency of the demand projections developed by SFPUC in consultation with the water customers with those of the regional planning agency [ABAG] and the respective local jurisdictions.)

This analysis then reviews ABAG's *Projections 2002*, which was the published set of regional projections available at the time the water demand projections were prepared, and which provided a basis for many of those projections. It goes on to trace the evolution of ABAG's projections sets through *Projections 2003* and *Projections 2005,* to establish the trend in thinking, on the part of the regional planning agency, about how the Bay Area will grow. These projections do not incorporate explicit assumptions about the Water System Improvement Program (WSIP), and consequently provide a reasonable regional framework for evaluation of the projections on which the water demand forecasts are based.

Next, this analysis describes other sets of projections– those in cities' general plans and water districts' urban water management plans (UWMPs) (to the extent they are available) – for the areas served by the SFPUC and its wholesale customers, and compares these other sets of

projections and ABAG's *Projections 2005* to the employment and population projections used by the respective water customers as the basis for projecting water demand.

Finally, this appendix compares the percentage increases in employment and population projected for the water customer service areas in both *Projections 2005* and the water customer demand studies (URS, 2004; Hannaford and Hydroconsult, 2004) to the percentage increase in water demand projected for each water customer service area.

Water Demand Projections

The majority of the wholesale customers selected ABAG's *Projections 2002* as the population and employment forecasts to be used in their demand forecasting models. There were some exceptions to this approach, such as where projections developed by the jurisdictions served or the BAWSCA annual survey were used. Table 4-1 of the *SFPUC Wholesale Customer Water Demand Projections Technical Report* (URS, 2004) (referenced in this appendix as the wholesale customer demand study) identifies the source of the projection for each wholesale customer. The *City and County of San Francisco Retail Water Demands and Conservation Potential* study (Hannaford and Hydroconsult, 2004) (referenced in this chapter as the retail customer demand study) identifies the sources of demographic data used for that study.

The wholesale customer demand study shows population and employment estimates for 2001 and projections through 2030. Because the horizon year for *Projections 2002* was 2025, it was necessary for the purposes of this EIR to extend the projections to 2030. In most cases, the projections were extended by assuming the same (numeric) amount of growth between 2025 and 2030 as was projected to occur between 2020 and 2025.

Tables E.3.1 and **E.3.2** summarize the projections of employment and population growth used for the water demand projections, by county. In Table E.3.1, two interim years – 2005 and 2025 – have been added to the boundary years shown in the wholesale customer demand study. The estimates for 2005 and 2025 were created to provide a consistent interval for comparison of the growth assumed for the water demand projections to other sets of projections (primarily ABAG's *Projections 2003* and *Projections 2005*). For wholesale customers, the interim year estimates assume a constant numeric rate of growth over the entire projection period; in other words, both employment and population would increase in a straight line with constant slope over the 29-year period (2001-2030). This assumption is consistent with the procedure used in the wholesale demand report both to create year-by-year estimates and to extend the projections to 2030. The retail customer demand study uses a base year of 2000, but includes projections for 2005 and 2025 as well as 2030.

Table E.3.2 calculates the numeric and percentage changes in employment and population that would occur in the portion of each county served by the SFPUC and its wholesale customers.

TABLE E.3.1
EMPLOYMENT AND POPULATION PROJECTIONS FOR WATER DEMAND ESTIMATES: SUMMARY BY COUNTY[a]

	Employment				Population			
	2001	2005	2025	2030	2001	2005	2025	2030
Alameda County	238,565	251,963	318,953	335,701	456,962	468,786	527,908	542,688
Santa Clara County	501,186	519,755	612,598	635,809	466,452	482,168	560,746	580,391
San Mateo County	394,346	411,273	495,898	517,056	703,185	718,517	795,642	814,904
Total Wholesale Customers	1,134,097	1,182,991	1,427,449	1,488,566	1,626,599	1,669,471	1,884,296	1,937,983
San Francisco	638,840	656,480	770,500	795,400	760,075	772,470	834,448	849,942
Total Area Served	1,772,937	1,839,471	2,197,949	2,283,966	2,386,674	2,441,941	2,718,744	2,787,925

[a] Includes only those portions of each county served by SFPUC wholesale water customers or served directly by the SFPUC (San Francisco County). Population estimates for San Mateo County include updated figures for the Westborough Water District from the district's Urban Water Management Plan .

SOURCES: URS, 2004; Hannaford and Hydroconsult, 2004; Mundie & Associates, 2006; Westborough Water District, 2005.

TABLE E.3.2
POPULATION AND EMPLOYMENT PROJECTIONS FOR WATER DEMAND ESTIMATES: EXPECTED CHANGE BY COUNTY[a]

	2001-2030		2005-2025		2005-2030	
Area	**#**	**%**	**#**	**%**	**#**	**%**
Change in Employment						
Alameda County[a]	97,136	40.7%	66,990	26.6%	83,738	33.2%
Santa Clara County	134,623	26.9%	92,843	17.9%	116,054	22.3%
San Mateo County	122,710	31.1%	84,627	20.6%	105,783	25.7%
Total Wholesale Customers	354,469	31.3%	244,462	20.7%	305,575	25.8%
San Francisco	156,560	24.5%	114,020	17.4%	138,920	21.2%
Total Area Served	511,029	28.8%	358,482	19.5%	444,495	24.2%
Change in Population						
Alameda County[a]	85,726	18.8%	59,122	12.6%	73,902	15.8%
Santa Clara County	113,939	24.4%	78,578	16.3%	98,223	20.4%
San Mateo County	111,719	15.9%	77,125	10.7%	96,387	13.4%
Total Wholesale Customers	311,384	19.1%	214,825	12.9%	268,512	16.1%
San Francisco	89,867	11.8%	61,978	8.0%	77,472	10.0%
Total Area Served	401,251	16.8%	276,803	11.3%	345,984	14.2%

[a] Includes only those portions of each county served by SFPUC wholesale water customers or served directly by the SFPUC (San Francisco County). Population estimates for San Mateo County include updated figures for the Westborough Water District from the district's Urban Water Management Plan .

SOURCES: URS, 2004; Hannaford and Hydroconsult, 2004; Mundie & Associates, 2006; Westborough Water District, 2005.

These employment and population projections used in the water demand models indicate the type and amount of growth that is expected by wholesale customers and the SFPUC in the service area for which water will be required, and provide a basis for comparison with ABAG's current forecasts and other forecasts for the region.

Table E.3.3 compares the amount of growth expected between 2005 and 2025 to the amount that occurred between 1985 and 2005. This table provides an indication of whether future growth is expected to exceed past growth. It indicates that the percentage change in employment between 2005 and 2025 is expected to be smaller than the percentage change observed between 1985 and 2005, except in Santa Clara County and San Francisco County. Santa Clara County, which absorbed major employment losses during the "dot com bust" at the beginning of this decade, is estimated to have lost employment during the past 20 years. As a result, the percentage gain projected for the served portions of Santa Clara County during the next 20 years, although smaller than the percentage changes expected in the served portions of Alameda and San Mateo Counties, would represent a marked positive change from the experience of the past two decades. San Francisco, which was also affected by the dot com bust (but not as severely as Santa Clara County), showed modest employment growth during the past 20 years, but is expected to gain more jobs in the future.

TABLE E.3.3
POPULATION AND EMPLOYMENT PROJECTIONS FOR WATER DEMAND ESTIMATES: EXPECTED CHANGE COMPARED TO PAST CHANGE[a]

Area	1985-2005		2005-2025	
	#	%	#	%
Employment Change				
Alameda County	74,090	53.5%	66,990	26.6%
Santa Clara County	-18,770	-4.6%	92,843	17.9%
San Mateo County	54,770	21.5%	84,627	20.6%
Total Wholesale Customers	110,090	13.7%	244,462	20.7%
San Francisco	22,360	4.0%	114,020	17.4%
Total Area Served	132,450	9.7%	358,482	19.5%
Population Change				
Alameda County	116,100	32.4%	59,122	12.6%
Santa Clara County	74,600	19.2%	78,578	16.3%
San Mateo County	113,050	18.7%	77,125	10.7%
Total Wholesale Customers	303,750	22.5%	214,825	12.9%
San Francisco	79,500	11.1%	61,978	8.0%
Total Area Served	383,250	18.5%	276,803	11.3%

[a] Includes only those portions of each county served by SFPUC wholesale water customers or served directly by the SFPUC (San Francisco County). Population estimates for San Mateo County include updated figures for the Westborough Water District from the district's Urban Water Management Plan .

SOURCES: URS, 2004; Hannaford and Hydroconsult, 2004; ABAG, 2004; Mundie & Associates, 2006; Westborough Water District, 2005.

In the areas of San Mateo County served by SFPUC wholesale customers, the percentage increase in employment is expected to be slightly smaller during the forecast period than it was during the past two decades, but the numeric change is expected to be greater (by nearly 30,000 jobs, which would be about 55 percent more than were added during 1985-2005).

Table E.3.3 further indicates that, without exception, the percentage change in population during the next two decades is expected to be smaller than the percentage change during the past two, and that, except areas of Santa Clara County served by SFPUC water customers, the numeric change is expected to be smaller as well. (The number of residents added in this portion of Santa Clara County between 2005 and 2025 is projected to exceed the number added between 1985 and 2005 by about 4,000, or five percent.)

Projections of employment and population for each wholesale customer's service area are presented in **Table E.3.4**. This table parallels county Table E.3.1 in that it provides estimates of employment and population in 2001, 2005, 2025, and 2030.

Tables E.3.5 and **E.3.6** provide information parallel to that provided in county Table E.3.2, by calculating the numeric and percentage change in employment (Table E.3.5) and population (Table E.3.6) for each wholesale customer service area during 2001-30, 2005-2025, and 2005-30.

Comparisons of ABAG and Other Forecasts

Overview of ABAG Projections

As was noted on page E.3-2, many of the wholesale customers selected the employment and population growth projections prepared by the Association of Bay Area Governments (ABAG) for use in the water demand model to forecast 2030 water demand for their service areas.[1] ABAG generally updates its projections every other year. At the time the demand projections for this project were prepared, *Projections 2002* was the current set.

Comparing Water Customers' Projections to ABAG Projections

The SFPUC wholesale customers' projections are specific to the area served by the respective water districts, while ABAG provides projections for cities – both for the area within each city's corporate limits and, where cities abut unincorporated areas, for cities and their spheres of influence or planning areas. Because most water customers' service areas are not congruent with the boundaries of ABAG projection areas, the wholesale customers' projections of employment and population growth are not directly comparable to ABAG's projections of employment and population growth.

[1] The end-use demand model utilized published population and employment projections to forecast the growth in the number of applicable water accounts. Each wholesale customer selected the projections source to be used for its service area. The selected population and employment projections were input into the demand model and the growth rate from the selected projection was applied to the applicable accounts. The water demand model and the development of water demand projections is described in more detail in PEIR Appendix E.2 and in the wholesale and retail customer demand studies (URS, 2004; Hannaford and Hydroconsult, 2004).

TABLE E.3.4
EMPLOYMENT AND POPULATION PROJECTIONS FOR WATER DEMAND ESTIMATES: DETAIL FOR WATER CUSTOMERS

Customer	Employment				Population			
	2001	2005	2025	2030	2001	2005	2025	2030
Alameda County								
Alameda County Water District	151,092	160,853	209,657	221,858	316,523	325,269	368,999	379,931
Hayward	87,473	91,110	109,296	113,843	140,439	143,517	158,909	162,757
Santa Clara County								
Milpitas	53,566	56,678	72,239	76,129	62,756	66,354	84,344	88,841
Mountain View	75,629	78,393	92,214	95,669	71,160	72,610	79,858	81,670
Palo Alto	105,432	106,645	112,708	114,224	59,954	61,229	67,605	69,199
Purissima Hills Water District	420	425	451	457	6,032	6,133	6,637	6,763
San Jose (North)	2,500	2,618	3,206	3,353	11,098	11,455	13,240	13,686
Santa Clara	138,163	143,524	170,326	177,027	104,349	109,363	134,431	140,698
Stanford University	na	na	na	na	19,738	20,867	26,513	27,924
Sunnyvale	125,476	131,472	161,454	168,950	131,365	134,157	148,119	151,610
San Mateo County								
Brisbane	3,789	5,966	16,853	19,575	3,174	3,372	4,359	4,606
Burlingame	31,205	31,888	35,306	36,160	30,154	30,818	34,137	34,967
CWS – Bear Gulch District	42,899	43,571	46,933	47,774	66,197	67,235	72,422	73,719
CWS – Mid-Peninsula District	79,493	82,400	96,934	100,568	120,856	123,474	136,562	139,834
CWS – South San Francisco District	49,288	51,089	60,093	62,344	49,207	50,638	57,795	59,584
Coastside County Water District	5,402	5,594	6,555	6,795	18,319	19,237	23,826	24,973
Daly City	26,941	27,912	32,767	33,981	106,117	107,432	114,007	115,651
East Palo Alto	3,289	4,032	7,745	8,673	24,395	25,542	31,278	32,712
Estero MID	24,318	25,356	30,543	31,840	34,568	35,330	39,143	40,096
Guadalupe Valley MID	4,442	4,611	5,457	5,668	446	599	1,366	1,558
Hillsborough	1,216	1,239	1,352	1,380	11,618	11,768	12,520	12,708
Los Trancos County Water District[a]	na	na	na	na	740	789	1,033	1,094
Menlo Park	10,053	10,499	12,729	13,287	12,153	12,360	13,396	13,655
Mid-Peninsula Water District	14,705	15,742	20,925	22,221	26,443	26,657	27,729	27,997
Millbrae	6,664	6,850	7,777	8,009	21,460	21,972	24,534	25,174
North Coast County Water District	5,797	6,029	7,188	7,478	40,457	41,474	46,558	47,829
Redwood City	66,389	68,774	80,697	83,678	81,888	83,494	91,527	93,535
San Bruno	16,622	17,884	24,193	25,770	40,727	41,762	46,936	48,229
Skyline County Water District	224	224	224	224	1,210	1,413	2,429	2,683
Westborough Water District[b]	1,610	1,613	1,627	1,631	13,056	13,150	14,225	14,300
Total Wholesale Customers	**1,134,097**	**1,182,991**	**1,427,449**	**1,488,566**	**1,626,599**	**1,669,470**	**1,884,437**	**1,937,983**
San Francisco	**638,840**	**656,480**	**770,500**	**795,400**	**760,075**	**772,470**	**834,448**	**849,942**
Total Area Served	**1,772,937**	**1,839,471**	**2,197,949**	**2,283,966**	**2,386,674**	**2,441,940**	**2,718,885**	**2,787,925**

[a] Los Trancos County Water District was acquired by CWS in 2006, and is now part of the CWS – Bear Gulch District. Because it was a separate entity when these projections were prepared, it is presented separately in this analysis.

[b] Population estimates from Westborough Water District's 2005 Urban Water Management Plan.

SOURCES: URS, 2004; Hannaford and Hydroconsult, 2004; Mundie & Associates, 2006; Westborough Water District, 2005.

TABLE E.3.5
EMPLOYMENT PROJECTIONS FOR WATER DEMAND ESTIMATES:
EXPECTED CHANGE FOR WATER CUSTOMERS

	Employment Change					
	2001-2030		2005-2025		2005-2030	
Area	**#**	**%**	**#**	**%**	**#**	**%**
Alameda County						
Alameda County Water District	70,766	46.8%	48,804	30.3%	61,005	37.9%
Hayward	26,370	30.1%	18,186	20.0%	22,733	25.0%
Santa Clara County						
Milpitas	22,563	42.1%	15,561	27.5%	19,451	34.3%
Mountain View	20,040	26.5%	13,821	17.6%	17,276	22.0%
Palo Alto	8,792	8.3%	6,063	5.7%	7,579	7.1%
Purissima Hills Water District	37	8.8%	26	6.0%	32	7.5%
San Jose (North)	853	34.1%	588	22.5%	735	28.1%
Santa Clara	38,864	28.1%	26,802	18.7%	33,503	23.3%
Stanford University	na	na	na	na	na	na
Sunnyvale	43,474	34.6%	29,982	22.8%	37,478	28.5%
San Mateo County						
Brisbane	15,786	416.6%	10,887	182.5%	13,609	228.1%
Burlingame	4,955	15.9%	3,418	10.7%	4,272	13.4%
CWS – Bear Gulch District	4,875	11.4%	3,362	7.7%	4,203	9.6%
CWS – Mid-Peninsula District	21,075	26.5%	14,534	17.6%	18,168	22.0%
CWS – South San Francisco District	13,056	26.5%	9,004	17.6%	11,255	22.0%
Coastside County Water District	1,393	25.8%	961	17.2%	1,201	21.5%
Daly City	7,040	26.1%	4,855	17.4%	6,069	21.7%
East Palo Alto	5,384	163.7%	3,713	92.1%	4,641	115.1%
Estero MID	7,522	30.9%	5,187	20.5%	6,484	25.6%
Guadalupe Valley MID	1,226	27.6%	846	18.3%	1,057	22.9%
Hillsborough	164	13.5%	113	9.1%	141	11.4%
Los Trancos County Water District[b]	na	na	na	na	na	na
Menlo Park	3,234	32.2%	2,230	21.2%	2,788	26.6%
Mid-Peninsula Water District	7,516	51.1%	5,183	32.9%	6,479	41.2%
Millbrae	1,345	20.2%	927	13.5%	1,159	16.9%
North Coast County Water District	1,681	29.0%	1,159	19.2%	1,449	24.0%
Redwood City	17,289	26.0%	11,923	17.3%	14,904	21.7%
San Bruno	9,148	55.0%	6,309	35.3%	7,886	44.1%
Skyline County Water District	0	0.0%	0	0.0%	0	0.0%
Westborough Water District[b]	21	1.3%	14	0.9%	18	1.1%
Total Wholesale Customers	**354,469**	**31.3%**	**244,462**	**20.7%**	**305,577**	**25.8%**
San Francisco	**156,560**	**24.5%**	**114,020**	**17.4%**	**138,920**	**21.2%**
Total Area Served	**511,029**	**28.8%**	**358,482**	**19.5%**	**444,497**	**24.2%**

[a] Los Trancos County Water District was acquired by CWS in 2006, and is now part of the CWS – Bear Gulch District. Because it was a separate entity when these projections were prepared, it is presented separately in this analysis.

[b] Population estimates from Westborough Water District's 2005 Urban Water Management Plan.

SOURCES: URS, 2004; Hannaford and Hydroconsult, 2004; Mundie & Associates, 2006.

TABLE E.3.6
POPULATION PROJECTIONS FOR WATER DEMAND ESTIMATES:
EXPECTED CHANGE FOR WATER CUSTOMERS

	Population Change					
	2001-2030		2005-2025		2005-2030	
Area	**#**	**%**	**#**	**%**	**#**	**%**
Alameda County						
Alameda County Water District	63,408	20.0%	43,730	13.4%	54,662	16.8%
Hayward	22,318	15.9%	15,392	10.7%	19,240	13.4%
Santa Clara County						
Milpitas	26,085	41.6%	17,990	27.1%	22,487	33.9%
Mountain View	10,510	14.8%	7,248	10.0%	9,060	12.5%
Palo Alto	9,245	15.4%	6,376	10.4%	7,970	13.0%
Purissima Hills Water District	731	12.1%	504	8.2%	630	10.3%
San Jose	2,588	23.3%	1,785	15.6%	2,231	19.5%
Santa Clara	36,349	34.8%	25,068	22.9%	31,335	28.7%
Stanford University	8,186	41.5%	5,646	27.1%	7,057	33.8%
Sunnyvale	20,245	15.4%	13,962	10.4%	17,453	13.0%
San Mateo County						
Brisbane	1,432	45.1%	987	29.3%	1,234	36.6%
Burlingame	4,813	16.0%	3,319	10.8%	4,149	13.5%
CWS - Bear Gulch District	7,522	11.4%	5,187	7.7%	6,484	9.6%
CWS - Mid-Peninsula District	18,978	15.7%	13,088	10.6%	16,360	13.3%
CWS - South San Francisco District	10,377	21.1%	7,157	14.1%	8,946	17.7%
Coastside County Water District	6,654	36.3%	4,589	23.9%	5,736	29.8%
Daly City	9,534	9.0%	6,575	6.1%	8,219	7.7%
East Palo Alto	8,317	34.1%	5,736	22.5%	7,170	28.1%
Estero MID/Foster City	5,528	16.0%	3,813	10.8%	4,766	13.5%
Guadalupe Valley MID	1,112	249.3%	767	127.9%	959	159.9%
Hillsborough	1,090	9.4%	752	6.4%	940	8.0%
Los Trancos County Water District[a]	354	47.8%	244	30.9%	305	38.7%
Menlo Park	1,502	12.4%	1,036	8.4%	1,295	10.5%
Mid-Peninsula Water District	1,554	5.9%	1,072	4.0%	1,340	5.0%
Millbrae	3,714	17.3%	2,562	11.7%	3,202	14.6%
North Coast County Water District	7,372	18.2%	5,084	12.3%	6,355	15.3%
Redwood City	11,647	14.2%	8,033	9.6%	10,041	12.0%
San Bruno	7,502	18.4%	5,174	12.4%	6,467	15.5%
Skyline County Water District	1,473	121.7%	1,016	71.9%	1,270	89.9%
Westborough Water District	1,244	9.5%	1,075	8.2%	1,150	8.7%
Total	**311,384**	**19.1%**	**214,966**	**12.9%**	**268,513**	**16.1%**
San Francisco	**89,867**	**11.8%**	**61,978**	**8.0%**	**77,472**	**10.0%**
Total Area Served	**401,251**	**16.8%**	**276,944**	**11.3%**	**345,985**	**14.2%**

[a] Los Trancos County Water District was acquired by CWS in 2006, and is now part of the CWS – Bear Gulch District. Because it was a separate entity when these projections were prepared, it is presented separately in this analysis.

SOURCES: URS, 2004; Hannaford and Hydroconsult, 2004; Mundie & Associates, 2006; Westborough Water District, 2005.

To compare the changing expectation of growth in the SFPUC wholesale customer service area as depicted in the evolving sets of projections produced by ABAG, therefore, this analysis assigns wholesale customers to ABAG's projection units (typically cities or, where a city is bordered by unincorporated area, subregional study areas). As suggested above, this assignment is inexact: in some cases, only part of a city is served by a wholesale customer, or the wholesale customer serves an unincorporated area that could not be segregated from other unincorporated areas in the ABAG materials. **Tables E.3.A.1** and **E.3.A.2**, in Attachment E.3.A (at the end of this appendix)**,** detail the assumptions that were made to establish a correspondence between areas served by wholesale water customers and areas for which ABAG has prepared projections of employment and population, and the resulting correspondences between water customers and ABAG areas.

Most of the discussion that follows – describing ABAG's projections for employment and population growth in the nine-county Bay Area, the four counties that include the SFUC service area, and the portions of the four counties within the SFPUC service area – is based solely on the ABAG estimates of current and future conditions. It is only when the ABAG projections are compared to the water customers' projections (e.g., beginning with **Table E.3.33** and the related text), that the correspondence between water customer service areas and ABAG jurisdictions may introduce some distortion into the analysis, because of the inexact matches between the ABAG areas and the water service areas.

ABAG Projections: Evolution from *Projections 2002* to *Projections 2005*

ABAG, the regional planning agency in the Bay Area, provides long-term demographic and economic forecasts for the nine Bay Area counties. ABAG produces a biennial *Projections* series developed from a series of computer models. The projections are utilized by regional transportation and air quality agencies, local government, and private industry. As noted above, ABAG projections were selected by many of the wholesale customers as the basis for their growth and employment projections. In addition, because ABAG is the regional planning agency in the Bay Area, the ABAG projections in general provide a useful tool for assessing assumptions and forecasts made by other agencies regarding future trends in the area.

In 2003, ABAG revised the assumptions that provide the basis for its biennial (every two year) projections, to incorporate additional assumptions about future development in the Bay Area. To lay out how this change in underlying assumptions compares to the underlying assumptions at the time water demand projections were being prepared (and to compare the projections based on those assumptions), this appendix first presents a comprehensive comparison of the ABAG *Projections 2002* with *Projections 2003*, the first year incorporating the smart growth principles, and then presents a comprehensive comparison of *Projections 2003* and *Projections 2005*, ABAG's current projections set. This process provides a look at the evolution of ABAG's expectations for growth in the Bay Area and its constituent communities.

Changes in the Underlying Assumptions

Basis for Projections 2002

ABAG's projections have historically been based on a model that forecasts growth in the region in relation to national economic and demographic trends. In this model, projections of total employment growth in the nine-county Bay Area are based on expected growth of the national economy and the relative attractiveness of the Bay Area compared to other regions. This regional forecast provides a "control total," which is then distributed among subareas within the region The subareas are based primarily on municipal jurisdictions. [2]

The allocation of growth to subareas within the region has historically been based on existing patterns of economic activity and the availability of land for commercial, industrial, and residential development, and housing opportunities for employees. The distribution process begins with jobs: new economic activities are assumed to locate near existing similar or linked activities, and trends showing growth or decline are generally assumed to continue (although not necessarily at the same rate).

Residential (household and population) growth is projected for each county, based primarily on the "cohort-survival method" (births minus deaths), with additional assumptions about net migration. The migration assumptions are based on the relationship between predicted labor force-aged population and forecast employment: if a tight labor market is expected, then in-migration is assumed to occur. Assumptions about housing costs are also used, in recognition of the fact that housing prices outside the nine-county region may be more affordable than prices within the region.

The total population for each county is distributed to specific locations within the Bay Area (and beyond) based a series of variables including employment locations, housing opportunities and costs, education, and the cost of travel. The final forecasts are refined to recognize potential constraints on land availability. Land availability estimates are based on local land use policies and regulations, such as general plans and zoning codes.

Basis for Projections Beginning with Projections 2003

Beginning in 2003, ABAG added a new policy dimension to its regional forecasts, an overlay of "smart growth" principles. ABAG defines smart growth as:

> Development that reflects higher densities, mixed use, and a higher proportion of housing and employment growth in urban areas, particularly near transit stations and along transit corridors, as well as in town centers (ABAG, 2002).

[2] Subareas reported in the *Projections* series are "subregional study areas," which may be cities (when city limits coincide with a city's sphere of influence), city spheres of influence (considered to be each city's expected ultimate urban boundaries until modified), or "other subregional areas." ABAG also develops some projections (including population) for cities within jurisdictional boundaries (city limits). ABAG details its projections for areas as small as census tracts.

The smart growth policies have the following key impacts of the on the projections:

- Substitution of ABAG's smart growth policy-based assumptions about development potential for local land use policy assumptions. This substitution results in a geographic redistribution of development expectations. ABAG assumes that, over time – as general plans and zoning ordinances are updated – local policies will be modified to reflect smart growth principles.

- Rearrangement of the total expected growth in the region among jurisdictions, beginning in about 2010. The pattern of growth reflected in *Projections 2003* and *Projections 2005* is "mainly transit-oriented, and focuses development in urban core areas throughout the region." ABAG, the Metropolitan Transportation Commission (MTC), and the State of California are assumed to make funding recommendations and decisions linking transportation projects to the adoption and implementation of smart growth land use principles. ABAG recognizes, however, that "because of the time required to obtain incentives and make investments a reality, changes to land use patterns won't begin to occur until 2010" (ABAG, 2004).

- Increased housing production. *Projections 2003* (like its successor, *Projections 2005*) assumes that a combination of regulatory and policy changes, along with "partial government funding," will be needed "to spur an increase in overall housing production, and to channel housing toward infill sites". Specifically, the projections anticipate that the removal of barriers to infill development and an increase in (unspecified) government funds of $350 million per year will help to increase regional housing production by 5,000 units per year between 2010 and 2020, and by 7,500 units per year between 2020 and 2030.

Growth Expected by *Projections 2002* and *Projections 2003*

Projected Growth in the San Francisco Bay Area

Table E.3.7 establishes a framework for evaluating the evolution of the ABAG projections by comparing the employment projections for ABAG's entire nine-county area presented in ABAG's *Projections 2002* – the set on which most of the wholesale customer water demand projections are based – to employment projections for the nine counties in *Projections 2003*, the first set that uses the smart growth principles. This comparison illustrates the change in expectations for employment growth resulting from ABAG's shift to a smart growth policy-based projection. The table focuses on the change expected to occur between 2005 and 2025, which is the horizon year for *Projections 2002*.

TABLE E.3.7
ABAG *PROJECTIONS 2002* AND *PROJECTIONS 2003*:
EMPLOYMENT PROJECTIONS FOR THE NINE-COUNTY BAY AREA

Source of Projection	Jobs in 2005	Jobs in 2025	New Jobs, 2005-2025
Projections 2002	3,933,870	4,932,590	998,720
Projections 2003	3,848,870	4,982,800	1,133,930
% change	-2%	1%	14%

SOURCES: ABAG, 2001; ABAG, 2002.

This table shows that *Projections 2003* anticipates more employment growth within the Bay Area than did *Projections 2002*: the number of jobs is estimated to be lower in 2005, and to increase to a higher total in 2025. *Projections 2003* forecasts that the Bay Area will gain 135,210 more jobs between 2005 and 2025 than *Projections 2002* forecasts for this period; by 2025, the Bay Area is projected to have about 50,200 more jobs, according to *Projections 2003*. This adjustment in the employment projection reflects ABAG's increasing understanding of how many jobs were lost in the "dot com bust" recession in the early part of this decade, coupled with the ongoing assumption that the *Projections 2002* forecast of total employment in 2025 continued to represent a reasonable expectation for the future.

Table E.3.8 provides a similar comparison for population in the nine-county Bay Area. This table indicates that *Projections 2003* anticipates about 23 percent more population growth in the nine-county Bay Area between 2005 and 2025 than was anticipated in *Projections 2002*. This additional growth (234,100 more residents by 2025 in *Projections 2003*) is consistent with the increase in housing production forecasted in *Projections 2003* compared with *Projections 2002*, which would add 87,500 housing units between 2010 and 2025.

TABLE E.3.8
ABAG *PROJECTIONS 2002* AND *PROJECTIONS 2003*:
POPULATION PROJECTIONS FOR THE NINE-COUNTY BAY AREA

Source of Projection	Population in 2005	Population in 2025	Added Population, 2005-2025
Projections 2002	7,193,900	8,223,740	1,029,840
Projections 2003	7,193,900	8,457,800	1,263,900
% change	0%	3%	23%

SOURCES: ABAG, 2001; ABAG, 2002.

Projected Growth in the Four Water System Counties

The SFPUC water system delivers water to customers in four Bay Area counties: Alameda, Santa Clara, San Mateo, and San Francisco. The SFPUC system delivers water to 30 wholesale customers in the first three of these counties[3] and to retail customers in San Francisco.[4] (The four counties are considered here in their entirety; the following subsection considers the portion of the four-county area served within the service area of the SFPUC and its wholesale customers.)

[3] There are 27 wholesale customers, but California Water Service Company (CWS) serves three distinct subgroups—Bear Gulch District, Mid-Peninsula District, and South San Francisco District —which are tracked separately in the SFPUC reports. One former wholesale customer, the Los Trancos County Water District, which was purchased by CWS and is now part of the Bear Gulch District, is also tracked separately in most of the SFPUC reports. The 30 wholesale customer entities referenced here include the CWS districts and Los Trancos as distinct entities.

[4] The SFPUC also serves a few large retail customers in Alameda, San Mateo, and Tuolumne Counties, which project no change in water demand for 2030. This analysis focuses on projections of the wholesale customers and San Francisco.

To illuminate the differences between ABAG's *Projections 2002* and *Projections 2003* for the counties served by SFPUC water, **Tables E.3.9** and **E.3.10** compare employment and population projections in this four-county area. *Projections 2003* estimates that the four-county area had 81,000 fewer jobs in 2005 than did *Projections 2002*, but expects 20 percent (138,400) more jobs to be added between 2005 and 2025. By 2025, the number of jobs in the four-county area would be about two percent higher under *Projections 2003* than under *Projections 2002*.

TABLE E.3.9
ABAG *PROJECTIONS 2002* AND *PROJECTIONS 2003*:
EMPLOYMENT PROJECTIONS FOR THE FOCUSED FOUR-COUNTY AREA

Source of Projection	Jobs in 2005	Jobs in 2025	Added Jobs, 2005-2025
Projections 2002	2,989,370	3,682,510	693,140
Projections 2003	2,908,370	3,739,920	831,550
% change	-3%	2%	20%

SOURCES: ABAG, 2001; ABAG, 2002.

TABLE E.3.10
ABAG *PROJECTIONS 2002* AND *PROJECTIONS 2003*:
POPULATION PROJECTIONS FOR THE FOCUSED FOUR-COUNTY AREA

Source of Projection	Population in 2005	Population in 2025	Added Population, 2005-2025
Projections 2002	4,855,400	5,406,900	551,500
Projections 2003	4,855,400	5,695,800	840,400
% change	0%	5%	52%

SOURCES: ABAG, 2001; ABAG, 2002.

In combination with Table E.3.7, Table E.3.9 shows that:

- On a percentage basis, the four-county area accounts for greater employment losses as a result of the "dot com bust" than does the nine-county area as a whole. In the Bay Area as a whole (Table E.3.7), *Projections 2003* estimates *total* employment in 2005 that is about two percent lower than 2005 employment projected in *Projections 2002*; in the four-county area, the difference between these projections is three percent. Numerically, *Projections 2003* estimates that the nine Bay Area counties had 85,000 fewer jobs in 2005 than were forecasted in *Projections 2002*, and it estimates that the four-county area had 81,000 fewer jobs. In other words, the four-county area accounts for 95 percent of the nine-county employment adjustment for 2005 incorporated into *Projections 2003*.

- The increase in job *growth* in the four-county area anticipated by *Projections 2003* compared to *Projections 2002* – that is, about 138,400 more new jobs between 2005 and 2025 – is greater than the increase projected for the nine-county Bay Area as a whole (a

difference of about 135,200 new jobs between *Projections 2003* and *Projections 2002*). This difference means that, just as the four-county area experienced most of the job loss during the dot com bust, it would account for all of the added job growth during the ensuing recovery.

Together, the comparisons of projections for the nine-county Bay Area and the four-county area indicate that employment in the Bay Area is expected to be increasingly concentrated in the four counties in which SFPUC water customers are located.

Table E.3.10 provides similar comparisons for population in the four-county area. It shows that the estimates of population in 2005 are the same in the two sets of projections, but that *Projections 2003* anticipates 52 percent more growth (840,400 new residents compared to 551,500 million) than *Projections 2002*. By 2025, *Projections 2003* projects the four counties to have about 5 percent more residents than were forecasted in *Projections 2002*.

In combination with Table E.3.8, Table E.3.10 shows that:

- The difference between *Projections 2002* and *Projections 2003* in the expected *total* population in 2025 is greater for the four-county area (about 289,000 more residents in *Projections 2003* in 2025) than for the entire nine-county Bay Area (about 234,100 more residents forecasted in 2025).

- The difference between the two sets of projections in the expected population *growth* forecasted for the 20-year period is also greater in the four-county area (with nearly 289,000 more new residents forecasted in the four counties in *Projections 2003* than were forecasted in *Projections 2002*, compared to about 234,100 more new residents in the nine counties in *Projections 2003*). (The difference in the *change* is the same as the difference in the *total* (previous bullet) are the same because the starting point – that is, population in 2005 – is the same in *Projections 2003* and *Projections 2002*.)

Together, the comparisons of projections for the nine-county and four-county areas indicate an expectation that population growth in the Bay Area will increasingly be concentrated in the four counties in which SFPUC water customers are located.

Projected Growth in the Area Served by SFPUC Water Customers

Employment Growth

ABAG projections of employment growth in the portion of the four-county area served by SFPUC water are compared in **Table E.3.11**. This table indicates that, in general, more new jobs are forecasted for this area by *Projections 2003* than were forecasted by *Projections 2002*. Overall, according to *Projections 2003*, the area would add nearly 438,300 jobs during the 20-year period, representing a 25 percent gain compared to the 2005 employment base and about 20 percent more growth than was forecast in *Projections 2002*.

Table E.3.12 provides detail about the employment projections for the ABAG cities that are served by one or more SFPUC water customers.

TABLE E.3.11
ABAG *PROJECTIONS 2002* AND *PROJECTIONS 2003*:
EMPLOYMENT PROJECTIONS FOR THE AREA SERVED BY SFPUC WATER CUSTOMERS (WHOLESALE AND RETAIL)[a]

Area	Source of Projection	Jobs in 2005	Jobs in 2025	Change, 2005-2025	
				Number	Percent
Alameda County	Proj. 2002	248,720	316,270	67,550	27.2%
	Proj. 2003	248,720	325,440	76,720	30.8%
Santa Clara County	Proj. 2002	517,310	617,590	100,280	19.4%
	Proj. 2003	499,410	608,030	108,620	21.7%
San Mateo County	Proj. 2002	382,280	465,240	82,960	21.7%
	Proj. 2003	362,460	464,870	102,410	28.3%
Total Wholesale Customers	Proj. 2002	1,148,310	1,399,100	250,790	21.8%
	Proj. 2003	1,110,590	1,398,340	287,750	25.9%
San Francisco	Proj. 2002	656,480	770,500	114,020	17.4%
	Proj. 2003	635,480	786,020	150,540	23.7%
Total Customers	Proj. 2002	1,804,790	2,169,600	364,810	20.2%
	Proj. 2003	1,746,070	2,184,360	438,290	25.1%

[a] Includes only those portions of each county served by SFPUC wholesale water customers or served directly by the SFPUC (San Francisco County).

SOURCES: ABAG, 2001; ABAG, 2002.

Table E.3.13 sorts the individual jurisdictions within the service area (a single wholesale customer may serve several jurisdictions) according to whether greater (total) employment in 2025 is expected by *Projections 2003* or *Projections 2002*. The projections are generally similar: *Projections 2003* expects that about one-half (16) of the jurisdictions will have about the same number of jobs in 2025 as were anticipated in *Projections 2002* (i.e., the projection is within 5 percent of the figure in *Projections 2002*); eight jurisdictions will have more jobs in 2025; and seven will have fewer jobs.

Table E.3.14 sorts the individual jurisdictions according to which set of projections anticipates a greater *increase* in the number of jobs between 2005 and 2025. This table differs from Table E.3.13 in that it shows the *change* in jobs during the 20-year period rather than the *total* number of jobs at the end of the period. As shown in the table, *Projections 2003* anticipates greater employment growth in 19 of the jurisdictions, about the same amount in 3,[5] and less growth in 10.

Combining the information from Tables E.3.13 and E.3.14 indicates that most of the jurisdictions in which more growth is anticipated during the next 20 years (from Table E.3.14) would be, in large part, regaining jobs lost at the beginning of this decade (reflected in a reduced ABAG estimate of employment in 2005).

[5] In all of the comparison tables, "about the same" means "within five percent."

TABLE E.3.12
ABAG *PROJECTIONS 2002* AND *PROJECTIONS 2003*:
EMPLOYMENT PROJECTIONS FOR CITIES WITHIN THE SFPUC SERVICE AREA
(WHOLESALE AND RETAIL)[a]

	Projections 2002				Projections 2003			
			Change, 2005-2025				Change, 2005-2025	
ABAG Jurisdiction	2005	2025	#	%	2005	2025	#	%
Alameda County								
Fremont[b]	115,700	146,520	30,820	26.6%	115,700	154,740	39,040	33.7%
Hayward	92,060	109,850	17,790	19.3%	92,060	109,760	17,700	19.2%
Newark[b]	19,480	26,630	7,150	36.7%	19,480	22,720	3,240	16.6%
Union City[b]	21,480	33,270	11,790	54.9%	21,480	38,220	16,740	77.9%
Santa Clara County								
Milpitas	53,310	69,540	16,230	30.4%	49,770	68,440	18,670	37.5%
Mountain View	78,710	94,370	15,660	19.9%	82,410	102,840	20,430	24.8%
Los Altos Hills[c]	2,730	2,890	160	5.9%	2,720	2,790	70	2.6%
Palo Alto[d]	112,520	119,040	6,520	5.8%	110,620	119,600	8,980	8.1%
Santa Clara	140,820	170,260	29,440	20.9%	135140	166,710	31,570	23.4%
Sunnyvale	129,220	161,490	32,270	25.0%	118,750	147,650	28,900	24.3%
San Mateo County								
Atherton[f]	3,600	4,040	440	12.2%	3,470	4,450	980	28.2%
Belmont[g]	15,380	19,500	4,120	26.8%	14,410	18,710	4,300	29.8%
Brisbane	8,800	15,820	7,020	79.8%	8130	16,580	8,450	103.9%
Burlingame	29,780	32,590	2,810	9.4%	28640	32,980	4,340	15.2%
Colma[h]	2,640	3,270	630	23.9%	2,530	3,610	1,080	42.7%
Daly City	26,250	30,840	4,590	17.5%	25,230	34,110	8,880	35.2%
East Palo Alto	3,730	8,540	4,810	129.0%	3450	5,920	2,470	71.6%
Foster City[i]	21,130	25,580	4,450	21.1%	20,330	24,120	3,790	18.6%
Half Moon Bay[j]	5,220	6,140	920	17.6%	5,010	5,720	710	14.2%
Hillsborough	1,240	1,360	120	9.7%	1,210	1,280	70	5.8%
Menlo Park[k]	31,140	38,580	7,440	23.9%	30,310	37,050	6,740	22.2%
Millbrae	6,210	7,200	990	15.9%	6,060	8,520	2,460	40.6%
Pacifica[l]	4,960	6,000	1,040	21.0%	4,770	5,970	1,200	25.2%
Portola Valley[f]	1,140	1,160	20	1.8%	1,130	1,140	10	0.9%
Woodside[f]	2,050	2,100	50	2.4%	2,050	2,060	10	0.5%
Redwood City[m]	65,020	77,650	12,630	19.4%	56,740	70,660	13,920	24.5%
San Bruno	16,680	22,880	6,200	37.2%	16,390	26,890	10,500	64.1%
San Carlos[n]	17,880	21,070	3,190	17.8%	17,430	22,080	4,650	26.7%
San Mateo[n]	64,060	75,490	11,430	17.8%	61,600	79,400	17,800	28.9%
South San Francisco[o]	55,370	65,430	10,060	18.2%	53,570	63,620	10,050	18.8%
Total Wholesale Customers	1,148,310	1,399,100	250,790	21.8%	1,118,590	1,395,340	287,750	25.9%
San Francisco	656,480	770,500	114,020	17.4%	635,480	786,020	150,540	23.7%
Total Area Served	1,804,790	2,169,600	364,810	20.2%	1,746,070	2,184,360	438,290	25.1%

a No separate projections for Guadalupe MID (part of Brisbane), Skyline County Water District (serves part of Woodside), Westborough Water District (serves part of South San Francisco), Stanford University (included by ABAG in the projections for Palo Alto), or San Jose (serves only a small portion of the city). Totals differ slightly from those shown in Table E.3.11 because the ABAG jurisdictions for which employment projections are reported in this table differ in geography from the water customer areas (see Tables E.3.A.1 and E.3.A.2).
b Fremont, Newark, and Union City are served by the Alameda County Water District.
c Los Altos Hills is served by the Purissima Hills Water District.
d Palo Alto projections include Stanford University
e This footnote deleted.
f Atherton, Portola Valley, and part of Woodside are served by CWS - Bear Gulch District. All of Portola Valley (including the portion previously served by Los Trancos County Water District, which is now a part of CWS) and Woodside are included in these projections.
g Belmont is served by the Mid-Peninsula Water District, which also serves parts of San Carlos.
h Colma is served by CWS - South San Francisco District
i Foster City is served by Estero MID, which also serves a portion of San Mateo. The projections for San Mateo are included in the projections for CWS - Mid-Peninsula District.
j Half Moon Bay and the adjacent unincorporated area (included in these figures) are served by the Coastside County Water District.
k The City of Menlo Park Water Agency serves only a portion of the City of Menlo Park (less than half of the city's population). These figures are for the entire city.
l Pacifica is served by the North Coast County Water District.
m Redwood City Water Agency also serves portions of San Carlos and Woodside.
n Parts of San Carlos and San Mateo are served by CWS - Mid Peninsula District. Both cities are included here in their entirety.
o South San Francisco is served by CWS - South San Francisco District + Westborough Water District.

SOURCE: ABAG, 2001; ABAG, 2002.

TABLE E.3.13
ABAG *PROJECTIONS 2002* AND *PROJECTIONS 2003*: TOTAL JOBS IN 2025

***Projections 2003* Forecast is Greater than *Projections 2002* Forecast**			***Projections 2003* Forecast is About the Same as *Projections 2002* Forecast[a]**			***Projections 2003* Forecast is Less than *Projections 2002* Forecast**		
Jurisdiction	**Jobs in 2025[b]**	**Proj. 2002 Jobs as % of Proj. 2003 Jobs**	**Jurisdiction**	**Jobs in 2025[b]**	**Proj. 2002 Jobs as % of Proj. 2003 Jobs**	**Jurisdiction**	**Jobs in 2025[b]**	**Proj. 2002 Jobs as % of Proj. 2003 Jobs**
Alameda County								
Union City	38,220	87.0%	Hayward	109,760	100.1%	Newark	22,720	117.2%
Fremont	154,740	94.7%						
Santa Clara County[d]								
Mountain View	102,840	91.8%	Palo Alto	119,600	99.5%	Sunnyvale	147,650	109.4%
			Milpitas	68,440	101.6%			
			Santa Clara	166,710	102.1%			
			Los Altos Hills	2,790	103.6%			
San Mateo County								
Millbrae	8,520	84.5%	San Mateo	79,400	95.1%	Foster City	24,120	106.1%
San Bruno	26,890	85.1%	Brisbane	16,580	95.4%	Hillsborough	1,280	106.3%
						Half Moon Bay[d]	5,720	107.3%
Daly City	34,110	90.4%	San Carlos	22,080	95.4%			
						Redwood City	70,660	109.9%
Colma	3,610	90.6%						
Atherton	4,450	90.8%	Burlingame	32,980	98.8%	East Palo Alto	5,920	144.3%
			Pacifica	5,970	100.5%			
			Portola Valley	1,140	101.8%			
			Woodside	2,060	101.9%			
			South San Francisco	63,620	102.8%			
			Menlo Park	37,050	104.1%			
			Belmont	18,710	104.2%			
San Francisco County								
			San Francisco	786,020	98.0%			

[a] Number of jobs in 2025 in *Projections 2003* is within five percent of the number of jobs in 2025 in *Projections 2002*.
[b] Number of jobs in 2025 forecast in *Projections 2003*.
[c] Stanford University is included within the City of Palo Alto in the ABAG projections. Only a small portion of the City of San Jose is within the district that obtains water from the SFPUC. It is considered misleading to include figures for all of San Jose in this analysis.
[d] Half Moon Bay plus Half Moon Bay (unincorporated).

SOURCES: ABAG, 2001; ABAG, 2002.

TABLE E.3.14
ABAG *PROJECTIONS 2002* AND *PROJECTIONS 2003*: CHANGE IN NUMBER OF JOBS, 2005-2025

***Projections 2003* Forecast is Greater than *Projections 2002* Forecast**			***Projections 2003* Forecast is About the Same as *Projections 2002* Forecast[a]**			***Projections 2003* Forecast is Less than *Projections 2002* Forecast**		
Jurisdiction	**Change in Jobs, 2005-2025[b]**	**Proj. 2002 Change in Jobs as % of Proj. 2003 Change in Jobs**	**Jurisdiction**	**Change in Jobs, 2005-2025[b]**	**Proj. 2002 Change in Jobs as % of Proj. 2003 Change in Jobs**	**Jurisdiction**	**Change in Jobs, 2005-2025[b]**	**Proj. 2002 Change in Jobs as % of Proj. 2003 Change in Jobs**
Alameda County								
Union City	16,740	70.4%	Hayward	17,700	100.5%	Newark	3,240	220.7%
Fremont	39,040	78.9%						
Santa Clara County[c]								
Palo Alto	8,980	72.6%				Sunnyvale	28,900	111.7%
Mountain View	20,430	76.7%				Los Altos Hills	70	228.6%
Milpitas	18,670	86.9%						
Santa Clara	31,570	93.3%						
San Mateo County								
Millbrae	2,460	40.2%	Belmont	4,300	95.8%	Menlo Park	6,740	110.4%
Atherton	980	44.9%	South San Francisco	10,050	100.1%	Foster City	3,790	117.4%
Daly City	8,880	51.7%				Half Moon Bay[d]	710	129.6%
Colma	1,080	58.3%				Hillsborough	70	171.4%
San Bruno	10,500	59.0%				East Palo Alto	2,470	194.7%
San Mateo	17,800	64.2%				Portola Valley	10	200.0%
Burlingame	4,340	64.7%				Woodside	10	500.0%
San Carlos	4,650	68.6%						
Brisbane	8,450	83.1%						
Pacifica	1,200	86.7%						
Redwood City	13,920	90.7%						
San Francisco County								
San Francisco	150,540	75.7%						

[a] Number of jobs added between 2005 and 2025 in *Projections 2003* is within five percent of the number of jobs added between 2005 and 2025 in *Projections 2002*.
[b] Number of jobs added between 2005 and 2025 in *Projections 2003*.
[c] Stanford University is included within the City of Palo Alto in the ABAG projections. Only a small portion of the City of San Jose is within the district that obtains water from the SFPUC. It is considered misleading to include figures for all of San Jose in this analysis.
[d] Half Moon Bay plus Half Moon Bay (unincorporated).

SOURCES: ABAG, 2001; ABAG, 2002.

Population Growth

Table E.3.15 compares expectations of population growth between 2005 and 2025 in the portion of the four-county area served by SFPUC water. This table indicates that *Projections 2003* expects nearly 137,000 more residents in the part of the four-county area served by SFPUC and its wholesale customers than did *Projections 2002*. This expectation represents overall growth of 350,420 residents, or about 66 percent more new residents than the 211,600 forecast by earlier set of projections.

TABLE E.3.15
ABAG *PROJECTIONS 2002* AND *PROJECTIONS 2003*:
POPULATION PROJECTIONS FOR THE AREA SERVED BY SFPUC WATER CUSTOMERS
(WHOLESALE AND RETAIL)[a]

Area	Source of Projection	Population in 2005	Population in 2025	Change, 2005-2025	
				Number	Percent
Alameda County	Proj 2002	482,700	532,500	49,800	10.32%
	Proj 2003	481,100	552,500	71,400	14.84%
Santa Clara County	Proj 2002	473,100	545,300	72,200	15.26%
	Proj 2003	472,700	560,800	88,100	18.64%
San Mateo County	Proj 2002	727,000	800,000	73,000	10.04%
	Proj 2003	726,990	826,710	99,720	13.72%
Total Wholesale Customers	Proj 2002	1,682,800	1,877,800	195,000	11.59%
	Proj 2003	1,680,790	1,940,010	259,220	15.42%
San Francisco	Proj 2002	798,600	815,200	16,600	2.08%
	Proj 2003	798,600	889,800	91,200	11.42%
Total Customers	Proj 2002	2,481,400	2,693,000	211,600	8.53%
	Proj 2003	2,479,390	2,829,810	350,420	14.13%

[a] Includes only those portions of each county served by SFPUC wholesale water customers or served directly by the SFPUC (San Francisco County).

SOURCES: ABAG, 2001; ABAG, 2002.

Table E.3.16 provides detail about the population projections for the ABAG cities that are served by one or more SFPUC water customers.

Table E.3.17 sorts the jurisdictions served by SFPUC water according to whether greater *total* population in 2025 is expected by *Projections 2003* or *Projections 2002*. Slightly more than one-half of the jurisdictions (18 of 31) are expected to have about the same number of residents in 2025 (within 5 percent) in both sets of projections. In this case, however, most of the remaining jurisdictions (11 of 13) are expected by *Projections 2003* to have more residents in 2025, and only 2 are expected to have fewer residents.

Table E.3.18 sorts the jurisdictions according to whether greater *change* in population is expected by *Projections 2003* or *Projections 2002* in the jurisdictions served by SFPUC water. This table indicates that the same 18 jurisdictions that are expected to have greater population *growth* during the coming two decades under *Projections 2003* also are expected to have greater *total* population at the end of the 20-year period (as shown in Table E.3.17 [i.e., jurisdictions where the *Projections 2002* population as a percent of *Projections 2003* population is less than 1.00 percent]). Of the remaining 14 jurisdictions, however, 11 are expected to have less population growth with *Projections 2003* than with *Projections 2002*. Most of these 11 jurisdictions are relatively small: the population growth anticipated for these communities by *Projections 2003* ranges from 400 to 3,500 new residents over the 20-year period (except in Newark, where 6,400 new residents are expected).

TABLE E.3.16
ABAG *PROJECTIONS 2002* AND *PROJECTIONS 2003*:
POPULATION PROJECTIONS FOR THE AREA SERVED BY SFPUC WATER CUSTOMERS
(WHOLESALE AND RETAIL)[a]

	Projections 2002				Projections 2003			
			Change, 2005-2025				Change, 2005-2025	
ABAG Jurisdiction	2005	2025	#	%	2005	2025	#	%
Alameda County								
Fremont[b]	214,600	233,200	18,600	8.7%	214,600	245,500	30,900	14.4%
Hayward	148,800	161,200	12,400	8.3%	147,600	164,200	16,600	11.2%
Newark[b]	45,400	53,400	8,000	17.6%	45,300	51,700	6,400	14.1%
Union City[b]	73,900	84,700	10,800	14.6%	73,600	91,100	17,500	23.8%
Santa Clara County								
Milpitas	68,400	86,300	17,900	26.2%	68,700	89,300	20,600	30.0%
Mountain View	73,300	80,900	7,600	10.4%	73,200	85,700	12,500	17.1%
Los Altos Hills[c]	10,000	10,500	500	5.0%	9,800	10,200	400	4.1%
Palo Alto[d]	75,800	82,800	7,000	9.2%	74,500	85,100	10,600	14.2%
Santa Clara	108,600	134,000	25,400	23.4%	108,600	133,100	24,500	22.6%
Sunnyvale	137,000	150,800	13,800	10.1%	137,900	157,400	19,500	14.1%
San Mateo County								
Atherton[f]	7,300	8,000	700	9.6%	7,400	8,000	600	8.1%
Belmont[g]	25,900	28,200	2,300	8.9%	25,800	28,300	2,500	9.7%
Brisbane	3,870	5,480	1,610	41.6%	3,770	4,940	1,170	31.0%
Burlingame	30,300	33,600	3,300	10.9%	30,000	32,300	2,300	7.7%
Colma[h]	1,330	1,620	290	21.8%	1,320	1,870	550	41.7%
Daly City	111,300	118,400	7,100	6.4%	112,000	125,300	13,300	11.9%
East Palo Alto	31,500	38,200	6,700	21.3%	32,200	43,100	10,900	33.9%
Foster City[i]	29,900	33,000	3,100	10.4%	30,100	31,900	1,800	6.0%
Half Moon Bay[j]	24,500	29,800	5,300	21.6%	24,200	27,700	3,500	14.5%
Hillsborough	11,100	11,800	700	6.3%	11,100	11,700	600	5.4%
Menlo Park[k]	36,100	39,100	3,000	8.3%	36,300	41,200	4,900	13.5%
Millbrae	21,400	23,100	1,700	7.9%	21,500	22,600	1,100	5.1%
Pacifica[l]	40,000	44,300	4,300	10.8%	40,200	42,600	2,400	6.0%
Portola Valley[f]	7,300	7,900	600	8.2%	7,100	7,700	600	8.5%
Redwood City[m]	103,100	112,600	9,500	9.2%	102,100	119,500	17,400	17.0%
San Bruno	41,200	44,700	3,500	8.5%	40,800	47,900	7,100	17.4%
San Carlos[n]	29,600	31,200	1,600	5.4%	29,800	33,300	3,500	11.7%
San Mateo[n]	101,900	113,100	11,200	11.0%	102,100	117,100	15,000	14.7%
South San Francisco[o]	62,800	68,700	5,900	9.4%	62,500	72,600	10,100	16.2%
Woodside[f]	6,600	7,200	600	9.1%	6,700	7,100	400	6.0%
Total Wholesale Customers	1,682,800	1,877,800	195,000	11.6%	1,680,790	1,940,010	259,220	15.4%
San Francisco	798,600	815,200	16,600	2.1%	798,600	889,800	91,200	11.4%
Total Area Served	2,481,400	2,693,000	211,600	8.5%	2,479,390	2,829,810	350,420	14.1%

a No separate projections for Guadalupe MID (part of Brisbane), Skyline County Water District (serves part of Woodside), Westborough Water District (serves part of South San Francisco), Stanford University (included by ABAG in the projections for Palo Alto), or San Jose (serves only a small portion of the city). Totals differ slightly from those shown in Table E.3.15 because the ABAG jurisdictions for which employment projections are reported in this table differ in geography from the water customer areas (see Tables E.3.A.1 and E.3.A.2).

b Fremont, Newark, and Union City are served by the Alameda County Water District.

c Los Altos Hills is served by the Purissima Hills Water District.

d Palo Alto projections include Stanford University

e This footnote deleted.

f Atherton, Portola Valley, and part of Woodside are served by CWS - Bear Gulch District. All of Portola Valley (including the portion previously served by Los Trancos County Water District, which is now a part of CWS) and Woodside are included in these projections.

g Belmont is served by the Mid-Peninsula Water District, which also serves parts of San Carlos.

h Colma is served by CWS - South San Francisco District

i Foster City is served by Estero MID, which also serves a portion of San Mateo. The projections for San Mateo are included in the projections for CWS - Mid-Peninsula District.

j Half Moon Bay and the adjacent unincorporated area (included in these figures) are served by the Coastside County Water District.

k The City of Menlo Park Water Agency serves only a portion of the City of Menlo Park (less than half of the city's population). These figures are for the entire city.

l Pacifica is served by the North Coast County Water District.

m Redwood City Water Agency also serves portions of San Carlos and Woodside.

n Parts of San Carlos and San Mateo are served by CWS - Mid Peninsula District. Both cities are included here in their entirety.

o South San Francisco is served by CWS - South San Francisco District + Westborough Water District.

SOURCE: ABAG, 2001; ABAG, 2002.

TABLE E.3.17
ABAG *PROJECTIONS 2002* AND *PROJECTIONS 2003*: TOTAL POPULATION IN 2025

***Projections 2003* Forecast is Greater than *Projections 2002* Forecast**			***Projections 2003* Forecast is About the Same as *Projections 2002* Forecast[a]**			***Projections 2003* Forecast is Less than *Projections 2002* Forecast**		
Jurisdiction	**Population in 2025[b]**	**Proj. 2002 Pop. as % of Proj. 2003 Pop.**	**Jurisdiction**	**Population in 2025[b]**	**Proj. 2002 Pop. as % of Proj. 2003 Pop.**	**Jurisdiction**	**Population in 2025[b]**	**Proj. 2002 Pop. as % of Proj. 2003 Pop.**
Alameda County								
Union City	91,100	93.0%	Fremont	245,500	95.0%			
			Hayward	164,200	98.2%			
			Newark	51,700	103.3%			
Santa Clara County[c]								
Mountain View	85,700	94.4%	Sunnyvale	157,400	95.8%			
			Milpitas	89,300	96.6%			
			Palo Alto	85,100	97.3%			
			Santa Clara	133,100	100.7%			
			Los Altos Hills	10,200	102.9%			
San Mateo County								
Colma	1,870	86.6%	San Mateo	117,100	96.6%	Half Moon Bay	27,700	107.6%
East Palo Alto	43,100	88.6%	Belmont	28,300	99.6%			
San Bruno	47,900	93.3%	Atherton	8,000	100.0%	Brisbane	4,940	110.9%
San Carlos	33,300	93.7%	Hillsborough	11,700	100.9%			
Redwood City	119,500	94.2%	Woodside	7,100	101.4%			
Daly City	125,300	94.5%	Millbrae	22,600	102.2%			
South San Francisco	72,600	94.6%	Portola Valley	7,700	102.6%			
Menlo Park	41,200	94.9%	Foster City	31,900	103.4%			
			Pacifica	42,600	104.0%			
			Burlingame	32,300	104.0%			
San Francisco County								
San Francisco	889,800	91.6%						

[a] Population in 2025 in *Projections 2003* is within five percent of the population in 2025 in *Projections 2002*.
[b] Population in 2025 forecast in *Projections 2003*.
[c] Stanford University is included within the City of Palo Alto in the ABAG projections. Only a small portion of the City of San Jose is within the district that obtains water from the SFPUC. It is considered misleading to include figures for all of San Jose in this analysis.
[d] Half Moon Bay plus Half Moon Bay (unincorporated).

SOURCES: ABAG, 2001; ABAG, 2002.

Growth Expected by *Projections 2003* and *Projections 2005*

Projected Growth in the San Francisco Bay Area

ABAG's current set of projections, *Projections 2005*, continues to assume that Bay Area growth will begin to reflect "smart growth" principles beginning in about 2010. Accordingly, *Projections 2005* relies on the same assumptions about increased housing production introduced in *Projections 2003*. *Projections 2005* differs from *Projections 2003*, however, in that it readjusts employment and population estimates for 2005 to reflect improved information about the number of jobs lost in the dot com bust of the early part of this decade and improved estimates of the 2005 population.

TABLE E.3.18
ABAG *PROJECTIONS 2002* AND *PROJECTIONS 2003*: CHANGE IN POPULATION, 2005-2025

***Projections 2003* Forecast is Greater than *Projections 2002* Forecast**			***Projections 2003* Forecast is About the Same as *Projections 2002* Forecast[a]**			***Projections 2003* Forecast is Less than *Projections 2002* Forecast**		
Jurisdiction	**Change in Population, 2005-2025[b]**	**Proj. 2002 Change in Pop. as % of Proj. 2003 Change in Pop.**	**Jurisdiction**	**Change in Population, 2005-2025[b]**	**Proj. 2002 Change in Pop. as % of Proj. 2003 Change in Pop.**	**Jurisdiction**	**Change in Population, 2005-2025[b]**	**Proj. 2002 Change in Pop. as % of Proj. 2003 Change in Pop.**
Alameda County								
Fremont	30,900	60.2%				Newark	6,400	125.0%
Union City	17,500	61.7%						
Hayward	16,600	74.7%						
Santa Clara County[c]								
Mountain View	12,500	60.8%	Santa Clara	24,500	103.7%	Los Altos Hills	400	125.0%
Palo Alto	10,600	66.0%						
Sunnyvale	19,500	70.8%						
Milpitas	20,600	86.9%						
San Mateo County								
San Carlos	3,500	45.7%	Portola Valley	600	100.0%	Atherton	600	116.7%
San Bruno	7,100	49.3%				Hillsborough	600	116.7%
Colma	550	52.7%				Brisbane	1,170	137.6%
Daly City	13,300	53.4%				Burlingame	2,300	143.5%
Redwood City	17,400	54.6%				Woodside	400	150.0%
South San Francisco	10,100	58.4%				Half Moon Bay[d]	3,500	151.4%
Menlo Park	4,900	61.2%				Millbrae	1,100	154.5%
East Palo Alto	10,900	61.5%				Foster City	1,800	172.2%
San Mateo	15,000	74.7%				Pacifica	2,400	179.2%
Belmont	2,500	92.0%						
San Francisco County								
San Francisco	91,200	18.2%						

[a] Population added between 2005 and 2025 in *Projections 2003* is within five percent of the population added between 2005 and 2025 in *Projections 2002*.
[b] Population added between 2005 and 2025 in *Projections 2003*.
[c] Stanford University is included within the City of Palo Alto in the ABAG projections. Only a small portion of the City of San Jose is within the district that obtains water from the SFPUC. It is considered misleading to include figures for all of San Jose in this analysis.
[d] Half Moon Bay plus Half Moon Bay (unincorporated).

SOURCES: ABAG, 2001; ABAG, 2002.

Table E.3.19 compares estimates of employment in 2005, and projections of employment in 2025, from *Projections 2003* and *Projections 2005* for the nine-county Bay Area. This comparison shows a reduction in the estimate of total jobs in 2005 from about 3.8 million to about 3.5 million, an adjustment of nine percent. *Projections 2005* forecasts nearly 4.8 million jobs in 2025, down from the 5.0 million anticipated by *Projections 2003*. This future total reflects an expectation of stronger employment growth (more new jobs), but even the addition of 12 percent more jobs than were anticipated in *Projections 2003* is not sufficient to achieve the same number of jobs anticipated by that set of forecasts, given the smaller employment base estimated for 2005 in *Projections 2005*.

TABLE E.3.19
ABAG *PROJECTIONS 2003* AND *PROJECTIONS 2005*:
EMPLOYMENT PROJECTIONS FOR THE NINE-COUNTY BAY AREA

Source of Projection	Jobs in 2005	Jobs in 2025	Jobs in 2030	New Jobs, 2005-2025	New Jobs, 2005-2030
Projections 2003	3,848,870	4,982,800	5,226,400	1,133,930	1,377,530
Projections 2005	3,516,960	4,788,330	5,120,600	1,271,370	1,603,640
% change	-9%	-4%	-2%	12%	16%

SOURCES: ABAG, 2001; ABAG, 2002

Because both *Projections 2003* and *Projections 2005* extend the forecasts through 2030, that year is also included in this table. By 2030, *Projections 2005* anticipates that total employment in the nine-county Bay Area will reach 5.1 million jobs, which is within 2 percent of the *Projections 2003* forecast of 5.2 million. This total reflects the expected addition of 1.6 million new jobs during the 25-year interval from 2005, or about 16 percent more than the 1.4 million anticipated in *Projections 2003*.

Table E.3.20 provides the same comparison for population. It shows that the two sets of ABAG forecasts – *Projections 2003* and *Projections 2005* – maintain similar estimates of population in the nine Bay Area counties in 2005, and similar projections of population in the nine-county area in 2025. The projections for 2025 (8.42 million in *Projections 2005*; 8.46 million in *Projections 2003*) are within 0.5 percent of each other.

TABLE E.3.20
ABAG *PROJECTIONS 2003* AND *PROJECTIONS 2005*:
POPULATION PROJECTIONS FOR THE NINE-COUNTY BAY AREA

Source of Projection	Population in 2005	Population in 2025	Population in 2030	Added Population, 2005-2025	Added Population, 2005-2030
Projections 2003	7,193,900	8,457,800	8,780,300	1,263,900	1,586,400
Projections 2005	7,091,700	8,419,100	8,747,100	1,327,400	1,655,400
% Change	-1%	0%	0%	5%	4%

SOURCES: ABAG, 2002; ABAG, 2004.

By 2030, both sets of projections anticipate that the population of the Bay Area will exceed 8.7 million, or about 1.6 million more than in 2005. The projections for that year are also within 0.5 percent of each other.

Projected Growth in the Four Water System Counties

Table E.3.21 focuses the comparison of employment anticipated in *Projections 2003* and *Projection 2005* on the four counties in which the SFPUC system provides water. (The four counties are considered here in their entirety; the following subsection considers the portion of the four-county area within the service area of the SFPUC and its wholesale customers.) This comparison indicates a downward adjustment of the job base in 2005 by about 345,000 jobs, or 12 percent (compared to a downward adjustment of 332,000, or 9 percent, for the nine-county area). This adjustment provides further indication that most of the Bay Area job losses early in this decade were in these four counties.

TABLE E.3.21
ABAG *PROJECTIONS 2003* AND *PROJECTIONS 2005*:
EMPLOYMENT PROJECTIONS FOR THE FOCUSED FOUR-COUNTY AREA

Source of Projection	Jobs in 2005	Jobs in 2025	Jobs in 2030	New Jobs, 2005-2025	New Jobs, 2005-2030
Projections 2003	2,908,370	3,739,920	3,911,320	831,550	1,002,950
Projections 2005	2,563,600	3,516,890	3,765,020	953,290	1,201,420
% Change	-12%	-6%	-4%	15%	20%

SOURCES: ABAG, 2002; ABAG, 2004.

Table E.3.21 shows that *Projections 2005* anticipates that the four-county area will gain more employment between 2005 and 2025, and between 2005 and 2030, than did *Projections 2003*. The total numbers of jobs projected in 2025 and 2030 are, however, smaller in *Projections 2005*, as the expected growth in employment is insufficient to compensate for the reduction in 2005 employment (based on more recent, and, presumably, more accurate, information about current employment) incorporated into the forecasts.

Table E.3.22 provides the comparison *of Projections 2003* and *Projections 2005* in the four counties for population projections. This table also shows a small downward adjustment in the estimate for 2005 compared to *Projections 2003*; however, this adjustment is minor (about one percent of total population in the four-county area). *Projections 2005* anticipates more population growth in the four-county area than does *Projections 2003,* and a similar total population projected in the horizon years of 2025 and 2030 (within 0.5 percent of the total forecast in *Projections 2003*).

Projected Growth in the Area Served by SFPUC Water Customers

Employment Growth

Employment growth anticipated in the area served by SFPUC water customers by *Projections 2003* and *Projections 2005* is compared in **Table E.3.23**. This table shows that employment growth in three of the four counties is expected to follow the pattern observed in the nine-county area: *Projections 2005* anticipates greater employment growth between 2005 and 2025, and between 2005 and 2030, than does *Projections 2003*, but, because of the lower estimate of

TABLE E.3.22
ABAG *PROJECTIONS 2003* AND *PROJECTIONS 2005*:
POPULATION PROJECTIONS FOR THE FOCUSED FOUR-COUNTY AREA

Source of Projection	Population in 2005	Population in 2025	Population in 2030	Added Population, 2005-2025	Added Population, 2005-2030
Projections 2003	4,855,400	5,695,800	5,943,500	840,400	1,088,100
Projections 2005	4,788,400	5,681,700	5,924,700	893,300	1,136,300
% Change	-1%	0%	0%	6%	4%

SOURCES: ABAG, 2002; ABAG, 2004.

TABLE E.3.23
ABAG *PROJECTIONS 2003* AND *PROJECTIONS 2005*:
EMPLOYMENT PROJECTIONS FOR THE AREA SERVED BY SFPUC WATER CUSTOMERS (WHOLESALE AND RETAIL)[a]

Area	Source of Projection	Jobs in 2005	Jobs in 2025	Jobs in 2030	Change, 2005-2025		Change, 2005-2030	
					Number	Percent	Number	Percent
Alameda County[a]	Proj 2003	248,720	325,440	341,510	76,720	30.8%	92,790	37.3%
	Proj 2005	212,560	308,120	329,800	95,560	45.0%	117,240	58.2%
Santa Clara County	Proj 2003	499,410	608,030	624,370	108,620	21.7%	124,960	25.0%
	Proj 2005	393,700	512,830	544,610	119,130	30.3%	150,910	38.3%
San Mateo County	Proj 2003	362,460	464,870	483,850	102,410	28.3%	121,390	33.5%
	Proj 2005	309,470	435,600	469,900	126,130	40.8%	160,430	51.8%
Total Wholesale Customers	Proj 2003	1,110,590	1,398,340	1,449,730	287,750	25.9%	339,140	30.5%
	Proj 2005	915,730	1,256,550	1,344,310	340,820	37.2%	428,580	46.8%
San Francisco	Proj 2003	635,480	786,020	815,680	150,540	23.7%	180,200	28.4%
	Proj 2005	575,800	776,100	829,090	200,300	34.8%	253,290	44.0%
Total Customers	Proj 2003	1,746,070	2,184,360	2,265,410	438,290	25.1%	519,340	29.7%
	Proj 2005	1,491,530	2,032,650	2,173,400	541,120	36.3%	681,870	45.7%

[a] Includes only those portions of each county served by SFPUC wholesale water customers or served directly by the SFPUC (San Francisco County).

SOURCES: ABAG, 2002; ABAG, 2004.

employment in 2005, *Projections 2005* forecasts less *total* employment in both horizon years than does *Projections 2003*. In San Francisco, however, *Projections 2005* forecasts stronger employment *growth* through 2030, and this change lifts the *total* employment in that year higher than that projected for San Francisco in *Projections 2003*.

Table E.3.24 provides detail about the employment projections for the ABAG cities that are served by one or more SFPUC water customers. Because of format constraints, the projections for 2025 are omitted; only estimates for 2005 and projections for 2030 are shown.

TABLE E.3.24
ABAG *PROJECTIONS 2003* AND *PROJECTIONS 2005*: EMPLOYMENT PROJECTIONS FOR CITIES WITHIN THE AREA SERVED BY SFPUC WATER CUSTOMERS (WHOLESALE AND RETAIL)[a]

	Projections 2003				Projections 2005			
			Change, 2005-2030				Change, 2005-2030	
ABAG Jurisdiction	2005	2030	#	%	2005	2030	#	%
Alameda County								
Fremont[b]	115,700	163,690	47,990	41.5%	96,530	160,410	63,880	66.2%
Hayward	92,060	112,560	20,500	22.3%	74,930	100,430	25,500	34.0%
Newark[b]	19,480	23,220	3,740	19.2%	21,180	24,960	3,780	17.8%
Union City[b]	21,480	42,040	20,560	95.7%	19,920	44,000	24,080	120.9%
Santa Clara County								
Milpitas	49,770	70,490	20,720	41.6%	50,980	68,940	17,960	35.2%
Mountain View	82,410	104,750	22,340	27.1%	57,130	81,110	23,980	42.0%
Los Altos Hills[c]	2,720	2,790	70	2.6%	1,650	1,780	130	7.9%
Palo Alto[d]	110,620	121,130	10,510	9.5%	99,350	117,090	17,740	17.9%
Santa Clara	135,140	171,520	36,380	26.9%	110,030	152,670	42,640	38.8%
Sunnyvale	118,750	153,690	34,940	29.4%	74,560	123,020	48,460	65.0%
San Mateo County								
Atherton[f]	3,470	4,570	1,100	31.7%	2,530	3,710	1,180	46.6%
Belmont[g]	14,410	19,860	5,450	37.8%	8,190	14,070	5,880	71.8%
Brisbane	8,130	19,910	11,780	144.9%	8,200	20,420	12,220	149.0%
Burlingame	28,640	33,870	5,230	18.3%	22,850	33,370	10,520	46.0%
Colma[h]	2,530	3,930	1,400	55.3%	3,180	4,570	1,390	43.7%
Daly City	25,230	37,230	12,000	47.6%	17,980	29,830	11,850	65.9%
East Palo Alto	3,450	7,000	3,550	102.9%	2,130	6,110	3,980	186.9%
Foster City[i]	20,330	24,520	4,190	20.6%	14,190	21,110	6,920	48.8%
Half Moon Bay[j]	5,010	5,820	810	16.2%	7,540	8,490	950	12.6%
Hillsborough	1,210	1,280	70	5.8%	1,660	2,030	370	22.3%
Menlo Park[k]	30,310	37,670	7,360	24.3%	28,750	43,700	14,950	52.0%
Millbrae	6,060	8,930	2,870	47.4%	6,860	9,960	3,100	45.2%
Pacifica[l]	4,770	6,280	1,510	31.7%	6,170	7,670	1,500	24.3%
Portola Valley[f]	1,130	1,140	10	0.9%	2,560	2,720	160	6.3%
Redwood City[m]	56,740	71,890	15,150	26.7%	55,040	76,550	21,510	39.1%
San Bruno	16,390	28,400	12,010	73.3%	13,910	28,400	14,490	104.2%
San Carlos[n]	17,430	23,270	5,840	33.5%	16,590	26,930	10,340	62.3%
San Mateo[n]	61,600	81,490	19,890	32.3%	45,700	70,780	25,080	54.9%
South San Francisco[o]	53,570	64,730	11,160	20.8%	42,170	56,080	13,910	33.0%
Woodside[f]	2,050	2,060	10	0.5%	3,270	3,400	130	4.0%
Total Wholesale Customers	**1,110,590**	**1,449,730**	**339,140**	**30.5%**	**915,730**	**1,344,310**	**428,580**	**46.8%**
San Francisco	635,480	815,680	180,200	28.4%	575,800	829,090	253,290	44.0%
Total Area Served	**1,746,070**	**2,265,410**	**519,340**	**29.7%**	**1,491,530**	**2,173,400**	**681,870**	**45.7%**

a No separate projections for Guadalupe MID (part of Brisbane), Skyline County Water District (serves part of Woodside), Westborough Water District (serves part of South San Francisco), Stanford University (included by ABAG in the projections for Palo Alto), or San Jose (serves only a small portion of the city). Totals differ slightly from those shown in Table E.3.23 because the ABAG jurisdictions for which employment projections are reported in this table differ in geography from the water customer areas (see Tables E.3.A.1 and E.3.A.2).
b Fremont, Newark, and Union City are served by the Alameda County Water District.
c Los Altos Hills is served by the Purissima Hills Water District.
d Palo Alto projections include Stanford University
e This footnote deleted.
f Atherton, Portola Valley, and part of Woodside are served by CWS - Bear Gulch District. All of Portola Valley (including the portion previously served by Los Trancos County Water District, which is now a part of CWS) and Woodside are included in these projections.
g Belmont is served by the Mid-Peninsula Water District, which also serves parts of San Carlos.
h Colma is served by CWS - South San Francisco District
i Foster City is served by Estero MID, which also serves a portion of San Mateo. The projections for San Mateo are included in the projections for CWS - Mid-Peninsula District.
j Half Moon Bay and the adjacent unincorporated area (included in these figures) are served by the Coastside County Water District.
k The City of Menlo Park Water Agency serves only a portion of the City of Menlo Park (less than half of the city's population). These figures are for the entire city.
l Pacifica is served by the North Coast County Water District.
m Redwood City Water Agency also serves portions of San Carlos and Woodside.
n Parts of San Carlos and San Mateo are served by CWS - Mid Peninsula District. Both cities are included here in their entirety.
o South San Francisco is served by CWS - South San Francisco District + Westborough Water District.

SOURCES: ABAG, 2002; ABAG, 2004.

Table E.3.25 sorts the individual jurisdictions within the service area (a single water customer may comprise several jurisdictions) according to whether greater employment in 2030 is expected by *Projections 2005* or *Projections 2003*. In this case, 8 of the 31 jurisdictions are expected to have about the same total employment in 2030 (within 5 percent) in both sets of projections, 11 of the jurisdictions are expected by *Projections 2005* to have more employment in 2030, and 12 are expected to have less.

TABLE E.3.25
ABAG *PROJECTIONS 2003* AND *PROJECTIONS 2005*: TOTAL JOBS IN 2030

***Projections 2005* Forecast is Greater than *Projections 2003* Forecast**			***Projections 2005* Forecast is About the Same as *Projections 2003* Forecast[a]**			***Projections 2005* Forecast is Less than *Projections 2003* Forecast**		
Jurisdiction	**Jobs in 2030[b]**	**Proj. 2003 Jobs as % of Proj. 2005 Jobs**	**Jurisdiction**	**Jobs in 2030[b]**	**Proj. 2003 Jobs as % of Proj. 2005 Jobs**	**Jurisdiction**	**Jobs in 2030[b]**	**Proj. 2003 Jobs as % of Proj. 2005 Jobs**
Alameda County								
Newark	24,960	93.0%	Union City	44,000	95.5%	Hayward	100,430	112.1%
			Fremont	160,410	102.0%			
Santa Clara County[c]								
			Milpitas	68,940	102.2%	Santa Clara	152,670	112.3%
			Palo Alto	117,090	103.5%	Sunnyvale	123,020	124.9%
						Mountain View	81,110	129.1%
						Los Altos Hills	1,780	156.7%
San Mateo County								
Portola Valley	2,720	41.9%	Brisbane	20,420	97.5%	East Palo Alto	6,110	114.6%
	8,490	45.9%						
Half Moon Bay[d]			San Bruno	28,400	100.0%	San Mateo	70,780	115.1%
Woodside	3,400	60.6%						
			Burlingame	33,370	101.5%	South San Francisco	56,080	115.4%
Hillsborough	2,030	63.1%				Foster City	21,110	116.2%
Pacifica	7,670	81.9%				Atherton	3,710	123.2%
Colma	4,570	86.0%				Daly City	29,830	124.8%
Menlo Park	43,700	86.2%				Belmont	14,070	141.2%
San Carlos	26,930	86.4%						
Millbrae	9,960	89.7%						
Redwood City	76,550	93.9%						
San Francisco County								
			San Francisco	829,090	98.4%			

[a] Number of jobs in 2030 in *Projections 2005* is within five percent of the number of jobs in 2030 in *Projections 2003*.
[b] Number of jobs in 2030 forecast in *Projections 2005*.
[c] Stanford University is included within the City of Palo Alto in the ABAG projections. Only a small portion of the City of San Jose is within the district that obtains water from the SFPUC. It is considered misleading to include figures for all of San Jose in this analysis.
[d] Half Moon Bay plus Half Moon Bay (unincorporated).

SOURCES: ABAG, 2002; ABAG, 2004.

For comparison, as shown in Table E.3.13, *Projections 2003* expected 16 jurisdictions to have about the same employment in 2025 as did *Projections 2002*; 8 were expected to have more, and 7 were expected to have less. This comparison with the previous projections suggests that, although employment estimates for 2005 have again been readjusted downward in *Projections 2005*, expectations of future employment growth are now stronger than they were previously.

Table E.3.26 sorts the individual jurisdictions within the service area according to whether greater *increases* in employment between 2005 and 2030 are expected by *Projections 2005* or *Projections 2003*. Supporting the conclusions of the preceding paragraph, this table shows that *Projections 2005* forecasts greater employment growth than does *Projections 2003* for 25 of the 31 areas, about the same amount of growth for 5 areas, and less growth for only 1 area.

TABLE E.3.26
ABAG *PROJECTIONS 2003* AND *PROJECTIONS 2005*: CHANGE IN NUMBER OF JOBS, 2005-2030

***Projections 2005* Forecast is Greater than *Projections 2003* Forecast**			***Projections 2005* Forecast is About the Same as *Projections 2003* Forecast[a]**			***Projections 2005* Forecast is Less than *Projections 2003* Forecast**		
Jurisdiction	**Change in Jobs, 2005-2030[b]**	**Proj. 2003 Change in Jobs as % of Proj. 2005 Change in Jobs**	**Jurisdiction**	**Change in Jobs, 2005-2030[b]**	**Proj. 2003 Change in Jobs as % of Proj. 2005 Change in Jobs**	**Jurisdiction**	**Change in Jobs, 2005-2030[b]**	**Proj. 2003 Change in Jobs as % of Proj. 2005 Change in Jobs**
Alameda County								
Fremont	63,880	75.1%	Newark	3,780	98.9%			
Hayward	25,500	80.4%						
Union City	24,080	85.4%						
Santa Clara County[c]								
Los Altos Hills	130	53.8%				Milpitas	17,960	115.4%
Palo Alto	17,740	59.2%						
Sunnyvale	48,460	72.1%						
Santa Clara	42,640	85.3%						
Mountain View	23,980	93.2%						
San Mateo County								
Portola Valley	160	6.3%	Brisbane	12,220	96.4%			
Woodside	130	7.7%	Pacifica	1,500	100.7%			
Hillsborough	370	18.9%	Colma	1,390	100.7%			
Menlo Park	14,950	49.2%	Daly City	11,850	101.3%			
Burlingame	10,520	49.7%						
San Carlos	10,340	56.5%						
Foster City	6,920	60.5%						
Redwood City	21,510	70.4%						
San Mateo	25,080	79.3%						
South San Francisco	13,910	80.2%						
Half Moon Bay[d]	950	85.3%						
San Bruno	14,490	82.9%						
East Palo Alto	3,980	89.2%						
Millbrae	3,100	92.6%						
Belmont	5,880	92.7%						
Atherton	1,180	93.2%						
San Francisco County								
San Francisco	253,290	71.1%						

[a] Number of jobs added between 2005 and 2030 in *Projections 2005* is within five percent of the number of jobs added between 2005 and 2030 in *Projections 2003*.
[b] Number of jobs added between 2005 and 2030 forecast in *Projections 2005*.
[c] Stanford University is included within the City of Palo Alto in the ABAG projections. Only a small portion of the City of San Jose is within the district that obtains water from the SFPUC. It is considered misleading to include figures for all of San Jose in this analysis.
[d] Half Moon Bay plus Half Moon Bay (unincorporated).

SOURCES: ABAG, 2002; ABAG, 2004.

Population Growth

Population growth forecasted in *Projections 2003* and *Projections 2005* for the portion of the four-county area served by SFPUC water is summarized in **Table E.3.27**. This table shows that *Projections 2005* anticipates greater *total* population in three of the counties (Alameda, Santa Clara, and San Francisco) in 2025, and greater population in all four in 2030, than does *Projections 2003*.

TABLE E.3.27
ABAG *PROJECTIONS 2003* AND *PROJECTIONS 2005*:
POPULATION PROJECTIONS FOR THE AREA SERVED BY SFPUC WATER CUSTOMERS (WHOLESALE AND RETAIL)[a]

Area	Source of Projection	Population in 2005	Population in 2025	Population in 2030	Change, 2005-2025		Change, 2005-2030	
					Number	Percent	Number	Percent
Alameda County	Proj 2003	481,100	552,500	575,700	71,400	14.8%	94,600	19.7%
	Proj 2005	473,900	552,700	576,200	78,800	16.6%	102,300	21.6%
Santa Clara County	Proj 2003	472,700	560,800	579,200	88,100	18.6%	106,500	22.5%
	Proj 2005	463,100	561,700	585,100	98,600	21.3%	122,000	26.3%
San Mateo County	Proj 2003	726,990	826,710	838,230	99,720	13.7%	111,240	15.3%
	Proj 2005	716,100	818,800	840,900	102,700	14.3%	124,800	17.4%
Total Wholesale Customers	Proj 2003	1,680,790	1,940,010	1,993,130	259,220	15.4%	312,340	18.6%
	Proj 2005	1,653,100	1,933,200	2,002,200	280,100	16.9%	349,100	21.1%
San Francisco	Proj 2003	798,600	889,800	935,100	91,200	11.4%	136,500	17.1%
	Proj 2005	798,000	890,400	924,600	92,400	11.6%	126,600	15.9%
Total Customers	Proj 2003	2,479,390	2,829,810	2,928,230	350,420	14.1%	448,840	18.1%
	Proj 2005	2,451,100	2,823,600	2,926,800	372,500	15.2%	475,700	19.4%

[a] Includes only those portions of each county served by SFPUC wholesale water customers or served directly by the SFPUC (San Francisco County).

SOURCES: ABAG, 2002, ABAG, 2004.

The table also shows that *Projections 2005* forecasts greater population *growth* in every county than does *Projection 2003*, during the 20-year period from 2005 through 2025, and greater *growth* in three of the four counties (excluding San Francisco) during the 25-year period from 2005 through 2030.

Table E.3.28 provides detail about the population projections for the ABAG cities that are served by one or more SFPUC water customers. Because of format constraints, the projections for 2025 are omitted; only estimates for 2005 and projections for 2030 are shown.

Table E.3.29 sorts the jurisdictions according to whether *Projections 2005* anticipates greater total population in 2030 than does *Projections 2003*. This table shows that, in most jurisdictions (28 of the 31), the projections are about the same. *Projections 2005* expects one jurisdiction (Millbrae) to have more residents in 2030, and two (Half Moon Bay and Colma) to have fewer.

TABLE E.3.28
ABAG *PROJECTIONS 2003* AND *PROJECTIONS 2005*:
POPULATION PROJECTIONS FOR CITIES WITHIN THE AREA SERVED BY SFPUC WATER CUSTOMERS (WHOLESALE AND RETAIL)[a]

	Projections 2003				Projections 2005			
			Change, 2005-2030				Change, 2005-2030	
ABAG Jurisdiction	2005	2030	#	%	2005	2030	#	%
Alameda County								
Fremont[b]	214,600	257,100	42,500	19.8%	211,100	257,200	46,100	21.8%
Hayward[d]	147,600	169,800	22,200	15.0%	147,000	171,500	24,500	16.7%
Newark[b]	45,300	53,500	8,200	18.1%	44,400	53,400	9,000	20.3%
Union City[b]	73,600	95,300	21,700	29.5%	71,400	94,100	22,700	31.8%
Santa Clara County								
Milpitas	68,700	91,500	22,800	33.2%	65,500	91,400	25,900	39.5%
Mountain View	73,200	87,700	14,500	19.8%	72,000	89,600	17,600	24.4%
Los Altos Hills[c]	9,800	10,300	500	5.1%	9,900	10,700	800	8.1%
Palo Alto[d]	74,500	89,000	14,500	19.5%	74,000	92,200	18,200	24.6%
Santa Clara	108,600	138,700	30,100	27.7%	108,700	142,100	33,400	30.7%
Sunnyvale	137,900	162,000	24,100	17.5%	133,000	159,100	26,100	19.6%
San Mateo County								
Atherton[f]	7,400	8,100	700	9.5%	7,300	8,200	900	12.3%
Belmont[g]	25,800	28,900	3,100	12.0%	25,500	28,800	3,300	12.9%
Brisbane	3,770	5,390	1,620	43.0%	3,750	5,240	1,490	39.7%
Burlingame	30,000	32,500	2,500	8.3%	29,400	31,900	2,500	8.5%
Colma[h]	1,320	2,040	720	54.5%	1,350	1,860	510	37.8%
Daly City	112,000	126,900	14,900	13.3%	109,400	127,200	17,800	16.3%
East Palo Alto	32,200	44,600	12,400	38.5%	32,700	43,600	10,900	33.3%
Foster City[i]	30,100	32,100	2,000	6.6%	29,800	32,500	2,700	9.1%
Half Moon Bay[j]	24,200	28,000	3,800	15.7%	23,900	27,100	3,200	13.4%
Hillsborough	11,100	11,900	800	7.2%	11,000	11,800	800	7.3%
Menlo Park[k]	36,300	41,800	5,500	15.2%	35,300	41,100	5,800	16.4%
Millbrae	21,500	22,700	1,200	5.6%	21,200	24,500	3,300	15.6%
Pacifica[l]	40,200	42,900	2,700	6.7%	38,600	42,200	3,600	9.3%
Portola Valley[f]	7,100	7,800	700	9.9%	7,100	7,800	700	9.9%
Redwood City[m]	102,100	121,400	19,300	18.9%	101,700	122,300	20,600	20.3%
San Bruno	40,800	48,500	7,700	18.9%	41,700	50,700	9,000	21.6%
San Carlos[n]	29,800	34,100	4,300	14.4%	29,300	35,200	5,900	20.1%
San Mateo[n]	102,100	118,000	15,900	15.6%	99,300	119,800	20,500	20.6%
South San Francisco[o]	62,500	73,400	10,900	17.4%	61,200	71,800	10,600	17.3%
Woodside[f]	6,700	7,200	500	7.5%	6,600	7,300	700	10.6%
Total Wholesale Customers	**1,680,790**	**1,993,130**	**312,340**	**18.6%**	**1,653,100**	**2,002,200**	**349,100**	**21.1%**
San Francisco	798,600	935,100	136,500	17.1%	798,000	924,600	126,600	15.9%
Total Area Served	**2,479,390**	**2,928,230**	**448,840**	**18.1%**	**2,451,100**	**2,926,800**	**475,700**	**19.4%**

[a] No separate projections for Guadalupe MID (part of Brisbane), Skyline County Water District (serves part of Woodside), Westborough Water District (serves part of South San Francisco), Stanford University (included by ABAG in the projections for Palo Alto), or San Jose (serves only a small portion of the city). Totals differ slightly from those shown in Table E.3.27 because the ABAG jurisdictions for which employment projections are reported in this table differ in geography from the water customer areas (see Tables E.3.A.1 and E.3.A.2).
[b] Fremont, Newark, and Union City are served by the Alameda County Water District.
[c] Los Altos Hills is served by the Purissima Hills Water District.
[d] Palo Alto projections include Stanford University
[e] This footnote deleted.
[f] Atherton, Portola Valley, and part of Woodside are served by CWS - Bear Gulch District. All of Portola Valley (including the portion previously served by Los Trancos County Water District, which is now a part of CWS) and Woodside are included in these projections.
[g] Belmont is served by the Mid-Peninsula Water District, which also serves parts of San Carlos.
[h] Colma is served by CWS - South San Francisco District
[i] Foster City is served by Estero MID, which also serves a portion of San Mateo. The projections for San Mateo are included in the projections for CWS - Mid-Peninsula District.
[j] Half Moon Bay and the adjacent unincorporated area (included in these figures) are served by the Coastside County Water District.
[k] The City of Menlo Park Water Agency serves only a portion of the City of Menlo Park (less than half of the city's population). These figures are for the entire city.
[l] Pacifica is served by the North Coast County Water District.
[m] Redwood City Water Agency also serves portions of San Carlos and Woodside.
[n] Parts of San Carlos and San Mateo are served by CWS - Mid Peninsula District. Both cities are included here in their entirety.
[o] South San Francisco is served by CWS - South San Francisco District + Westborough Water District.

SOURCES: ABAG, 2002; ABAG, 2004.

TABLE E.3.29
ABAG *PROJECTIONS 2003* AND *PROJECTIONS 2005*: TOTAL POPULATION IN 2030

***Projections 2005* Forecast is Greater than *Projections 2003* Forecast**			***Projections 2005* Forecast is About the Same as *Projections 2003* Forecast[a]**			***Projections 2005* Forecast is Less than *Projections 2003* Forecast**		
Jurisdiction	**Population in 2030[b]**	**Proj. 2003 Pop. as % of Proj. 2005 Pop.**	**Jurisdiction**	**Population in 2030[b]**	**Proj. 2003 Pop. as % of Proj. 2005 Pop.**	**Jurisdiction**	**Population in 2030[b]**	**Proj. 2003 Pop. as % of Proj. 2005 Pop.**
Alameda County								
			Hayward	171,500	99.0%			
			Fremont	257,200	100.0%			
			Newark	53,400	100.2%			
			Union City	94,100	101.3%			
Santa Clara County[c]								
			Los Altos Hills	10,700	96.3%			
			Palo Alto	92,200	96.5%			
			Santa Clara	142,100	97.6%			
			Mountain View	89,600	97.9%			
			Milpitas	91,400	100.1%			
			Sunnyvale	159,100	101.8%			
San Mateo County								
Millbrae	24,500	92.7%	San Bruno	50,700	95.7%	Half Moon Bay [d]	27,100	103.3%
			San Carlos	35,200	96.9%	Colma	1,860	109.7%
			San Mateo	119,800	98.5%			
			Woodside	7,300	98.6%			
			Foster City	32,500	98.8%			
			Atherton	8,200	98.8%			
			Redwood City	122,300	99.3%			
			Daly City	127,200	99.8%			
			Portola Valley	7,800	100.0%			
			Belmont	28,800	100.3%			
			Hillsborough	11,800	100.8%			
			Pacifica	42,200	101.7%			
			Menlo Park	41,100	101.7%			
			Burlingame	31,900	101.9%			
			South San Francisco	71,800	102.2%			
			East Palo Alto	43,600	102.3%			
			Brisbane	5,240	102.9%			
San Francisco County								
			San Francisco	924,600	101.1%			

[a] Population in 2030 in *Projections 2005* is within five percent of the population in 2030 in *Projections 2003*.
[b] Population in 2030 forecast in *Projections 2005*.
[c] Stanford University is included within the City of Palo Alto in the ABAG projections. Only a small portion of the City of San Jose is within the district that obtains water from the SFPUC. It is considered misleading to include figures for all of San Jose in this analysis.
[d] Half Moon Bay plus Half Moon Bay (unincorporated).

SOURCES: ABAG, 2002; ABAG, 2004.

Table E.3.30 sorts the jurisdictions according to whether *Projections 2005* anticipates more population growth between 2005 and 2030 than does *Projections 2003*. As shown, 5 jurisdictions are expected to gain about the same number of new residents (within 5 percent), 21 are expected to gain more, and 5 are expected to gain fewer new residents, according to *Projections 2005*.

TABLE E.3.30
ABAG *PROJECTIONS 2003* AND *PROJECTIONS 2005*:
CHANGE IN POPULATION, 2005-2030

***Projections 2005* Forecast is Greater than *Projections 2003* Forecast**			***Projections 2005* Forecast is About the Same as *Projections 2003* Forecast[a]**			***Projections 2005* Forecast is Less than *Projections 2003* Forecast**		
Jurisdiction	**Change in Population, 2005-2030[b]**	**Proj. 2003 Change in Pop. as % of Proj. 2005 Change in Pop.**	**Jurisdiction**	**Change in Population, 2005-2030[b]**	**Proj. 2003 Change in Pop. as % of Proj. 2005 Change in Pop.**	**Jurisdiction**	**Change in Population, 2005-2030[b]**	**Proj. 2003 Change in Pop. as % of Proj. 2005 Change in Pop.**
Alameda County								
Hayward	24,500	90.6%	Union City	22,700	95.6%			
Newark	9,000	91.1%						
Fremont	46,100	92.2%						
Santa Clara County[c]								
Los Altos Hills	800	62.5%						
Palo Alto	18,200	79.7%						
Mountain View	17,600	82.4%						
Milpitas	25,900	88.0%						
Santa Clara	33,400	90.1%						
Sunnyvale	26,100	92.3%						
San Mateo County								
Millbrae	3,300	36.4%	Burlingame	2,500	100.0%	Brisbane	1,490	108.7%
Woodside	700	71.4%	Portola Valley	700	100.0%	East Palo Alto	10,900	113.8%
San Carlos	5,900	72.9%	Hillsborough	800	100.0%	Half Moon Bay[d]	3,200	118.8%
Foster City	2,700	74.1%	South San Francisco	10,600	102.8%			
Pacifica	3,600	75.0%				Colma	510	141.2%
San Mateo	20,500	77.6%						
Atherton	900	77.8%						
Daly City	17,800	83.7%						
San Bruno	9,000	85.6%						
Redwood City	20,600	93.7%						
Belmont	3,300	93.9%						
Menlo Park	5,800	94.8%						
San Francisco County								
						San Francisco	126,600	107.8%

[a] Population added between 2005 and 2030 in *Projections 2005* is within five percent of the population added between 2005 and 2030 in *Projections 2003*.
[b] Population added between 2005 and 2030 in *Projections 2005*.
[c] Stanford University is included within the City of Palo Alto in the ABAG projections. Only a small portion of the City of San Jose is within the district that obtains water from the SFPUC. It is considered misleading to include figures for all of San Jose in this analysis.
[d] Half Moon Bay plus Half Moon Bay (unincorporated).

SOURCES: ABAG, 2002; ABAG, 2004.

Conclusions about ABAG Growth Projections

The evolution of ABAG forecasts of employment and population growth in the Bay Area paints a picture of changed expectations of growth in the nine-county Bay Area, the four-county area in which SFPUC water customers are located, and the area served by SFPUC water customers, in generally consistent ways.

- Expectations of future *total* employment increased between *Projections 2002* and *Projections 2003,* and then decreased between *Projections 2003* and *Projections 2005*.

  The reduction shown in *Projections 2005* results primarily from ongoing adjustments to the estimate of employment in 2005. Projections of *growth* between 2005 and 2025, and between 2005 and 2030, have been increased in successive sets of forecasts, but these increases do not completely offset the cumulative reductions in beginning year (2005) employment that have been made as the impacts of the dot com bust in the early part of this decade have become clearer; as a result, *total* employment expected at the end of the forecast period is lower in the later projections.

  The successive sets of projections show that *Projections 2003* anticipated greater employment in 2025 than *Projections 2002*, but *Projections 2005* anticipate less employment in 2025 than either *Projections 2002* or *Projections 2003,* and less employment in 2030 than *Projections 2003* in all of the geographic areas considered. This summary comparison is shown in **Table E.3.31**.

TABLE E.3.31
ABAG PROJECTIONS OF EMPLOYMENT IN 2025: SUMMARY COMPARISON

Area	Year	*Projections 2002*	*Projections 2003*	*Projections 2005*
Nine-County Bay Area	2025	4,932,590	4,982,800	4,788,330
	2030		5,226,400	5,120,600
Four-County Area	2025	3,682,510	3,739,920	3,516,890
	2030		3,911,320	3,765,020
SFPUC Water Customers	2025	2,169,600	2,184,360	2,032,650
	2030		2,265,410	2,173,400

SOURCES: Tables E.3.7, E.3.9, E.3.11, E.3.19, E.3.21, E.3.23.

- Expectations of future population increased between *Projections 2002* and *Projections 2003,* and then decreased slightly between *Projections 2003* and *Projections 2005*. The future population anticipated by *Projections 2005* is, however, greater than the population anticipated by *Projections 2002*.

  The increases result primarily from the smart growth assumptions that were initiated with *Projections 2003*. These assumptions *rearrange* population growth (but not employment growth) within the Bay Area, compared to assumed population growth trends in previous projections sets, locating it generally in urban areas that have transit stations and/or transit corridors, and *add* growth based on the assumption that barriers to infill development will be removed and increasing government assistance for housing production will be provided (ABAG 2002). The summary of population comparisons is shown in **Table E.3.32**.

TABLE E.3.32
ABAG PROJECTIONS OF POPULATION IN 2025: SUMMARY COMPARISON

Area	Year	*Projections 2002*	*Projections 2003*	*Projections 2005*
Nine-County Bay Area	2025	8,223,740	8,457,800	8,419,100
	2030		8,780,300	8,747,100
Four-County Area	2025	5,406,900	5,695,800	5,681,700
	2030		5,943,500	5,924,700
SFPUC Water Customers	2025	2,693,000	2,829,810	2,823,600
	2030		2,928,230	2,926,800

SOURCES: Tables E.3.8, E.3.10, E.3.17, E.3.20, E.3.22, E.3.28.

Figures E.3.1 and **E.3.2** provide a summary comparison of the thee projections sets for the nine-county bay area and the four counties that are partially served by the SFPUC and its wholesale customers. The figures illustrate that, notwithstanding the changes incorporated into *Projections 2003* and *Projections 2005*, the three sets of projections are similar both for the nine-county Bay Area (Figure E.3.1) and for the four-county area that is partially served by SFPUC water[6] (Figure E.3.2). The employment graphs reflect the lower estimates of 2005 employment presented in *Projections 2003* and *Projections 2005*, and the more rapid growth expected between 2005 and 2030 that would make up for most of the job losses in the early part of this decade.

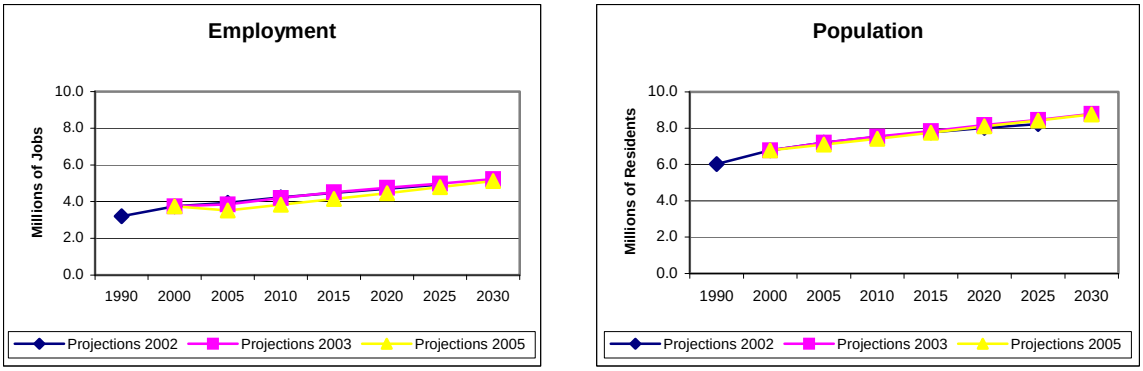

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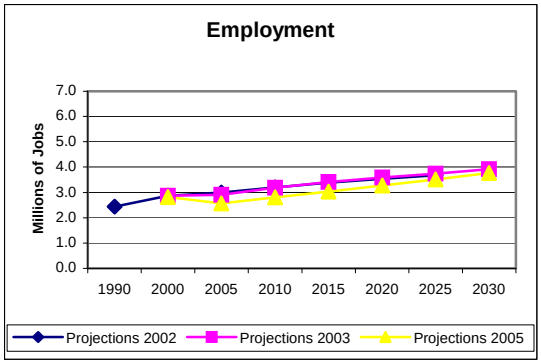
Figure E.3.1
ABAG Projections of Employment and Population in the Nine-County Bay Area

6 SFPUC water serves all of San Francisco County and portions of Alameda, Santa Clara, and San Mateo Counties.



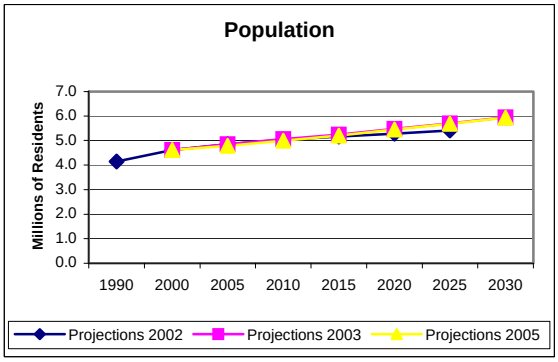


Figure E.3.2
ABAG Projections of Employment and Population in the Four County Area (Partially) Served by SFPUC Water

Other Growth Projections

The ABAG projections reviewed above are the only comprehensive set of employment and population projections that cover the area served by SFPUC water. There are, however, other planning documents that include projections of population and/or jobs, and these documents provide additional context for considering the San Francisco and wholesale customer demand projections. Most of the SFPUC wholesale customers, or the cities they represent, have adopted urban water management plans, which include projections to 2030. Cities and counties served by SFPUC water have general plans that typically include projections of employment and population, and these projections provide indications of whether the demand forecasts are consistent with or more ambitious than the adopted planning policies. **Table E.3.33** compares projections of employment from these local sources to employment anticipated by ABAG's *Projections 2005*.

For each source, the table shows the expected employment in the most distant year for which the general plan has a forecast. In some cases, the projections from different sources are similar; in others, they diverge. Reasons for differences between sources may include:

- Age of the projection source. *Projections 2005* was prepared during 2004. Some of the general plans were prepared 10 or more years ago. The water customers updated their urban water management plans in 2005. Some of the UWMPs utilize more recent ABAG projections than were available when the water demand studies were undertaken.

- Methodology. Some local projections may be based more on the development capacity of the land available for development (e.g., as designated in the general plan) than on demand factors such as economic growth and comparative advantage of a location in the community.

- Area covered. General plans typically cover a city's "planning area," which may be larger than its corporate limits or sphere of influence in cases where there is unincorporated land adjacent to the city limits. Because UWMPs are produced by the water customers for their service areas,

TABLE E.3.33
COMPARISON OF GENERAL PLAN EMPLOYMENT PROJECTIONS TO ABAG *PROJECTIONS 2005*, UWMPS, AND WATER CUSTOMER DEMAND PROJECTIONS FOR GENERAL PLAN PROJECTION YEAR

	Employment in General Plan Employment Year[a] Shown in:			
	General Plan[b]	UWMP	SFPUC Water Customer Projection[c]	*Projections 2005*
Cities with GP Employment Projections for 2010				
East Palo Alto	5,940	see note d	8,673	6,110
Foster City	18,760	see note d	see note e	15,560
Menlo Park	17,900	see note d	11,057[f]	31,730
Milpitas	65,200	see note d	60,567	54,340
Mountain View	84,810	see note d	81,848	63,330
Palo Alto	98,500	108,450	108,161	102,190
San Mateo	67,628	see note d	see notes e, g	50,110
Santa Clara	151,280		177,027	152,670
Cities with GP Employment Projections for 2015				
Millbrae	12,006	see note d	7,313	8,190
Cities with GP Employment Projections for 2020				
Atherton	3,840	see note d	see note h	3,380
Colma	2,080	see note d	see note i	4,080
Daly City	34,260	34,000	33,981	29,830
Fremont	130,530	see note d	see note j	96,530
Newark	26,560	see note d	see note j	23,310
San Bruno	19,180		25,770	28,400
San Francisco	745,600	770,500	770,500	776,100
South San Francisco	71,400	see note d	59,466[k]	51,210
Sunnyvale	152,730	see note d	153,959	101,590
Union City	20,710	see note d	see note j	34,900
Cities with GP Employment Projections for 2025				
Hayward	108,830	see note d	109,296	95,430
Hillsborough	1,360		1,323[l]	1,970
Cities with GP Employment Projections for Years Prior to 2005 or No Applicable GP: Projections for 2030				
Belmont			22,221	14,070
Brisbane + Guadalupe Valley MID			25,243	20,420
Burlingame			36,160[m]	33,370
Half Moon Bay			6,795	8,490[n]
Los Altos Hills			see note o	1,780
Pacifica			7,478	7,670
Portola Valley				2,720
Redwood City		69,980	83,678	76,550
San Carlos			see note g	26,930
San Jose			3,353[p]	
Stanford University				n.a.
Woodside				3,400

n.a. = Not available.

[a] Employment shown is for the year of the most distant employment projection available in the general plan or other relevant local document (see note b). For example, employment figures in all columns for cities in the group titled "Cities with GP Employment Projections for 2010" are employment projected for or estimated in 2010.
[b] Employment estimates are from each city's general plan (GP) or the general plan's EIR.
[c] Estimates for years between 2001 and 2030 are derived by Mundie & Associates, based on linear interpolations of the water customers' projections presented in URS 2004.
[d] UWMP does not forecast employment (some, but not all, UWMPs do forecast commercial, industrial, and other types of nonresidential accounts).
[e] Estero MID (Foster City and part of San Mateo) projection for 2010 is 26,652.
[f] Figure shown is for the portion of Menlo Park (less than half of the city's population) served by the SFPUC wholesale customer, the City of Menlo Park water agency.
[g] CWS – Mid-Peninsula District (parts of the cities of San Mateo and San Carlos plus unincorporated areas) projection for 2010 is 86,034.
[h] CWS – Bear Gulch District (Atherton, parts of Menlo Park, Portola Valley, and Woodside, plus unincorporated areas) projection for 2020 is 46,093.

TABLE E.3.33 (Continued)
COMPARISON OF GENERAL PLAN EMPLOYMENT PROJECTIONS TO ABAG *PROJECTIONS 2005*, UWMPS, AND WATER CUSTOMER DEMAND PROJECTIONS FOR GENERAL PLAN PROJECTION YEAR

[i] CWS – South San Francisco District (Colma, parts of Daly City and South San Francisco, plus unincorporated areas) plus Westborough Water District projection for 2020 is 59,466.
[j] Alameda County Water District (cities of Fremont, Newark, and Union City) projection is 151,092 in 2005; 160,853 in 2010, and 197,456 in 2020.
[k] Figure shown is for CWS – South San Francisco District (Colma, parts of Daly City and South San Francisco, plus unincorporated areas) plus Westborough Water District.
[l] Figure shown is for Town of Hillsborough water agency, which also serves some unincorporated area.
[m] Figure shown is for the City of Burlingame water agency, which also serves some unincorporated areas.
[n] Figure shown for *Projections 2005* includes ABAG's unincorporated Half Moon Bay.
[o] Projection for Purissima Hills Water District (part of Los Altos Hills and some unincorporated areas) is 457.
[p] Figure shown is for the City of San Jose water agency, which serves only a small part of the City of San Jose.

SOURCES: ABAG, 2004; ACWD, 2005; City and County of San Francisco, 2004; City of Burlingame, 2005; City of Daly City, 2004; City of Daly City,2005; City of East Palo 2001; City of East Palo Alto, 2006; City of Foster City, 2001; City of Fremont, 2003; City of Hayward, 2002; City of Hayward, 2005; City of Menlo Park, 1994; City of Menlo Park. 2006, City of Millbrae,1998; City of Millbrae, 2005; City of Milpitas, 2002a; City of Milpitas, 2005; City of Mountain View, 2002; City of Mountain View, 2005; City of Newark, 2002;City of Palo Alto, 2002; City of Palo Alto, 2005; City of Redwood City, 2005; City of San Mateo, 2001; City of Santa Clara, 2002; City of Santa Clara, 2005; City of South San Francisco, 2002; City of Sunnyvale, 2002; City of Sunnyvale, 2005; City of Union City, 2002; Coastside County Water District,2005; CWS-Mid-Peninsula, 2005; CWS-South San Francisco, 2006; Hannaford and Hydroconsult, 2004; Mid-Peninsula Water District, 2005; SFPUC, 2005; Town of Atherton, 2002; Town of Colma, 1999; Town of Hillsborough, 2002; Westborough Water District, 2005; URS, 2004.

the area covered in these plans would be the same as the area considered for the water demand projections. However, in many cases the service area boundaries do not coincide with boundaries covered in cities' general plans or the areas covered in ABAG projections; some service areas include unincorporated areas or portions of multiple cities. As noted elsewhere in this analysis, the ABAG areas that were assigned to water customer service areas are not congruent with those areas (see **Attachment E.3.A, Tables E.3.A.1** and **E.3.A.2** for correspondence between water customer service areas and ABAG areas).

In 13 of the 20 cases for which direct comparisons are available, Table E.3.33 shows that water customer projections of employment in the given general plan projection year exceed *Projections 2005* employment. This result is expected, because most of the water customer projections are based on extensions of *Projections 2002*, which anticipated higher overall employment in the near term and future years for most jurisdictions than does *Projections 2005*.

Table E.3.34 compares population projections contained in local general plans, urban water management plans, SFPUC demand documents, and *Projections 2005*. In almost all cases, Table E.3.34 indicates that future population levels anticipated by *Projections 2005* or the city's general plan exceed the population levels anticipated in the relevant water customer projection.[7] In most cases, *Projections 2005* contains the highest forecast. This pattern is consistent with ABAG's assumptions that smart growth principles and increased housing production will be incorporated into planning policy and practice in the future, especially after 2010.

[7] In Foster City, the water customer projection is higher than any of the others, but the water customer, which is Estero MID, serves a portion of San Mateo in addition to the City of Foster City.

TABLE E.3.34
COMPARISON OF GENERAL PLAN POPULATION PROJECTIONS TO ABAG PROJECTIONS 2005, UWMPS, AND WATER CUSTOMER DEMAND PROJECTIONS FOR GENERAL PLAN PROJECTION YEAR

	Population in General Plan Population Year[a] Shown in:			
	General Plan[b]	UWMP	SFPUC Water Customer Projection[c]	*Projections 2005*
Cities with GP Population Projections for 2005				
Colma	1,285	see note d	see note d	1,350
Cities with GP Population Projections for 2010				
Belmont	27,800	see note f	see note f	26,000
Burlingame	31,500	30,200	31,648	30,200
Foster City	30,803	37,424[e]	36,284[e]	29,800
Menlo Park	35,285	10,344[g]	12,619[g]	35,600
Mountain View	75,200	75,200	74,422	76,000
Palo Alto	62,880	64,168	62,823	78,300
San Mateo	100,700	see note h	see note h	102,500
Santa Clara	129,900	116,527	115,630	117,400
Cities with GP Population Projections for 2015				
Millbrae	24,860	23,055	23,253	22,800
Cities with GP Population Projections for 2020				
Atherton	8,400	see note i	see note i	7,900
Daly City	113,000	114,291[j]	112,363[j]	120,200
East Palo Alto	34,600	29,612	29,844	39,600
Fremont	229,213	236,700	see note k	236,900
Half Moon Bay (incl. unincorporated area)	21,065	23,262	22,679	26,400
Milpitas	94,400[l]	82,400	79,846	82,400
Newark	49,800	50,000	see note k	49,000
Redwood City	87,100	89,492 [m]	89,519[m]	114,200
San Bruno	46,400	n.a.	45,642	47,700
San Francisco	811,100	840,000	818,954[n]	859,200
South San Francisco+Westborough Water District[d]	67,400	78,200	70,156	68,700
Sunnyvale	154,600	146,900	144,629	146,900
Union City	80,100	86,000	see note k	82,600
Cities with GP Population Projections for 2025				
Hayward	160,300	160,300	158,909	165,900
Hillsborough	11,800	n.a	12,520	11,600
Cities with GP Population Projections for Years Prior to 2005 or No Applicable GP: Projections for 2030				
Brisbane + Guadalupe Valley MID		n.a.	6,164	5,240
Los Altos Hills		n.a.	see note o	10,700
Los Trancos County Water District[p]		see note q	1,094	n.a.
Pacifica		42,100	47,829	42,200
Portola Valley		see note q	see note q	7,800
San Carlos		see note h	see note h	35,200
Stanford University		n.a.	27,924	n.a.
Woodside		see note q	see note q	7,300

n.a. = Not available.

a Population shown is for the year of the most distant population projection available in the general plan, housing element, or other relevant local document (see note b). For example, populations in all columns for cities in the group titled "Cities with GP Population Projections for 2005" are populations projected for or estimated in 2005.

b Population estimates are from each city's general plan (GP) or the general plan's EIR.

c Estimates for years between 2001 and 2030 are derived by Mundie & Associates, based on linear interpolations of water customer projections, except for the 2020 San Francisco projection, which is included in the Retail Demand Study (Hannaford and Hydroconsult, 2004).

d CWS – South San Francisco District (Colma, parts of Daly City and South San Francisco, plus unincorporated areas) UWMP projection for 2020 is 64,050, and Westborough Water District (which serves part of South San Francisco) UWMP projection for 2020 is 14,150; the CWS-South San Francisco water customer projection for 2020 is 56,006 and the Westborough Water District water customer projection is the same as its UWMP projection (14,150).

TABLE E.3.34 (Continued)
COMPARISON OF GENERAL PLAN POPULATION PROJECTIONS TO ABAG PROJECTIONS 2005, UWMPS, AND WATER CUSTOMER DEMAND PROJECTIONS FOR GENERAL PLAN PROJECTION YEAR

[e] Figures shown are for Estero MID (Foster City and part of San Mateo).
[f] Mid-Peninsula Water District (Belmont, part of San Carlos, and portions of unincorporated San Mateo County) UWMP projection for 2010 is 26,130; water customer projection is 26,925.
[g] Figures shown are for the City of Menlo Park water agency, which serves part of Menlo Park (less than half of the city's population).
[h] CWS – Mid-Peninsula District (parts of the cities of San Mateo and San Carlos plus unincorporated areas) UWMP projection for 2010 is 129,070; water customer projection is 126,746. Part of San Mateo is served by Estero MID.
[i] CWS – Bear Gulch District (Atherton, parts of Menlo Park, Portola Valley, and Woodside, plus unincorporated areas) UWMP projection for 2020 is 57,730; water customer projection for 2020 is 71,125.
[j] Figures shown are for City of Daly City water agency, which serves part of Daly City.
[k] Alameda County Water District (cities of Fremont, Newark, and Union City) projection is 358,066 in 2020.
[l] Based on Milpitas General Plan adjusted to include 5,000 housing units added by the Midtown Milpitas Specific Plan.
[m] Figure shown is for City of Redwood City water agency, which also serves part of the City of San Carlos, part of the Town of Woodside, and portions of unincorporated San Mateo County.
[n] Figure is for Household Population in 2020 as shown in the Retail Demand Study (Hannaford and Hydroconsult, 2004)
[o] Purissima Water District (part of Los Altos Hills and some unincorporated areas) water customer projection is 6,763.
[p] Los Trancos County Water District was acquired by CWS in 2006, and is now part of the CWS – Bear Gulch District. Because it was a separate entity when these projections were prepared, it is presented separately in this analysis.
[q] CWS – Bear Gulch District (Atherton, parts of Menlo Park, Portola Valley, and Woodside, plus unincorporated areas) UWMP projection for 2030 is 59,220; water customer projection is 73,719 (excluding Los Trancos).

SOURCES: ABAG, 2004; ACWD, 2005; CWS-Mid-Peninsula, 2005 ;CWS-South San Francisco, 2006; Carrington, 2006; City and County of San Francisco, 2004; City of Belmont, 2002; City of Burlingame, 2002a; City of Burlingame, 2005; City of Daly City, 2004; City of Daly City, 2005; City of East Palo Alto, 1999; City of East Palo Alto, 2006; City of Foster City, 2001; City of Fremont, 2003; City of Half Moon Bay, 1993; City of Hayward, 2002; City of Hayward, 2005; City of Menlo Park, 1994; City of Menlo Park, 2006; City of Millbrae, 1998; City of Millbrae, 2005; City of Milpitas, 2002b, City of Milpitas, 2005; City of Mountain View, 2002; City of Mountain View, 2005; City of Newark, 2002; City of Palo Alto, 1998; City of Palo Alto, 2005; City of Redwood City, 2005; City of Redwood City, 2007; City of San Bruno, 2003; City of San Bruno, 2007; City of San Mateo, 2001; City of Santa Clara, 2002; City of Santa Clara, 2005; City of South San Francisco, 2002; City of Sunnyvale, 2002; City of Sunnyvale, 2005; City of Union City, 2002; Coastside County Water District, 2005; Estero MID, 2005; Hannaford and Hydroconsult, 2004; Mid-Peninsula Water District, 2006; SFPUC, 2005; Town of Atherton, 2002; Town of Colma, 1999; Town of Hillsborough, 2002; URS, 2004, Westborough Water District, 2005.

Tables E.3.35 and **E.3.36** provide a different comparison of the projections published by the various water customers, local general purpose governments, and ABAG: instead of focusing on the most distant future year of general plan projections, they focus on employment and population forecasts for 2030.

In just over half of the cases for which direct comparisons are available (11 of 20), Table E.3.35 shows that water customer projections of employment in 2030 exceed *Projections 2005* employment in that year. As previously noted (regarding Table 3.33) this result is expected because most of the water customer projections are based on extensions of *Projections 2002*, which anticipated higher overall employment in 2025 (that projection's horizon year) than does *Projections 2005* (for a comparison, see Table E.3.31). In some cases, too, the water customer encompasses a greater area than the city.

In most cases, Table E.3.36 shows that water customer projections of population in 2030 are smaller than the *Projections 2005* estimates for that year. This result is also expected: because most of the customer projections are based on *Projections 2002*, they do not incorporate ABAG's smart growth assumptions, which include increased housing production (and, consequently, population) after about 2010.

TABLE E.3.35
COMPARISON OF GENERAL PLAN EMPLOYMENT PROJECTIONS TO ABAG *PROJECTIONS 2005*, UWMPS, AND WATER CUSTOMER DEMAND PROJECTIONS FOR 2030

	General Plan Employment Projection	UWMP Employment in 2030	SFUC Water Customer Employment Projection for 2030	*Projections 2005* Employment in 2030
Cities with GP Employment Projections for 2010				
East Palo Alto	5,940		8,673	6,110
Foster City	18,760		see note b	21,110
Menlo Park	17,900		13,287[c,d]	43,700
Milpitas	65,200		76,129	68,940
Mountain View	84,810		95,669[e]	81,110
Palo Alto	98,500	114,224	114,224	117,090
San Mateo	67,628		see notes b,f	70,780
Santa Clara	151,280		177,027	152,670
Cities with GP Employment Projections for 2015				
Millbrae	12,006		8,009	9,960
Cities with GP Employment Projections for 2020				
Atherton	3,840		see note d	3,710
Colma	2,080		see note g	4,570
Daly City	34,260	34,000	33,981[k,g]	29,830
Fremont	130,530		see note a	160,410
Newark	26,560		see note a	24,960
San Bruno	19,180		25,770[o]	28,400
San Francisco	745,600	795,400	795,400	829,090
South San Francisco+Westborough Water District	71,400		63,975[g]	56,080
Sunnyvale	152,730		168,950	123,020
Union City	20,710		see note a	44,000
Cities with GP Employment Projections for 2025				
Hayward	108,830		113,843	100,430
Hillsborough	1,360		1,380[h]	2,030
Cities with GP Employment Projections for Years Prior to 2005 or No Applicable GP Employment Projection				
Belmont			22,221[i]	14,070
Brisbane+Guadalupe Valley MID			25,243	20,420
Burlingame			36,160[j]	33,370
Half Moon Bay			6,795[l]	8,490[p]
Los Altos Hills			see note m	1,780
Pacifica			7,478	7,670
Portola Valley			see notes d,n	2,720
Redwood City		69,980	83,678	76,550
San Carlos			see note f	26,930
San Jose (North)			3,353	
Stanford University			see note q	see note q
Woodside			see note d	3,400

a Alameda County Water District (cities of Fremont, Newark, and Union City) projection for 2030 is 221,858.
b Estero MID (Foster City and part of San Mateo) projection for 2030 is 31,840.
c Figure shown is for the portion of Menlo Park (less than half of the city's population) served by the SFPUC wholesale customer, the City of Menlo Park Water Agency).
d CWS – Bear Gulch District (Atherton, parts of Menlo Park, Portola Valley, and Woodside, plus unincorporated areas) projection for 2030 is 47,774.
e Figure shown is for the City of Mountain View Water Agency, which serves most of Mountain View.
f CWS – Mid-Peninsula District (parts of the cities of San Mateo and San Carlos plus unincorporated areas) projection for 2030 is 100,568.
g Figure shown is for CWS – South San Francisco District (Colma, parts of Daly City and South San Francisco, plus unincorporated areas) and Westborough Water District combined.
h Figure shown is for the Town of Hillsborough Water Agency, which also serves some unincorporated area.
i Figure shown is for the Mid-Peninsula Water District, which also serves a portion of San Carlos and some unincorporated areas.
j Figure shown is for the City of Burlingame Water Agency, which also serves some unincorporated area.
k Figure shown is for the portion of Daly City served by the City of Daly City Water Agency.
l Figure shown is for the Coastside County Water District, which also serves unincorporated Half Moon Bay.
m Purissima Hills Water District (part of Los Altos Hills and some unincorporated area) projection for 2030 is 457.
n A portion of Portola Valley is in the Los Trancos County Water District, has no nonresidential accounts. (Los Trancos was acquired by CWS in 2006, and is now part of the CWS – Bear Gulch District.)
o Figure shown is for the City of San Bruno Water Agency, which also serves some unincorporated areas.
p Includes ABAG's "unincorporated Half Moon Bay."
q Employment projections were not provided for Stanford because it uses other parameters to forecast growth in non-residential accounts.

SOURCES: Same as sources for Table E.3.33.

TABLE E.3.36
COMPARISON OF GENERAL PLAN POPULATION PROJECTIONS TO ABAG *PROJECTIONS 2005*, UWMPS, AND WATER CUSTOMER DEMAND PROJECTIONS FOR 2030

	General Plan Population Projection	UWMP Population in 2030	SFPUC Water Customer Population Projection for 2030	*Projections 2005* Population in 2030
Cities with GP Population Projections for 2005				
Colma	1,285	see note a	see note a	1,860
Cities with GP Population Projections for 2010				
Belmont	27,800	see note c	see note c	28,800
Burlingame	31,500	31,900	34,967[d]	31,900
Foster City	30,803	40,866	40,096[b]	32,500
Menlo Park	35,285	11,218[e,f]	13,655[e,f]	41,100
Mountain View	75,200	81,700[g]	81,670[g]	89,600
Palo Alto	62,880	69,199	69,199	92,200
San Mateo	100,700	see note h	see note b,h	119,800
Santa Clara	129,900	140,698	140,698	142,100
Cities with GP Population Projections for 2015				
Millbrae	24,860	24,200	25,174	24,500
Cities with GP Population Projections for 2020				
Atherton	8,400	see note f	see note f	8,200
Daly City	113,000[i]	115,651 [j,k]	115,651[j,k]	127,200
East Palo Alto	34,600	32,712	32,712	43,600
Fremont	229,213	257,100	see note l	257,200
Half Moon Bay (incl. uninc. area)	21,065	24,973[m]	24,973[m]	27,100
Milpitas	94,400[n]	91,400	88,841	91,400
Newark	49,800	53,500	see note l	53,400
Redwood City	87,100	93,329 [o]	93,535 [o]	122,300
San Bruno	46,400	see note p	48,229[q]	50,700
San Francisco	811,100	871,000	849,942	924,600
South San Francisco+Westborough Water District	67,400	83,450[r]	73,884[r]	71,800
Sunnyvale	154,600	159,100	151,610	159,100
Union City	80,100	95,300	see note l	94,100
Cities with GP Population Projections for 2025				
Hayward	160,300	162,800	162,757	171,500
Hillsborough	11,800		12,708[s]	11,800
Cities with GP Population Projections for Years Prior to 2005 or No Applicable GP Population Projection				
Brisbane + Guadalupe Valley MID		n.a.	6,164	5,240
Los Altos Hills		n.a.	see note t	10,700
Los Trancos Valley Water Dist.[u]		n.a.	1,094[v]	
Pacifica		42,100	47,829	42,200
Portola Valley		n.a.	see notes f,w	7,800
San Carlos		see note h	see note h	35,200
Stanford University			27,924	n.a.
Woodside			see note f	7,300

a CWS – South San Francisco District (Colma, parts of Daly City and South San Francisco, plus unincorporated areas) UWMP projection for 2030 is 60,150; water customer projection for 2030 is 59,584.
b Estero MID (Foster City and part of San Mateo) projection for 2030 is 40,096.
c Mid-Peninsula Water District (Belmont, part of San Carlos, and portions of unincorporated San Mateo County) UWMP projection for 2030 is 28,930; water customer projection is 27,997.
d Figure shown is for the City of Burlingame Water Agency, which also serves some unincorporated area.
e Figure shown is for the portion of Menlo Park (less than half of the city's population) served by the City of Menlo Park Water Agency.
f CWS – Bear Gulch District (Atherton, parts of Menlo Park, Portola Valley, and Woodside, plus unincorporated areas) projection for 2030 is 73,719; UWMP population projection is 59,220 in 2030.
g Figure shown is for the City of Mountain View Water Agency, which serves most of Mountain View.
h CWS – Mid-Peninsula District (parts of the cities of San Mateo and San Carlos plus unincorporated areas) water customer population projection for 2030 is 139,834; UWMP population projection for 2030 is 134,010.
i The Housing Element of the Daly City General Plan projects this population within the city limits and a population of 120,000 within the (planning) area that corresponds to the ABAG subregional study area.
j Figure shown is for the portion of Daly City served by the City of Daly City Water Agency.
k Parts of Daly City and South San Francisco are served by CWS – South San Francisco District.
l Alameda County Water District (cities of Fremont, Newark, and Union City) projection for 2030 is 379,931.
m Figure shown is for the Coastside County Water District, which also serves unincorporated Half Moon Bay.
n Based on Milpitas General Plan adjusted to include 5,000 housing units added by the Midtown Milpitas Specific Plan (Carrington, 2006).
o Figure shown is for City of Redwood City Water Agency, which also serves part of the City of San Carlos, part of the Town of Woodside, and portions of unincorporated San Mateo County.
p San Bruno UWMP (City of San Bruno,2007) shows two population projections for 2030: 50,700, based on ABAG's *Projections 2005*, and 48,229, based on the City's Adjusted Draft General Plan.
q Figure shown is for the City of San Bruno Water Agency, which also serves some unincorporated areas.
r Figures shown are for the CWS – South San Francisco District plus Westborough Water District. For the Westborough Water District, the water customer projection is the same as the UWMP projection.
s Figure shown is for the Town of Hillsborough Water Agency, which also serves some unincorporated area.
t Purissima Hills Water District, (part of Los Altos Hills and some unincorporated area) projection is 6,763.
u Los Trancos County Water District was acquired by CWS in 2006, and is now part of the CWS – Bear Gulch District. Because it was a separate entity when these projections were prepared, it is presented separately in this analysis.
v Includes a portion of Portola Valley.
w Portola Valley is served by CWS – Bear Gulch District; a portion of the city was previously served by the Los Trancos County Water District, which is now part of CWS – Bear Gulch.

SOURCE: See sources for Table E.3.34.

Summary: Comparison of Employment and Population Projections to Water Demand Projections

The review of employment and population projections presented above traces the evolution of ABAG's projections for Bay Area counties and communities from *Projections 2002*, which provided the basis for most water customer forecasts of future demand for water, through *Projections 2003*, which applied smart growth principles to the forecasts, and *Projections 2005*, which updated the smart growth-based forecasts. As shown in Tables E.3.31 and E.3.32, ABAG's projections of both employment and population were greater with *Projections 2003* than with *Projections 2002*. *Projections 2005* anticipated less total employment and population in 2030 than *Projections 2003*, but more in 2025 than *Projections 2002*. The downward adjustments of employment between *Projections 2003* and *Projections 2005* reflect improved understanding of the magnitude of job losses in the early 2000s: although *Projections 2005* anticipates more employment growth between 2005 and 2030 than did *Projections 2003*, the increased growth does not make up for the adjusted starting point.

Tables E.3.37 and **E.3.38** provide final comparisons: they compare the percentage increases in employment and population to the expected percentage increase in water demand in each water customer service area. Table E.3.37 compares increased water demand to the employment and population forecasts in ABAG's *Projections 2005*, while Table E.3.38 compares increased water demand to employment and population forecasts used by the customers themselves.

There are two critical differences between Table E.3.37 and E.3.38: (1) in Table E.3.37, the geographic areas covered by the ABAG projections on the one hand and the customers' projections of water demand on the other are not congruent, and distortions in area may distort the comparisons of percentage change (see **Tables E.3.A.1** and **E.3.A.2** for the correspondence between ABAG areas used in the table and water customer service areas), and (2) the water customers' projections are based primarily on *Projections 2002*. If the greatest proportion of water demand is associated with population (rather than employment), then the water demand projections are likely to be lower than forecasts based on *Projections 2005* (see text above).

Table E.3.37 indicates that, with only two exceptions, the percentage increases in water demand forecast by the water customers are smaller than the percentage changes in population and employment anticipated by *Projections 2005*. The exceptions are:

- *Hayward*: the water customer forecast shows a 38 percent increase in water demand; *Projections 2005* shows a 34 percent increase in employment and a 17 percent increase in population.

- *Purissima Hills Water District*: the water customer forecast shows an increase of 38 percent in water demand; *Projections 2005* anticipates increases of about 8 percent in both employment and population. Note, however, that (1) the water district includes some unincorporated areas that are not captured in the ABAG figures reported here, and (2) the district is quite small, with district-estimated employment of about 400 and population of about 6,000 in 2001.

TABLE E.3.37
COMPARISON OF INCREASES IN EMPLOYMENT AND POPULATION TO EXPECTED INCREASES IN DEMAND
(*PROJECTIONS 2005* ESTIMATES OF EMPLOYMENT AND POPULATION)

Customer/Jurisdiction	% Change in:		Change in Demand			Projected % of Total Demand in 2030
	Employment	Population	2005 (MGD)	2030 (MGD)	% Change	
Alameda County						
Alameda County Water District	66.7%	23.8%	53.20	59.30	11.5%	14.2%
Hayward/Hayward	34.0%	16.7%	20.80	28.70	38.0%	6.9%
Santa Clara County						
Milpitas/Milpitas	35.2%	39.5%	13.00	17.70	36.2%	4.2%
Mountain View/Mountain View (most)	42.0%	24.4%	13.40	14.80	10.4%	3.6%
Palo Alto/Palo Alto	17.9%	24.6%	14.50	14.36	-1.0%	3.4%
Purissima Hills Water District	7.9%	8.1%	2.40	3.30	37.5%	0.8%
San Jose (North)	na	na	5.40	6.50	20.4%	1.6%
Santa Clara/Santa Clara	38.8%	30.7%	28.00	33.90	21.1%	8.1%
Stanford University/(part of Palo Alto)	na	na	4.30	6.80	58.1%	1.6%
Sunnyvale/Sunnyvale	65.0%	19.6%	25.00	26.80	7.2%	6.4%
San Mateo County						
Brisbane/Brisbane (part)	149.0%	39.7%	0.50	0.93	86.0%	0.2%
Guadalupe Valley MID/Brisbane (part)			0.39	0.81	107.7%	0.2%
Burlingame	46.0%	8.5%	4.80	4.90	2.1%	1.2%
CWS – Bear Gulch District	na	na	13.50	13.90	3.0%	3.3%
CWS – Mid Peninsula District	54.9%	20.5%	17.50	18.10	3.4%	4.3%
CWS – South San Francisco District	35.5%	17.8%	9.00	9.90	10.0%	2.4%
Coastside County Water District	12.6%	13.4%	2.70	3.20	18.5%	0.8%
Daly City/Daly City	65.9%	16.3%	8.70	9.10	4.6%	2.2%
East Palo Alto/East Palo Alto	186.9%	33.3%	2.60	4.80	84.6%	1.2%
Estero MID	48.8%	9.1%	6.00	6.80	13.3%	1.6%
Hillsborough	22.3%	7.3%	3.70	3.90	5.4%	0.9%
Los Trancos County Water District/ Portola Valley (part)[a]	na	na	0.11	0.14	27.3%	0.0%
Menlo Park/Menlo Park (part)	52.0%	16.4%	4.10	4.70	14.6%	1.1%
Mid-Peninsula Water District	71.8%	12.9%	3.70	3.80	2.7%	0.9%
Millbrae/Millbrae	45.2%	15.6%	3.30	3.30	0.0%	0.8%
North Coast County Water District/Pacifica	24.3%	9.3%	3.70	3.80	2.7%	0.9%
Redwood City	39.1%	20.3%	12.10	13.40	10.7%	3.2%
San Bruno	104.2%	21.6%	4.20	4.50	7.1%	1.1%
Skyline County Water District	na	na	0.19	0.31	63.2%	0.1%
Westborough Water District/ South San Francisco (part)	na	na	1.01	1.03	2.0%	0.2%
Total, Wholesale Service Area	**46.8%**	**21.1%**	**281.80**	**323.82**	**14.9%**	**77.6%**
SFPUC Retail Service Area/San Francisco	**44.0%**	**15.9%**	**92.40**	**93.40**	**1.1%**	**22.4%**
TOTAL	**45.7%**	**19.4%**	**374.20**	**417.22**	**11.5%**	**100.0%**

[a] Los Trancos County Water District was acquired by CWS in 2006, and is now part of the CWS – Bear Gulch District. Because it was a separate entity when these projections were prepared, it is presented separately in this analysis.

SOURCES: ABAG, 2004, URS, 2004, Hannaford and Hydroconsult, 2004; Westborough Water District, 2005

TABLE E.3.38
COMPARISON OF INCREASES IN EMPLOYMENT AND POPULATION TO EXPECTED INCREASES IN DEMAND (WATER CUSTOMER ESTIMATES OF EMPLOYMENT AND POPULATION)[a]

Customer/Jurisdiction	% Change in:		Change in Demand			Projected % of Total Demand in 2030
	Employ-ment (2005-2030)	Population (2005-2030)	2005 (MGD)	2030 (MGD)	% Change	
Alameda County						
Alameda County Water District	37.9%	16.8%	53.2	59.3	11.5%	14.2%
Hayward/Hayward	25.0%	13.4%	20.8	28.7	38.0%	6.9%
Santa Clara County						
Milpitas/Milpitas	34.3%	33.9%	13	17.7	36.2%	4.2%
Mountain View/Mountain View (most)	22.0%	12.5%	13.4	14.8	10.4%	3.6%
Palo Alto/Palo Alto	7.1%	13.0%	14.5	14.36	1.0%	3.4%
Purissima Hills Water District	7.5%	10.3%	2.4	3.3	37.5%	0.8%
San Jose (North)	28.1%	19.5%	5.4	6.5	20.4%	1.6%
Santa Clara/Santa Clara	23.3%	28.7%	28	33.9	21.1%	8.1%
Stanford University/(part of Palo Alto)	na	33.8%	4.3	6.8	58.1%	1.6%
Sunnyvale/Sunnyvale	28.5%	13.0%	25	26.8	7.2%	6.4%
San Mateo County						
Brisbane/Brisbane (part)	228.1%	36.6%	0.5	0.93	86.0%	0.2%
Burlingame	13.4%	13.5%	4.8	4.9	2.1%	1.2%
CWS – Bear Gulch District	9.6%	9.6%	13.5	13.9	3.0%	3.3%
CWS – Mid Peninsula District	22.0%	13.3%	17.5	18.1	3.4%	4.3%
CWS – South San Francisco District	22.0%	17.7%	9	9.9	10.0%	2.4%
Coastside County Water District	21.5%	29.8%	2.7	3.2	18.5%	0.8%
Daly City/Daly City	21.7%	7.7%	8.7	9.1	4.6%	2.2%
East Palo Alto/East Palo Alto	115.1%	28.1%	2.6	4.8	84.6%	1.2%
Estero MID	25.6%	13.5%	6	6.8	13.3%	1.6%
Guadalupe Valley MID/Brisbane (part)	22.9%	159.9%	0.39	0.81	107.7%	0.2%
Hillsborough	11.4%	8.0%	3.7	3.9	5.4%	0.9%
Los Trancos County Water District/ Portola Valley (part)[b]	na	38.7%	0.11	0.14	27.3%	0.0%
Menlo Park/Menlo Park (part)	26.6%	10.5%	4.1	4.7	14.6%	1.1%
Mid-Peninsula Water District	41.2%	5.0%	3.7	3.8	2.7%	0.9%
Millbrae/Millbrae	16.9%	14.6%	3.3	3.3	0.0%	0.8%
North Coast County Water District/Pacifica	24.0%	15.3%	3.7	3.8	2.7%	0.9%
Redwood City	21.7%	12.0%	12.1	13.4	10.7%	3.2%
San Bruno	44.1%	15.5%	4.2	4.5	7.1%	1.1%
Skyline County Water District	na	89.9%	0.19	0.31	63.2%	0.1%
Westborough Water District/ South San Francisco (part)[c]	1.3%	8.7%	1.01	1.03	2.0%	0.2%
Total, Wholesale Service Area	**25.8%**	**16.1%**	**281.8**	**323.8**	**14.9%**	**77.6%**
SFPUC Retail Service Area/ San Francisco	**21.2%**	**10.0%**	**92.4**	**93.4**	**1.1%**	**22.4%**
TOTAL	**24.2%**	**14.2%**	**374.2**	**417.2**	**11.5%**	**100.0%**

[a] Includes only those portions of each county served by SFPUC wholesale water customers or served directly by the SFPUC (San Francisco County).
[b] Los Trancos County Water District was acquired by CWS in 2006, and is now part of the CWS – Bear Gulch District. Because it was a separate entity when these projections were prepared, it is presented separately in this analysis.
[c] Population estimates from the Westborough Water District's 2005 Urban Water Management Plan.

SOURCES: URS, 2004; Hannaford and Hydroconsult, 2004; Westborough Water District, 2005

The figures in Table E.3.38 indicate that, with only a few exceptions, the water customers themselves anticipate smaller increases in water demand than they do in employment and population. This relationship between water demand and employment/population growth reflect that other factors also influence the rate of water consumption. These factors could include changes in land use patterns such as higher-density development that results in less open landscaped area, shifts toward landscaping with drought-tolerate plants, and the effects of plumbing codes that require low-flow appliances in all new development and fixture replacement over time in existing homes and businesses. As a result of these types of changes, the rate of increase in water demand is lower than the rate of increase in population and employment.

In three cases, the water customer's forecast of the percentage increase in water demand exceeds its forecasts of the percentage increases in *both* employment *and* population:

- *Hayward*: the forecast shows an increase of 38 percent in water demand, compared to 25 percent in employment and 13 percent in population.
- *Milpitas*: the forecast shows an increase of 36 percent in water demand, compared to 34 percent in employment and 34 percent in population.
- *Purissima Hills*: the forecast shows an increase of 38 percent in water demand, compared to 8 percent in employment and 10 percent in population.

All three customers anticipate growth in a new category of high-water-use residential accounts associated with development of larger residences with larger landscaped areas and substantially higher water usage than older residences. Hayward also expects growth in renovated single family residences, commercial, and industrial accounts that will have higher water usage than existing accounts in those categories. Milpitas anticipates growth of high water uses commercial accounts. Milpitas also expects to increase the use of recycled water which offset some of the increase in its future demand.

In three other cases, the water customer's forecast of the percentage increase in water demand exceeds its forecasts of the percentage increases in *either* employment *or* population:

- *Brisbane*: the forecast shows an increase of 86 percent in water demand, compared to 228 percent in employment but only 37 percent in population.
- *Guadalupe Valley MID*: the forecast shows an increase of 108 percent in water demand, compared to 23 percent in employment but 160 percent in population.
- *Menlo Park*: the forecast shows an increase of 15 percent in water demand, compared to 27 percent in employment but only 11 percent in population.
- *San Jose*: the forecast shows an increase of 20 percent in water demand, compared to 28 percent in employment but only 20 percent in population.

ATTACHMENT E.3.A

Table E.3.A.1 establishes a correspondence between the boundaries of wholesale customers in Alameda, Santa Clara, and San Mateo Counties and the jurisdictions/areas for which ABAG publishes population and employment projections. Table E.3.A.2 assigns jurisdictions to the respective water districts.

TABLE E.3.A.1
COMPARISON OF WHOLESALE CUSTOMER BOUNDARIES AND BOUNDARIES OF ABAG PROJECTION AREAS

Customer	County	ABAG Jurisdiction(s)	
Alameda County Water District	Alameda	Fremont	Union City
		Newark	
Brisbane	San Mateo	Brisbane (part)	
Burlingame	San Mateo	Burlingame	
		(Non-segregable) Unincorporated areas	
Coastside County Water District	San Mateo	Half Moon Bay	
		Unincorporated Half Moon Bay	
CWS - Bear Gulch District	San Mateo	Atherton	Portola Valley (part)
		Menlo Park (part)	Woodside (part)
		(Non-segregable) Unincorporated areas	
CWS - Mid Peninsula District	San Mateo	San Carlos (part)	San Mateo (part)
		(Non-segregable) Unincorporated areas	
CWS - South San Francisco District	San Mateo	Colma	South San Francisco (part)
		Daly City (part)	
		(Non-segregable) Unincorporated areas	
Daly City	San Mateo	Daly City	
East Palo Alto	San Mateo	East Palo Alto	
Estero MID	San Mateo	Foster City	San Mateo (part)
Guadalupe Valley MID	San Mateo	Brisbane (part)	
Hayward	Alameda	Hayward	
Hillsborough	San Mateo	Hillsborough	
		(Non-segregable) Unincorporated areas	
Los Trancos County Water District[a]	San Mateo	Portola Valley (part)	
Menlo Park	San Mateo	Menlo Park (part)	
Mid-Peninsula Water District	San Mateo	Belmont	San Carlos (part)
		(Non-segregable) Unincorporated areas	
Millbrae	San Mateo	Millbrae	
Milpitas	Santa Clara	Milpitas	
Mountain View	Santa Clara	Mountain View (most)	
North Coast County Water District	San Mateo	Pacifica	
Palo Alto	Santa Clara	Palo Alto	
Purissima Hills Water District	Santa Clara	Los Altos Hills	
		(Non-segregable) Unincorporated areas	
Redwood City	San Mateo	Redwood City	Woodside (part)
		San Carlos (part)	
		(Non-segregable) Unincorporated areas	
San Bruno	San Mateo	San Bruno	
		(Non-segregable) Unincorporated areas	
San Jose	Santa Clara	North San Jose/Alviso	
Santa Clara	Santa Clara	Santa Clara	
Skyline County Water District	San Mateo	Woodside (part)	
		(Non-segregable) Unincorporated areas	
Stanford University	Santa Clara	(part of Palo Alto)	
Sunnyvale	Santa Clara	Sunnyvale	
Westborough Water District	San Mateo	South San Francisco (part)	

[a] Los Trancos County Water District was acquired by CWS in 2006, and is now part of the CWS – Bear Gulch District. Because it was a separate entity when these projections were prepared, it is presented separately in this analysis.

TABLE E.3.A.2
CORRESPONDENCE OF ABAG JURISDICTIONS WITH WHOLESALE CUSTOMER WATER CUSTOMERS

Wholesale Water Customers	Corresponding Jurisdiction(s)
Alameda County Water District	Fremont, Newark, Union City
Brisbane Guadalupe Valley MID	Brisbane
Burlingame[a]	Burlingame
Coastside County Water District	Half Moon Bay, unincorporated HMB
CWS - Bear Gulch District[a,b] Los Trancos County Water District[n] Skyline County Water District	Atherton, Portola Valley, Woodside[l]
CWS - Mid Peninsula District[a]	San Carlos, San Mateo[j]
CWS - South San Francisco District[a,c] Westborough Water District[h]	Colma, South San Francisco[m]
Daly City[i]	Daly City
East Palo Alto	East Palo Alto
Estero MID[d]	Foster City
Hayward	Hayward
Hillsborough[a]	Hillsborough
Menlo Park	Menlo Park[k]
Mid-Peninsula Water District[a,e]	Belmont
Millbrae	Millbrae
Milpitas	Milpitas
Mountain View	Mountain View
North Coast County Water District	Pacifica
Palo Alto Stanford University	Palo Alto
Purissima Hills Water District[a]	Los Altos Hills
Redwood City[a,f]	Redwood City
San Bruno[a]	San Bruno
San Jose[g]	(None)
Santa Clara	Santa Clara
Sunnyvale	Sunnyvale

[a] Correspondence excludes non-segregable unincorporated areas that are not included in the ABAG definition of the jurisdiction.
[b] Portion of Menlo Park served by CWS – Bear Gulch District assigned to Menlo Park.
[c] Portion of Daly City served by CWS – South San Francisco District assigned to Daly City.
[d] Portion of San Mateo served by Estero MID assigned to San Mateo.
[e] Portion of San Carlos served by Mid-Peninsula Water District assigned to CWS – Mid-Peninsula District.
[f] Portion of San Carlos served by Redwood City assigned to CWS – Mid-Peninsula District; portion of Woodside served by Redwood City assigned to CWS – Bear Gulch District.
[g] Portion of North San Jose/Alviso served by San Jose Water District is not assigned.
[h] Portion of South San Francisco served by Westborough Water District assigned to CWS – South San Francisco District.
[i] Includes portion of Daly City served by CWS – South San Francisco District.
[j] Includes portions of San Carlos served by Mid-Peninsula Water District and Redwood City.
[k] Includes portions of Menlo Park served by CWS – Bear Gulch District
[l] Includes portion of Portola Valley served by Los Trancos Water District (now a part of CWS – Bear Gulch District) and portions of Woodside served by Redwood City and Skyline County Water District.
[m] Includes portion of South San Francisco served by Westborough Water District.
[n] Los Trancos County Water District was acquired by CWS in 2006, and is now part of the CWS – Bear Gulch District. Because it was a separate entity when these projections were prepared, it is presented separately in this analysis.

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APPENDIX E.4
Growth Trends and Policies of a Selection of Jurisdictions

To supplement information on forecasted population and employment growth presented in PEIR Chapter 7 and provide a more in-depth understanding of service area growth trends, this appendix takes a more detailed look at the growth trends and policies of San Francisco and a selection of jurisdictions (and a university) served by wholesale customers. A selection of jurisdictions served by wholesale customers in each county of the wholesale service area are included. These jurisdictions represent a range of sizes and include, but are not limited to, the largest city (San Francisco), some of the other larger cities in the wholesale service area, and some of the cities projecting relatively substantial increases in water demand in 2030. in each county of the wholesale service area.

Summaries of growth trends and policies are presented for the jurisdictions and university listed below. The profiles are based primarily on information in BAWSCA agency profiles (BAWSCA, 2005), the general plans of the respective jurisdictions, and contacts with city planning departments. The population of each jurisdiction from Census 2000 (U.S. Census Bureau, 2000), and population estimates for 2005 and 2006 from the U.S. Census Bureau, ABAG, and the California Department of Finance (DOF) (U.S. Census Bureau, 2006; ABAG, 2004; California Department of Finance 2006) are included to provide a sense of recent growth.

- Alameda County: Fremont, Newark, Union City, and Hayward
- Santa Clara County: Milpitas, Santa Clara, Stanford University, and Sunnyvale
- San Mateo County: East Palo Alto, Redwood City, San Mateo, and South San Francisco
- San Francisco (City and County)

E.4.1 Alameda County

Fremont

Overview

Fremont is bordered by San Francisco Bay to the west, the foothills and mountains of the Diablo Range to the east, Union City and Hayward to the north, and Milpitas and San Jose to the south (refer to Figure 7.2 in PEIR Chapter 7). Fremont also borders—and encircles—the city of Newark. According to the Fremont General Plan (adopted in 1991[1]), the city's land use mix

[1] Updated land use and housing elements, also cited herein, were a adopted in 2003.

consists of approximately 29 percent single-family and multifamily residences, 3 percent retail/commercial space, 13 percent industrial space, and 55 percent open space[2] (City of Fremont, 1991).

Water Service

Fremont is served by the Alameda County Water District (ACWD), which also includes the cities of Newark and Union City. The ACWD service area encompasses approximately 103 square miles in southwestern Alameda County, on the east side of San Francisco Bay (refer to Figure 7.1 in PEIR Chapter 7). The ACWD serves a population of about 323,000 people, providing water to the cities of Fremont, Newark, and Union City. The ACWD consists primarily of single-family, owner-occupied homes. Residential accounts represent approximately 64 percent of ACWD's current total water demand; commercial and industrial accounts represent approximately 22 percent; and other uses and unaccounted-for water represent 7 and 8 percent of demand, respectively. According to the BAWSCA agency profile, the SFPUC supplies approximately 24 percent of the ACWD's water, while water from the State Water Project, local groundwater, and local surface water meet the remaining need (URS, 2004; BAWSCA, 2005).

Growth Trends and Policies

Fremont grew rapidly following its incorporation in 1956, with population increasing fourfold (to 100,000) by 1970. The population doubled again over the next three decades, to 203,413 in 2000 (City of Fremont, 2003a; U.S. Census Bureau, 2000). Population estimates since 2000 vary somewhat. The U.S. Census Bureau estimates Fremont's 2005 population to be 200,468, a 1.4 percent decrease, whereas the California DOF estimates Fremont's 2006 population to be 210,158, a 3.3 percent increase from 2000. These figures, ABAG estimates for 2005, and the buildout projections of the general plan are shown in **Table E.4.1**.

The Fremont Municipal Code does not include a growth ordinance per se, but the stated purposes of sections of the code governing subdivisions (Section 8-1101) and development agreements (Section 8-7101) include the promotion of orderly growth and development (City of Fremont, 2007).

The Fremont General Plan is a statement of the community's vision of its long-term or ultimate physical form and contains goals, policies, and programs intended to guide decision-making for future development in the city (City of Fremont, 1991). Goals related to growth management articulated in the 2003 Fremont General Plan Land Use Element include conservation of the city's open space resources (Goal LU 4) and protection of "sensitive hill face and uses in the remainder of the hill area" consistent with the area's character and environmental constraints (Goal LU 6). Buildout under the 1991 Fremont General Plan is expected to occur by 2010 and result in a total population of approximately 201,100 (less than the actual population in 2000) (City of Fremont, 1991). The more recent housing element (City of Fremont, 2003a) projects that the population will increase by 25,800 between 2000 and 2020 (i.e., from 203,413 to 229,213). The average household size is projected to be 3.17 in 2010 (City of Fremont, 2003b).

[2] Percentages derived from area information (acreage and square footage) provided in the Fremont General Plan.

TABLE E.4.1
CURRENT POPULATION ESTIMATES AND FORECASTS OF SELECT JURISDICTIONS

	Actual Population	Current Population Estimates			Forecasts				
City	U.S. Census 2000 Population	U.S. Census Estimated 2005 Population	ABAG *Projections 2005* Estimated 2005 Population	Department of Finance Estimated 2006 Population	General Plan Buildout (Year) and Population	ABAG *Projections 2005 Population* Projection for General Plan Buildout Year	Customer-Selected Population Projection for 2030	ABAG *Projections 2005 Population* Projection for 2030	Percent of Supply (after Conservation) from SFPUC
Alameda County									
ACWD[a]	312,753	311,600	326,900	325,396	(2020) 359,113	368,500	379,931	404,700	25%
Fremont	*203,413*	*200,468*	*211,100*	*210,158*	*(2020) 229,213*	*236,900*		*257,200*	
Newark[b]	*42,471*	*41,956*	*44,400*	*43,486*	*(2020) 49,800*	*49,000*		*53,400*	
Union City	*66,869*	*69,176*	*71,400*	*71,752*	*(2020) 80,100*	*82,600*		*94,100*	
Hayward	140,030	140,293	146,300	146,398	(2025) 160,300	165,900	162,757	171,500	100%
Santa Clara County									
Milpitas[c]	62,698	63,383	65,400	65,276	(2020) 94,400	82,400	88,841	91,400	48%
Santa Clara[d]	102,361	105,402	108,700	110,771	(2010) 129,900	117,400	140,698	142,100	15%
Sunnyvale	131,760	128,902	131,700	133,544	(2025) 154,600	146,900	151,610	159,100	46%
San Mateo County									
East Palo Alto	29,506	32,242	32,700	32,083	(2020) 34,600	39,600	32,712	43,600	100%
Redwood City[e]	75,402	73,114	77,300	76,087	(2020) 87,100	87,100	93,535	122,300	92%
San Mateo[f]	92,482	91,081	94,900	94,315	(2010) 100,700	98,000	See note f	119,800	100%
South San Francisco[g]	60,552	60,735	61,000	61,824	(2020) 67,400	68,500	73,884	71,800	See note g
City and County of San Francisco	776,733	739,426	798,000	798,680	(2020) 811,100	859,200	849,942	924,600	97%

[a] ACWD = Alameda County Water District; U.S. Census, ABAG, Department of Finance (DOF), and general plan figures are the combined estimates for Fremont, Newark and Union City.
[b] The Newark general plan projection shown is from the 2002 housing element. The general plan (adopted in 1992) projected a buildout population of 51,942 by the year 2007.
[c] The general plan population is based on the population shown in the general plan (77,100) plus the additional population accommodated by the Milpitas Midtown Specific Plan, as advised by Milpitas Planning Department staff (Carrington, 2006), to account for 5,000 additional units with an assumed density of 3.46 persons per unit (i.e., an added population of 17,300). The City has amended to general plan to incorporate the specific plan.
[d] The general plan figure for Santa Clara is the average of the range projected in the general plan at buildout of 124,800 to 135,000.
[e] The SFPUC provides 100 percent of Redwood City's potable water. The remaining 8 percent of demand indicated here is met by recycled water.
[f] The city of San Mateo is served by the CWS–Mid-Peninsula District and Estero MID, both of which serve other jurisdictions as well; therefore, the 2030 population assumed by the wholesale customers is not comparable to projections for the city. The SFPUC supplies all of the CWS–Mid Peninsula District's and Estero MID's water.
[g] The customer-selected projection is the combined 2030 estimates for the CWS–South San Francisco District (which also serves Colma and a small portion of unincorporated San Mateo County), based on the 2004 demand study, and the Westborough Water District, based on the district's 2005 UWMP. The SFPUC would supply approximately 85 percent of the CWS–South San Francisco District's water supply in 2030 and 100 percent of Westborough Water District's. The other figures are for South San Francisco only.

SOURCES: ABAG, 2004; California Department of Finance, 2006; Carrington, 2006; City of East Palo Alto, 1999a; City of Fremont, 2003a; City of Hayward, 2002a; City of Milpitas, 2002a; City of Newark, 2002; City of Redwood City, 2007c; City of San Mateo, 2001; City of Santa Clara, 2002; City of Sunnyvale, 2002; City of Union City, 2002a; U.S. Census Bureau, 2000; U.S. Census Bureau, 2006; URS, 2004, Westborough Water District, 2005.

Newark

Overview

Newark is bordered on all sides by the city of Fremont—to the north, east, and south by developed areas of Fremont, and to the west by salt ponds, wetlands, and other areas of the Fremont baylands (refer to Figure 7.2 in PEIR Chapter 7). According to the Newark General Plan, the city's land use mix consists primarily of residential neighborhoods, with several key commercial shopping areas and smaller neighborhood commercial areas, industrial uses located primarily along the western edge of the developed part of the city, and salt evaporation ponds and processing facilities on the extreme western side of the city(City of Newark, 1992a).

Water Service

Newark, along with Fremont and Union City, is served by the ACWD. Refer to the description of ACWD under Fremont water service, above.

Growth Trends and Policies

Newark grew most rapidly in the 1960s, with the population nearly tripling (from 9,911 in 1960 to 27,157 in 1970). The population growth continued at a somewhat lower rate in the ensuing decades, increasing by approximately 18 percent in the 1970s and 1980s and 12 percent in the 1990s (City of Newark, 2002). According to the U.S. Census, the city's population was 42,471 in 2000. Population estimates since 2000 vary somewhat. The U.S. Census Bureau estimates Newark's 2005 population to be 41,956, a 1.2 percent decrease, whereas the DOF estimates Newark's total population to be 43,486 as of January 1, 2006, a 2.4 percent increase from 2000 (see Table E.4.1).

Newark does not have an adopted growth management ordinance; policies contained within the general plan are intended in part to manage growth in the city (Slafter, 2005). The Newark General Plan (adopted in 1992) contains goals, policies, and programs intended to direct public and private decision-making and guide future growth and change within the city (City of Newark 1992a). The general plan identifies six study areas with the most potential for change, including areas along the city's western and southern boundaries as well as an "infill[3] area," where development would result from development of the few remaining vacant sites or change in the existing uses within urbanized Newark.

Buildout under the general plan is expected to occur in 2007 and result in a total population of approximately 51,942 (City of Newark, 1992b). The more recent (2002) housing element projects a population of 49,800 in 2020, as shown in Table E.4.1. The housing element cites ABAG projections that the city will grow by about 13.5 percent by 2010 and at a lower rate (approximately 3 percent) between 2010 and 2020, as sites for new development are depleted (City of Newark, 2002).

[3] "Infill" development generally refers to development of individual or small groups of vacant parcels that are surrounded by development.

Union City

Overview

Union City is bordered on the west by a salt marsh that is within the Hayward city limits, on the east by the foothills of the Diablo Range, on the north by Hayward, and on the south by Fremont (refer to Figure 7.2 in PEIR Chapter 7). The city's land use mix consists of approximately 18 percent residential uses, 3 percent commercial, 3 percent public/institutional, 58 percent agricultural and open space, and 9 percent vacant land or miscellaneous uses such as rights-of-way and canals (City of Union City, 2002b).

Water Service

Union City, along with Fremont and Newark, is served by the ACWD. Refer to the description of ACWD under Fremont water service, above.

Growth Trends and Policies

The city grew rapidly from the 1960s through the 1980s, from a population of approximately 7,000 in 1962 to 45,000 in 1983 (City of Union City, 2002c); growth continued through the 1990s, and in 2000 the city had a population of 66,869 according to the U.S. Census. Population estimates since 2000 vary somewhat. The U.S. Census Bureau estimates Union City's 2005 population to be 69,176, a 3.5 percent increase, whereas the DOF estimates Union City's total population to be 71,752 as of January 1, 2006, a 7.3 percent increase from 2000 (see Table E.4.1).

Union City does not have an adopted growth management ordinance. A prior growth management ordinance was revoked about 10 years ago, and since then the general plan has guided growth in the city (Leonard, 2005). The Union City General Plan (2002c) contains goals and policies to guide future development in the city. The general plan identifies several physical constraints that present challenges in planning for future growth, including sensitive wetland habitat near the city's western border, steep topography on the east side of the city, and limited available land. Infill development and redevelopment strategies are therefore identified as the primary means for accommodating future growth. The general plan identifies five business districts, which are generally underutilized or have obsolete uses, that can be redeveloped to help the city achieve housing and job growth goals (City of Union City, 2002c). Buildout under the general plan is expected to occur in 2020 and result in a total population of approximately 80,100 (City of Union City, 2002a).

Hayward

Overview

Hayward is located in western Alameda County, on the east side of San Francisco Bay (refer to Figure 7.2 in PEIR Chapter 7). The city encompasses approximately 61 square miles and is bordered on the west by the Bay, on the east by unincorporated Alameda County and the city of Pleasanton, on the south by Fremont and Union City, and on the north by the unincorporated

communities of San Lorenzo, Ashland, and Castro Valley, and by other unincorporated Alameda County lands.

Water Service

Hayward owns and operates its own water system (which is maintained and operated by the City's Public Works Department Utilities Division) and receives all of its water from the SFPUC. The Hayward water system serves the entire city, except for a small area in the northern part of the city that is served by the East Bay Municipal Utility District (EBMUD). The service area population was 144,500 as of 2005. Residential accounts represent approximately 57 percent of Hayward's current total water demand; commercial and industrial accounts represent about 34 percent; other uses represent 4 percent; and unaccounted-for water represents 5 percent (BAWSCA, 2005).

Growth Trends and Policies

Hayward grew rapidly in the 1950s with the opening of Interstate 580, from a population of 14,000 in 1950 to 72,000 in 1960. Industrial development surged in the 1960s and 1970s, and multifamily residential housing grew through the 1980s; by 1990, the city's population was 111,000. Residential development in the 1990s predominantly consisted of infill development in the form of single-family detached homes on smaller lots and, toward the end of the decade, townhouses or single-family attached units. Today, Hayward is highly urbanized. Although only about 50 percent of the total area within the city limits is in urban use, the remaining land is either baylands (marshes and salt ponds, 9 square miles), rangelands (5 square miles), or under water (within San Francisco Bay, 17 square miles) (City of Hayward, 2002a). Current land uses include 29 percent residential uses, 5 percent commercial, 14 percent industrial, 31 percent institutional, and 21 percent categorized as agricultural/rural, vacant, or other/unknown (City of Hayward, 2002b). According to the Census 2000, Hayward had a total population of 140,030 in 2000. Population estimates since 2000 vary somewhat. The U.S. Census Bureau estimates Hayward's 2005 population to be 140,293, a 0.2 percent increase, whereas the DOF estimated Hayward's total population to be 146,398 as of January 1, 2006, a 4.5 percent increase from 2000 (see Table E.4.1).

Hayward does not have an adopted growth management ordinance; policies contained within the general plan are intended in part to manage growth in the city (Rizk, 2005). The Hayward General Plan (adopted in 2002) serves as a policy guide for determining physical development in the city through 2025. The general plan includes policies that encourage the use of "smart growth" principals in long-range planning and development.[4] The City of Hayward expects continued growth through 2025, with the general plan guiding a gradual transition of certain areas from lower to higher density. Buildout under the general plan is expected to occur in 2025 and

[4] The general plan states that, while there is no universally accepted definition of smart growth, smart growth principles generally include those that would foster development that revitalizes central cities and suburbs, supports public transit, and preserves open space and agricultural lands by encouraging more infill development, more concentrated development, and more redevelopment, especially in areas served by transit or close to major employment centers (City of Hayward, 2002b).

result in a total population of approximately 160,300 for the city itself and 190,700 for the Hayward Planning Area, which includes the communities of Cherryland and Fairview (City of Hayward, 2002a). The general plan also includes a policy to evaluate annexing unincorporated islands[5] and adjoining urbanized county areas within Hayward's sphere of influence (City of Hayward, 2002a; City of Hayward, 2002b).

E.4.2 Santa Clara County

Milpitas

Overview

Milpitas occupies an area of about 13.6 square miles and is located southeast of the south end of San Francisco Bay in northern Santa Clara County (refer to Figure 7.2 in PEIR Chapter 7). It is bordered by Fremont on the north, the foothills of the Diablo Range on the east, and San Jose on the south and west.

Water Service

The City of Milpitas owns and operates its own water system; it receives approximately 65 percent of its water from the SFPUC and the rest from the Santa Clara Valley Water District (SCVWD). In general, residents receive SFPUC water, while the SCVWD primarily serves industrial and commercial areas. Residential accounts represent approximately 43 percent of the city's total water demand; commercial/industrial uses represent 29 percent; other uses account for 23 percent; and unaccounted-for water represents approximately 4 percent of total demand (BAWSCA, 2005). According to the Milpitas general plan, the city's land uses consist of approximately 25 percent residential, 4 percent commercial, 14 percent industrial, 17 percent public facilities and parks, 5 percent transportation facilities (e.g., major streets, freeways, and rail), and 35 percent undeveloped lands (City of Milpitas, 2002a).

Growth Trends and Policies

While the origins of the city of Milpitas go back to the latter part of the 18th century, most of the city has developed in the last 30 years. Between 1980 and 1990 the city grew at an average annual rate of 3 percent, from a 1980 population of 37,820 to 50,690, and between 1990 and 2000 at an average annual rate of 2.2 percent. The city's growth rate between 1980 and 2000 was roughly twice that of Santa Clara County as a whole (City of Milpitas, 2002a). The city's population in 2000 was 62,698 (Census 2000). Population estimates since 2000 vary somewhat. The U.S. Census Bureau estimates Milpitas's 2005 population to be 63,383, a 1.1 percent increase, whereas the DOF estimates Milpitas's total population to be 65,276 as of January 1, 2006, a 4.1 percent increase from 2000 (see Table E.4.1). (The 2002 general plan update projected a population of 67,300 for 2005.)

[5] By "islands" the general plan refers to pockets of unincorporated area within and adjacent to the City's industrial corridor (Hayward, 2004b).

Milpitas does not have an adopted growth management ordinance. Policies contained within the general plan are intended in part to manage growth in the city (Duncan, 2005). The City has adopted an Urban Growth Boundary (UGB), which delineates the ultimate extent of the urbanized area. The UGB was approved by local voters in 1998 and is intended to remain in place through 2018. According to the housing element (City of Milpitas, 2002b), the UGB does not include provisions related to residential development capacity or growth control and was primarily created as a hillside protection measure. The land use element includes polices related to the UGB (City of Milpitas, 2002a).

The Milpitas general plan, *2002 Update of the 1994 General Plan* (City of Milpitas, 2002a), serves as a policy guide for determining physical development in the city. The 2002 general plan update incorporates the 2002 Midtown Milpitas Specific Plan, which includes mixed-use development and new, very-high-density multifamily development. The revised general plan also includes transit-oriented development and gateway office overlay designations. According to the general plan, the rapid growth in the region has left little room in the flatlands for expansion of the city boundaries. With the Midtown Milpitas Specific Plan, the city's general plan population at buildout is projected to be 94,400 (City of Milpitas, 2002a; City of Milpitas, 2002c; Carrington, 2006).

According to the 2002 housing element, approximately 87 percent of the development capacity to meet Milpitas' identified share of regional housing need is located within developed areas, and approximately 95 percent of the residential development capacity consists of higher density housing sites. The analysis of infrastructure and public services constraints concluded that adequate water supply is not a constraint to developing the city's fair share housing allocation (City of Milpitas 2002b).

City of Santa Clara

Overview

Santa Clara is located at the south end of San Francisco Bay; it is bordered by San Jose to the north, east, and south, and Sunnyvale and Cupertino to the west (refer to Figure 7.2 in PEIR Chapter 7).

Water Service

The City of Santa Clara owns and operates its own water system; the city's service area encompasses nearly 19.4 square miles. Local groundwater is the primary source of potable water. The SFPUC supplies approximately 15 percent of the city's water (URS, 2004; BAWSCA, 2005). According to the Santa Clara General Plan, the city normally receives about 30 percent of its water from the SFPUC and the SCVWD, and the remaining 70 percent from the city's 28 wells (City of Santa Clara, 2002). SFPUC water is delivered to the northern portion of the city, and SCVWD water is delivered to the southwestern portion of the city. Santa Clara also operates a recycled water system; tertiary-treated effluent from a plant jointly operated with San Jose is available for landscape irrigation and certain industrial uses (BAWSCA, 2005).

The northern portion of Santa Clara is predominantly commercial/industrial, and the southern portion is primarily residential (URS, 2004). Residential accounts represent approximately 45 percent of total water demand; commercial/industrial uses represent approximately 46 percent; other uses represent 7 percent; and unaccounted-for water represents 2 percent of total demand (BAWSCA, 2005). As of 2000, land uses consisted of approximately 37 percent residential, 6 percent commercial, 22 percent industrial, 30 percent public facilities (including institutional, educational, parks, and rights-of-way), 4 percent vacant, and 0.2 percent mixed use (City of Santa Clara, 2002).

Growth Trends and Policies

Santa Clara has grown by more than 800 percent since 1950, from a population of 11,702 in 1950 to 102,361 in 2000. The city's fastest growth occurred between 1950 and 1960, when the city experienced a fivefold population increase (to 58,850). Between 1960 and 1980, the population increased by nearly 50 percent (to 87,700). Since then, constraints on available land for residential development have limited new housing development and thus population growth. According to the housing element, the city grew by 7 percent between 1980 and 1990 and by 9 percent between 1990 and 2000 (City of Santa Clara, 2002). The city's population in 2000 was 102,361 (Census 2000), with 135,370 jobs and 39,630 dwelling units in the city (City of Santa Clara, 2002). Population estimates since 2000 vary somewhat. The U.S. Census Bureau estimates Santa Clara's 2005 population to be 105,402, a 3.0 percent increase, whereas the DOF estimates Santa Clara's total population to be 110,771 as of January 1, 2006, an 8.2 percent increase from 2000 (see Table E.4.1).

The 1992 Santa Clara General Plan (with land use and housing element updates in 2002) serves as a policy guide for determining physical development in the city through 2010. The general plan projects continued growth in the city through the development and redevelopment of underutilized properties and recognizes the need for preservation and enhancement of single-family areas. According to the general plan, the city is essentially built out; however, there is potential for development, redevelopment, and expansion at various locations in the city. The general plan identifies a number of sites for new development, including some sites distributed throughout the city and some in specific areas, such as along the El Camino Real corridor and the area northeast of Agnew Road (City of Santa Clara, 2002). Buildout under the general plan is expected to occur in 2010 and result in a total population ranging from 124,800 to 135,000, about 151,280 jobs, and up to 12,556 additional dwelling units (City of Santa Clara, 2002).

Stanford University

Overview

Stanford University comprises approximately 8,200 acres in Santa Clara and San Mateo Counties. Approximately 4,000 acres containing the university's academic, open space, and agricultural land are located in unincorporated Santa Clara County, on the border of San Mateo County. The university is generally bordered on the northwest by Menlo Park, on the southeast, east, and south by Palo Alto, and on the west by Portola Valley and unincorporated Santa Clara County.

Water Service

The university's water system, operated by the Stanford Utilities Division, primarily serves the central campus, which comprises approximately 2,000 acres (3.1 square miles). Approximately 70 percent of the university's water supply—and all of its potable water—is supplied by the SFPUC; approximately 8 percent of total supply is groundwater, and approximately 22 percent is nonpotable surface (lake) water used for irrigation (BAWSCA, 2005).

According to the Stanford University Community Plan, land uses in the central campus area consist of the academic campus, open space, and low- and moderate-density residential uses (Santa Clara County, 2000). Residential uses account for approximately 35 percent of water demand; commercial/industrial uses represent about 24 percent; other uses represent 40 percent; and unaccounted-for water represents approximately 1 percent of demand (BAWSCA, 2005). The current cumulative building area on campus is approximately 12.3 million gross square feet (gsf).

Growth Trends and Policies

Stanford was founded in 1891; most new development at the campus, in the form of academic buildings, support services, and student housing, has occurred since World War II. Since 1960, the building area has almost tripled, from 4,363,375 gsf to 12,294,230 in 2000. Growth since 1960 represents an average annual addition of approximately 198,300 square feet of building area. The campus building area includes approximately 9,760 units of undergraduate and graduate housing. (Stanford University is not shown in Table E.4.1 because most of the data presented in the table do not apply to the university. The Stanford Water Utility serves only the university, whereas ABAG, DOF, and the Census Bureau data are developed for cities and counties.)

The 1995 Santa Clara County General Plan sets goals and overall policy direction for physical development and land use in unincorporated areas of the county. The Stanford Community Plan (adopted as an amendment of the General Plan in 2000) refines the policies of the general plan as they apply to Stanford lands within the county. The community plan identifies policies and establishes various land use designations. The plan emphasizes two basic principles of the Santa Clara County General Plan: compact and efficient urban development, and conservation of natural resources. However, the community plan is not intended to define the long-term development potential of Stanford's unincorporated lands in terms of the amount or location of development beyond the planning horizon (Santa Clara County, 2000).

In the community plan, the concept of urban growth boundaries promoted in the county general plan is applied to the university in the form of an Academic Growth Boundary (AGB). According to the community plan, development at Stanford must occur within the AGB; furthermore, the AGB will remain in the established location for a period of at least 25 years and may only be modified within this period by a fourth-fifths vote of all members of the board of supervisors. In addition to the 25-year time limitation, the AGB cannot be modified until the total building area on the central campus reaches 17,300,000 square feet. At the rate of 200,000 square feet of additional development per year (the historical growth rate at the campus), a total of 5 million square feet would be added in 25 years, for a total building area in the central campus, excluding

housing, of 17,300,000 square feet. The community plan indicates that an additional 2,035,000 gsf of academic and academic support space and 3,018 additional housing units may be constructed through 2010.

Development on the campus is also regulated by a general use permit issued by Santa Clara County. Concurrent with development of the community plan, Stanford University applied to the County to revise its general use permit, requesting an additional 2,035,000 square feet of academic and support space, 2,000 housing units for students, and 350 units for postdoctoral fellows. These facilities would result in the development of 3,485,000 square feet of new building area on the campus between 2000 and 2010. A revised general use permit was issued in 2000.

City of Sunnyvale

Overview

Sunnyvale is located at the southwest end of San Francisco Bay (refer to Figure 7.2 in PEIR Chapter 7). The city is bordered on the north by San Francisco Bay, on the west by Mountain View and Los Altos, on the south by Cupertino, and on the east by Santa Clara and San Jose.

Water Service

The City of Sunnyvale owns and operates its own water system. The service area for the water utility is contiguous with the city limits; however, CWS serves several small areas within the city. The city's water service area encompasses nearly 24 square miles (URS, 2004; BAWSCA, 2005). The 1996 water resources sub-element of the Sunnyvale General Plan indicates that the SFPUC provides approximately 40 percent of the city's water and the SCVWD provides approximately 50 percent; the remaining 10 percent is from local groundwater sources (City of Sunnyvale, 1996). BAWSCA's more recent agency profiles indicate that the SFPUC provides approximately 42 percent, with SCVWD, CWS, and local groundwater providing the balance (BAWSCA, 2005). Residential accounts represent approximately 58 percent of total water demand; commercial/industrial uses represent 23 percent; other uses represent 17 percent; and unaccounted-for water represents 2 percent of demand (BAWSCA, 2005). According to the general plan, the city's land use mix consists of approximately 41 percent residential; 6 percent commercial; 18 percent industrial; 10 percent public facilities; 14 percent baylands, creeks, and sloughs; and 11 percent categorized as "other," which includes public and private schools and religious, military, park, agricultural, and vacant land uses (City of Sunnyvale, 1997).

Growth Trends and Policies

Between 1950 and 2000, Sunnyvale changed from an agricultural area and location for heavy industry to a center for high technology. The city's first surge of growth in the 1950s established its basic development pattern. The city continued to grow rapidly until the mid-1970s. Today Sunnyvale is nearly built out, and infill development, redevelopment, and revitalization activities predominate (City of Sunnyvale, 2002). The city's population in 2000 was 131,760 (Census 2000). Population estimates since 2000 vary somewhat. The U.S. Census Bureau estimates

Sunnyvale's 2005 population to be 128,902, a 2.2 percent decrease, whereas the DOF estimates the city's population to be 133,544 as of January 1, 2006, a 1.4 percent increase over 2000 (see Table E.4.1).

Sunnyvale does not have an adopted growth management ordinance. Growth in the city is managed through the general plan and zoning ordinance (Zarrin, 2006). The Sunnyvale General Plan is the principal policy document guiding future conservation and development of the city. It includes both long-term goals and policies and shorter term "action statements" to guide local government decisions (City of Sunnyvale, 2002). Growth-related policies of the land use and transportation element include promotion of integrated and coordinated local land use and transportation planning, protection of regional environmental resources through local land use practices, and protection of the integrity of the city's residential, industrial, and commercial neighborhoods (City of Sunnyvale, 1997). Buildout under the general plan is expected to occur in 2025 and result in a total population of 154,600 (City of Sunnyvale, 2002).

E.4.3 San Mateo County

City of East Palo Alto

Overview

East Palo Alto is located at the southern end of the San Francisco Peninsula on the populous west side of San Francisco Bay (refer to Figure 7.2 in PEIR Chapter 7). The city is bordered by the Bay to the east, Menlo Park to the north and west, and Palo Alto to the south.

Water Service

East Palo Alto's public water system is operated under contract through the city's Department of Public Works by American Water Company[6] (City of East Palo Alto, 2006). The city's service area encompasses approximately 2.5 square miles and covers most of the city. The SFPUC is the city's only source of supply. (Two other water companies, the Palo Alto Mutual Water Company and the O'Conner Tract Mutual Cooperative Water Company, which are not SFPUC customers, also provide water to small sections of the city.) Residential accounts represent approximately 68 percent of the municipal water system's total water demand; commercial/industrial accounts represent about 13 percent; other uses represent about 9 percent; and unaccounted-for water represents 10 percent (BAWSCA, 2005). According to the city's general plan, land uses consist of approximately 52 percent residential, 2 percent commercial, 6 percent industrial, 7 percent institutional, and 33 percent open space, conservation resource management, agricultural, or vacant lands (City of East Palo Alto, 1999b).

6 Previously, the city's water system had been operated by San Mateo County under the name East Palo Alto Waterworks District; the city took over the water distribution system from the county in 2001.

Growth Trends and Policies

Prior to the city's incorporation in 1983, East Palo Alto was part of unincorporated San Mateo County. The area historically regarded as East Palo Alto was much larger than the city's current area of 2.5 square miles. Between the late 1940s and 1960s, areas previously part of East Palo Alto were annexed to Menlo Park and Palo Alto. Economic activities in East Palo Alto have included farming, ranching, and brick manufacturing. Today, the city has a mix of small industrial, agricultural, and commercial businesses. Since its incorporation, the city has grown dramatically—by 29 percent between 1980 and 1990 (from a population of 18,292 to 23,451) and by 26 percent between 1990 and 2000. However, development of additional housing has not kept pace with the population growth, resulting in an increase in household size from 2.7 people per housing unit in 1980 to 4.2 people per housing unit in 2000 (City of East Palo Alto, 2001). The city's population in 2000 was 29,506 (Census 2000). Population estimates since 2000 are similar. The U.S. Census Bureau estimates East Palo Alto's 2005 population to be 32,242, a 9.3 percent increase, and the DOF estimates the city's population to be 32,083 as of January 1, 2006, an increase of 8.7 percent over 2000 (see Table E.4.1).

East Palo Alto does not have any growth management ordinances in effect (Banico, 2005). The East Palo Alto General Plan (City of East Palo Alto, 1999b) serves as a policy guide for determining the appropriate physical development and character for the city. The general plan identifies infill properties as the site of much of the new development that will occur in the city, and emphasizes redevelopment or renovation of major portions of the community as critical to achieving fiscal stability (City of East Palo Alto, 1999b). East Palo Alto expects continued growth through general plan buildout. Buildout is projected to occur in 2020, with a population of 34,600 (City of East Palo Alto, 1999a).

City of Redwood City

Overview

Redwood City is located in the geographic center of the San Francisco Peninsula, near the southern end of San Mateo County (refer to Figure 7.2 in PEIR Chapter 7). The city is bordered by the Bay to the east, San Carlos, Belmont, and Foster City and unincorporated county land to the north and west, Woodside to the west, and Atherton. Menlo Park , and unincorporated land to the south.

Water Service

Redwood City owns and operates its own water utility and supplies water to portions of Woodside, San Carlos, and unincorporated areas of the county. The city's service area includes about 83,000 residents and covers roughly 35 square miles. Redwood City purchases all of its potable water from the SFPUC (BAWSCA, 2005). The area within the city's boundaries is roughly divided between land and water areas, with 54 percent land area and 46 percent water area. According to the Redwood City General Plan (City of Redwood City, 1990), 46 percent of the city's land area is in residential development, the city's predominant land use; other uses

include public and quasi-public land uses (14 percent), commercial land use (10 percent), industrial land use (6 percent), and streets and rights-of-way (25 percent).

Growth Trends and Policies

At the time San Mateo County was formed, in 1856, Redwood City was the only bayside settlement that resembled a real town, and in 1867 it became the county's first incorporated city. By 1870, the city had a population of more than 700, which nearly doubled by 1880. While the city continued to grow steadily in the ensuing decades, the postwar population influx that occurred throughout California from 1940 to 1960 created the most dramatic growth in Redwood City's history—from 12,453 to 46,290 (City of Redwood City, 1990). During the 1970s and 1980s, changes in industry and housing occurred, with the craft industries of the city's early years giving way to high-technology and information-age industries (City of Redwood City, 1990). The EIR for the Downtown Precise Plan, a recent amendment of the general plan, cites ABAG's *Projections 2005* forecasts for the city (not including its sphere of influence) of 87,100 in 2020. The city's population in 2000 was 75,402 (Census 2000). Population estimates since 2000 vary somewhat. The U.S. Census Bureau estimates Redwood City's 2005 population to be 73,114, a 3.0 percent decrease, whereas the DOF estimates the city's population to be 76,087 as of January 1, 2006, a 0.9 percent increase over 2000 (see Table E.4.1).

Redwood City is essentially built out, and future development will be accommodated through infill development, including the redevelopment of industrial sites and development along the El Camino Real corridor. In May 2006, the Planning Commission adopted principals to guide its general plan update (currently underway) and provide the foundation for general plan elements. These guiding principals include (among others) planning for sustainability, which recognizes the city's long-term obligations to future residents and encourages development that conserves natural resources; working to develop attractive, convenient transportation alternatives to the automobile; and designing for active pedestrian and bicycle-friendly streets and public spaces (City of Redwood City, 2006). The City's recently adopted Downtown Precise Plan (City of Redwood City, 2007a) provides for housing in the downtown area that is affordable to a range of incomes, mixed residential and commercial development, and the concentration of retail development in certain areas proximate to civic buildings and activities, so that access to transit and parking, customers, and destination identity for a variety of land uses are shared. The plan is intended to revitalize the downtown area and serve as a tool to help the city meet its goals and achieve sustainable development (City of Redwood City, 2007a). The City Council approved the "moderate intensity" alternative of the plan, which would allow development of 2,500 additional residential units as well as specified amounts of office, retail and lodging in the downtown planning area (City of Redwood City, 2007b). According to the plan's EIR, neither of the development alternatives considered (a maximum intensity alternative and a moderate intensity alternative) would permit buildout totals that were substantially different from buildout allowed under existing zoning, the City expected that achieving permitted buildout totals was more likely to be realized with adoption of the precise plan; (City of Redwood City, 2007c).

Redwood City's Franklin Project Phase I, a development that includes residential units and retail within walking distance of the Caltrain station and downtown area, was the first project to receive a grant from the City/County Association of Governments of San Mateo County (C/CAG) Transit Oriented Development (TOD) Incentive Program. The C/CAG's TOD Incentive Program won the Environmental Protection Agency's National Award for Smart Growth in 2002 (U.S. EPA, 2002).

City of San Mateo

Overview

The city of San Mateo is located in the middle of the San Francisco Peninsula (refer to Figure 7.2 in PEIR Chapter 7). The city is bordered by the Bay to the east, Burlingame to the north, Hillsborough to the west, and Belmont to the south.

Water Service

San Mateo is served by the CWS–Mid-Peninsula District, which is located in central San Mateo County; this water district also serves San Carlos and adjacent unincorporated portions of San Mateo County, including the Highlands and Palomar Park (refer to Figure 7.1 in PEIR Chapter 7). In 2001, the CWS–Mid-Peninsula District served 120,856 residents and covered approximately 17 square miles. All of the district's water is supplied by the SFPUC, as local water storage is not feasible and groundwater of adequate quantity and quality is not available (BAWSCA, 2005).

Growth Trends and Policies

San Mateo's development began in earnest with the establishment of a stagecoach stop along the Old County Road (El Camino Real [Highway 82]) in the 1850s. With the advent of the railroad in the 1860s, the center of city activity shifted to the area along Third Avenue and B Street. The city was incorporated in 1894 and remained a relatively small, rural community until the 1940s. The city grew substantially during World War II and the following years, from a population of 19,405 in 1940 to 69,870 by 1960, and its economic base shifted toward office and retail sectors (City of San Mateo, 1990).

During the 1970s and 1980s, population growth slowed, increasing by only 16,000, while both retail space and office space increased significantly. Retail uses are now largely concentrated at Hillsdale Shopping Center, along El Camino Real, and office uses are concentrated in office parks along the Highway 92 corridor and, to a lesser extent, the downtown area. According to the general plan, these changes have altered the image of San Mateo as a "bedroom community" to a place where people can both live and work as well as an important subregional office retail center (City of San Mateo, 1990).

The general plan characterizes San Mateo as becoming a larger, more diverse, and more complex community, but also as one with a slowing growth rate due to the continued decrease in average household size, limited vacant land, and high local land values. The population of the city and its sphere of influence was expected to increase from an estimated 92,482 in 2000 to 100,700 in

2010 (City of San Mateo, 2001). According to the Census 2000, the city's population in 2000 was 92,482. Population estimates since 2000 vary somewhat. The U.S. Census Bureau estimates San Mateo's 2005 population to be 91,081, a 1.5 percent decrease, whereas the DOF estimates the city's population to be 94,315 as of January 1, 2006, a 2 percent increase over 2000 (see Table E.4.1).

The City of San Mateo does not have growth management policies, as the city is largely built out. Future growth is expected to be accommodated through redevelopment on infill sites (Ring, 2006). An example of such development is the San Mateo Rail Corridor Transit-Oriented Development Plan, which was adopted in 2005. Implementation of the plan is expected to improve access to Caltrain stations and provide higher density housing that will help alleviate some of the measures throughout the Bay Area for both affordable and market-rate housing (City of San Mateo, 2005).

City of South San Francisco

Overview

South San Francisco is located at the northern end of the San Francisco Peninsula (refer to Figure 7.2 in PEIR Chapter 7). The city is bordered by the Bay to the east, Colma to the north, Daly City and Pacifica to the west, and San Bruno to the south.

Water Service

South San Francisco is served by CWS–South San Francisco District, which also serves Colma, part of unincorporated San Mateo County, and a small part of Daly City, and Westborough Water District. CWS-South San Francisco encompasses approximately 11.2 square miles; in 2001, it served a population of 49,207. Land use in the water district service area includes both residential and commercial areas (City of South San Francisco, 1999). In FY 2001/2002 approximately 89 percent of the CWS-South San Francisco's water supply was provided by the SFPUC (BAWSCA, 2005). The remaining water demand in the CWS–South San Francisco service area is met by groundwater supply (City of South San Francisco, 1999). Westborough Water District encompasses approximately 1 square mile; in 2000 it served a population of 13,033 (Westborough Water District, 2005). Land use in the service area is primarily residential with some commercial land uses. In FY 2001/2002, 100 percent of Westborough's supply was provided by the SFPUC (BAWSCA, 2005).

Growth Trends and Policies

Steel mills and other industries began to locate in South San Francisco following construction of the Southern Pacific Railroad line between San Francisco and San Jose (1904 to 1907). When the city incorporated in 1908 it had 1,989 residents and 14 major industries. The city's steel and shipbuilding industries continued to grow through the 1920s and World War II, and helped to spur residential growth. South San Francisco's fastest period of growth was during the war and postwar period; between 1940 and 1960, the population increased sixfold, from approximately

6,000 to over 39,000. This growth, achieved through extensive annexation and residential subdivision, was fueled by continued industrial growth. Almost half of the city's existing housing units were built between 1940 and 1959. In the 1960s, drainage and fill of marshlands made shoreline areas available for development. Over the past 30 years, the city's industrial base has slowly transformed, with warehousing, research, and biotechnology replacing steel production and other heavy industries. Since the 1960s, infill development has been the primary means of accommodating growth and change along major arteries west of Highway 101, although major expansion has occurred in the Westborough area and the area east of Highway 101. South San Francisco contains 8.3 percent of San Mateo County's population (City of South San Francisco, 1999). The city's population in 2000 was 60,552 (Census 2000). Population estimates since 2000 vary slightly. The U.S. Census Bureau estimates South San Francisco's 2005 population to be 60,735, a 0.3 percent increase, whereas the DOF estimates the city's population to be 61,824 as of January 1, 2006, a 2.1 percent increase over 2000 (see Table E.4.1).

The city identifies the Terrabay multi-use development project, on the south slopes of San Bruno Mountain, as its last phase of expansion. Future growth is expected to be limited to redevelopment and a few remaining unincorporated islands within the city. The general plan projects that the city's growth rate will be much slower over the 20-year horizon of the plan than the growth experienced in the 10 years before its publication (in 1999). The general plan forecasts a buildout population of 67,400, although buildout is not necessarily expected to occur within the 20-year horizon of the plan (City of South San Francisco, 1999).

E.4.4 City and County of San Francisco

Overview

San Francisco is located at the northern tip of the San Francisco Peninsula. The city is surrounded by water on three sides: to the west by the Pacific Ocean, and to the north and east by San Francisco Bay. The city is bordered to the south by San Mateo County and the cities of Daly City and Brisbane.

Water Service

The City and County of San Francisco (CCSF) owns its own water system, which is maintained and operated by the SFPUC. The SFPUC is the retail water supplier for all of the city's water users. The SFPUC regional water system meets 100 percent of the city's potable water demand and about 97 percent of total demand. Nonpotable groundwater, which is not linked hydraulically to the SFPUC water system, supplements the city's potable supply and is used for landscape irrigation at Golden Gate Park, the San Francisco Zoo, and along the Great Highway. According to the *City and County of San Francisco Retail Water Demands and Conservation Potential* (Hannaford and Hydroconsult, 2004), in 2000 (the study's base year) residential water use accounted for approximately 57 percent of the city's water use; commercial, industrial, and municipal uses accounted for approximately 33 percent; other uses (which include builders and contractors and docks and shipping) accounted for less than 1 percent (0.3 percent); and

unaccounted-for water represented about 10 percent. For 2005, this distribution of water use was expected to shift slightly, with 56 percent residential use, 35 percent nonresidential, 0.3 percent builders/ contractors and docks/shipping, and 9 percent unaccounted-for water (Hannaford and Hydroconsult, 2004).

Growth Trends and Policies

San Francisco was incorporated as a city on April 15th, 1850. The County of San Francisco and the City of San Francisco were established as separate entities by the state legislature in 1850 and were combined by the legislature in 1856.[7] At that time, San Francisco's population was approximately 30,000 (CCSF, 2006a; CCSF, 2006b). By 1900, the city had grown approximately tenfold, to 342,782 residents (U.S. Census Bureau, 1995).

The city grew steadily for most of the first half of the 20th century, with the population increasing more than 20 percent each decade from 1900 to 1930. There was little change between 1930 and 1940, and between 1940 and 1950 the city grew by 22 percent, to a population of 775,357. In each of the next three decades the city's population declined somewhat, decreasing by 12 percent overall between 1950 and 1980. By 1980 this downward trend reversed, and the city grew by 7 percent each decade between 1980 and 2000, to a population of 776,733 (an increase of only 0.2 percent above the 1950 population) (U.S. Census Bureau, 1995; U.S, Census Bureau, 2000). Population estimates since 2000 vary somewhat. The U.S. Census Bureau estimates San Francisco's 2005 population to be 739,426, a 4.8 percent decrease, whereas the DOF estimates the city's population to be 798,680 as of January1, 2006, a 2.8 percent increase from 2000 (see Table E.4.1).

According to the general plan housing element, San Francisco is a "mature built-up city with very few large open tracts of land to develop" (CCSF, 2004). The *Citywide Action Plan* (CCSF, 2006c) "explores comprehensively the issue of how to meet the need for housing and jobs in ways that capitalize upon and enhance the best qualities of San Francisco as a place." Under this plan, the planning department is developing policy initiatives "for supporting and encouraging higher density, mixed-use—primarily residential—infill in selected transit-rich corridors."

In a November 2005 letter to ABAG, San Francisco's interim planning director indicated the CCSF's disagreement with the 2030 population projections contained in ABAG's *Draft Projections 2005* (provided to the CCSF prior to publication). The letter indicated that the CCSF expected less growth than was projected in *Draft Projections 2005*, despite its efforts to implement smart growth principles and increase development densities along major transit corridors (Macris, 2004). According to the CCSF, the forecast of job and household growth presented in its *2002 Land Use Allocation*—which estimates more growth in both jobs and households than forecasted in *Projections 2002*, but less than forecasted in the *Draft Projections 2005*—is a more realistic projection. The *2002 Land Use Allocation* estimates that San Francisco will add 23,144 housing units between 2000 and 2030 (for a total of 373,513, a 13 percent

[7] When the City and County were combined, the part of San Francisco County south of the city's corporate boundary became part of San Mateo County.

increase) and 151,807 jobs in the same period (for a total of 786,000, a 24 percent increase) (Macris, 2004). The published estimates in *Projections 2005* (of 829,090 jobs and 398,280 households by 2030) (ABAG, 2004) are somewhat lower than those presented in the draft document, but are still greater than estimates presented in San Francisco's *2002 Land Use Allocation*.

E.4.5 Summary of Growth Trends and Policies of Select Jurisdictions

The jurisdictions profiled in the preceding section are a sample of cities in the service area. These jurisdictions represent a range of sizes and include some of the larger cities and some of the cities projecting relatively substantial increases in water demand by 2030. As the profiles indicate, these cities are largely urbanized, typically experienced their most rapid period of growth in the postwar decades through the 1970s, and are largely built out. Milpitas and East Palo Alto have experienced high rates of growth more recently (over the past 30 years) and are also highly urbanized. On average, San Francisco's population has been stable over the past 50 years. While none of these jurisdictions has adopted growth management ordinances per se, their general plans include policies to manage growth, in some cases including the establishment of urban growth or hillside protection boundaries (or, in the case of Stanford University's community plan, an analogous academic growth boundary). Most of the general plans identify infill development and redevelopment and/or revitalization of previously developed areas (strategies consistent with smart growth policies) as the principal means of accommodating future growth.

In addition to the general plan projections discussed above, Table E.4.1 presents a comparison between the 2030 population projections used for the wholesale customer water demand forecasts and ABAG *Projections 2005* forecasts, for both 2030 and the buildout years for the respective general plans. (Table E.4.1 includes subtotals for Fremont, Newark, and Union City for comparison with the ACWD projection.)

As the table shows, the population projections used for the WSIP water demand projections are reasonably consistent with the population projections in the jurisdictions' general plans, although the stated general plan projection years do not extend to 2030. The general plans of three cities—Milpitas, Sunnyvale, and East Palo Alto—expect more population at buildout than is assumed for the 2030 water demand projections. The general plan projections for the jurisdictions served by the other water customers (that can be compared) are within 11 percent of the population projections used for the water demand forecasts, although the general plan projection years are 2010 or 2020. This comparison suggests that the population growth estimated in the water demand projections for these jurisdictions has largely been addressed in the jurisdictions' general plans, and has been fully addressed in the case of three of the cities.

The projected 2030 population projection used for Hayward in the demand study is about 2 percent higher than that presented in the city's general plan. The 2030 population assumed for San Francisco in the demand study is about 5 percent higher than projected in the city's general plan. The 2030 population assumed for the ACWD demand forecast is about 6 percent higher

than projections in the respective general plans (considering the projections in the Fremont, Newark, and Union City General Plans combined). The demand study projection for Redwood City is about 7 percent higher than that presented in the city's general plan. The population assumed for South San Francisco in the demand study (for CWS-South San Francisco and Westborough Water District, as updated by Westborough Water District's UWMP) is about 8 percent higher than the combined general plan projections of South San Francisco and Colma, which is also served by the CWS-South San Francisco, and the projection used for the Santa Clara demand forecast is about 8 percent higher than the population projected (for 2010) in the general plan.. (The 2030 population for the CWS–Mid-Peninsula District and Stanford University estimated in the demand study are not directly comparable to the growth projected in the San Mateo General Plan and the Stanford University Community Plan.)

The ABAG projections for 2030, which incorporate smart growth assumptions (as discussed in PEIR Section 7.3 and Appendix E.3), are somewhat higher than either the general plan or WSIP demand study projections (see Table E.4.1).

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APPENDIX E.5
Summary of Planned Growth – Impacts and Mitigation Measures

This appendix supplements information presented in PEIR Chapter 7, Growth Inducement Potential and Secondary Effects of Growth. As discussed in Chapter 7, the environmental impact reports (EIRs) prepared for the general plans, area plans and specific plans of the jurisdictions within the SFPUC service area identify impacts associated with planned growth in the respective jurisdictions and identify measures to mitigate those impacts. **Table E.5.1** summarizes the impacts and mitigation measures identified in the EIRs and CEQA Findings prepared for those planning documents. These environmental impacts are the secondary environmental effects of growth supported in part by the proposed project (see Chapter 7). Table E.5.1 is intended to provide a summary overview of the impacts and mitigation measures identified in the relevant planning document EIRs for jurisdictions served by SFPUC water, and does not purport to reflect the full scope and intent of those EIRs. For a complete discussion of the impacts, please refer to the specific EIRs.

The following EIRs and City Council and Board of Supervisors resolutions were reviewed and are summarized in Table E.5.1. These documents are incorporated by reference into this Draft PEIR, pursuant to CEQA Guidelines 15150. Please see Section 1.3.5 in PEIR Chapter 1, Introduction, for a list of locations where documents incorporated by reference are available for public review.

- City of Belmont San Juan Hills Area Plan EIR, State Clearinghouse #86122320 (1988), Western Hills Area Plan EIR, State Clearinghouse #89051615 (1990)
- City of Brisbane 1993 General Plan EIR, State Clearinghouse #93071072 (1994)
- City of East Palo Alto General Plan EIR, State Clearinghouse #98051028 (1999)
- City of Foster City General Plan EIR, State Clearinghouse #92073017 (1993)
- City of Fremont General Plan EIR, State Clearinghouse #90030675 (1991)
- City of Hayward General Plan EIR, State Clearinghouse #2001072069 (2002)
- City of Menlo Park General Plan EIR, State Clearinghouse #890 124 20 (1994)
- City of Millbrae General Plan EIR, State Clearinghouse #98041090 (1998), Millbrae Station Area Specific Plan EIR, State Clearinghouse #98041091 (1998)
- City of Milpitas Midtown Milpitas Specific Plan EIR, State Clearinghouse #2000092027 (2002)
- City of Mountain View General Plan EIR, State Clearinghouse #91083044 (1992)

- City of Newark General Plan Update Project 2007 EIR, State Clearinghouse #91093071 (1992)
- City of Palo Alto Comprehensive Plan 1998–2010 EIR, State Clearinghouse #96052043 (1997)
- City of Redwood City Downtown Precise Plan EIR, State Clearinghouse #2005052027 (2007)
- City of San Bruno General Plan and EIR (1984)
- City of San Jose General Plan EIR, State Clearinghouse #94023031 (1994)
- City of San Mateo General Plan EIR, State Clearinghouse #89100308 (1990)
- San Mateo County Board of Supervisors Resolution 48639 Adopting Findings Pursuant to Certification of the Final Environmental Impact Report for the San Mateo County General Plan, State Clearinghouse #84042404 (1986)
- City of Santa Clara Resolution No. 5728: A Resolution and Related Findings Certifying a Final Environmental Impact Report and Directing the Filing of a Notice of Determination, General Plan Amendment #32, State Clearinghouse #8908017 (1992)
- Santa Clara County General Plan EIR, State Clearinghouse #94023004 (1994)
- Stanford University Community Plan EIR, State Clearinghouse #1999112107 (2000)
- City of Union City General Plan EIR, State Clearinghouse #2000112009 (2002)

Negative declarations were prepared for the following general plans, specific plans, and general plan elements and therefore are not represented in Table E.5-1:

- Town of Atherton General Plan Revisions (2002)
- City of Burlingame General Plan (1969), Bayfront Specific Plan (2004), North Rollins Road Specific Plan (2004), and Housing Element (2002)
- Town of Colma General Plan (1999)
- City of Daly City General Plan Land Use and Circulation Elements (1987) and Housing Element (2004)
- Town of Hillsborough General Plan (2005)
- Town of Los Altos Hills General Plan (1975)
- Town of Portola Valley General Plan (1998 except for Housing Element, which appears to be 1990)
- City of San Carlos General Plan (1992) and Housing Element (2001)
- City and County of San Francisco General Plan (1998) and Housing Element (2004)
- City of Sunnyvale General Plan Elements: Land Use and Transportation Element (1997), Water Resources Sub-element, and (1996), Housing and Community Revitalization Sub-element (2002)
- Town of Woodside General Plan Housing Element (2003)

TABLE E.5.1
SIGNIFICANT MITIGABLE (S) AND SIGNIFICANT UNAVOIDABLE (U) IMPACTS OF GROWTH IDENTIFIED BY GENERAL AND SPECIFIC PLAN ENVIRONMENTAL IMPACT REPORTS IN PROJECT AREA

	JURISDICTION																				
Impact	**Belmont[a]**	**Brisbane[b]**	**East Palo Alto[c]**	**Foster City[d]**	**Fremont[e]**	**Hayward[f]**	**Menlo Park[g]**	**Millbrae[h]**	**Milpitas[i]**	**Mountain View[j]**	**Newark[k]**	**Palo Alto[l]**	**Redwood City[m]**	**San Bruno[n]**	**San Jose[o]**	**City of San Mateo[p]**	**San Mateo County[q]**	**City of Santa Clara[r]**	**Santa Clara County[s]**	**Stanford University[t]**	**Union City[u]**
2000 Population	25,123	3,597	29,506	28,803	203,413	140,030	30,785	20718	62,698	70,708	42,471	58,598	75,402	40,165	894,943	92,482		102,361	100,300		66,869
AESTHETICS																					
Impacts																					
• Alteration of visual setting or degradation of existing views	S	S			S	S		S			S				S, U	S	S			S	
• Impacts on scenic resources, including resources within a scenic highway corridor						S											S				
• Impacts on visual quality due to loss of open space														U							
• Creation of new source(s) of light and/or glare, or incremental increases in light or glare			S			S					S		S							S	S
• Cumulative impacts on visual quality																	U				
Mitigation Measures																					
• Develop, strengthen, and/or implement design and landscaping standards and conduct project-specific design review.	X		X																		
• Implement general plan programs and policies and general plan EIR measures that address visual quality in the planning area. (Such policies and measures may include site planning and design procedures and standards, architectural review, and standards pertaining to landscaping and natural areas.)		X				X		X			X						X				
• Provide incentives, including zoning ordinance density or intensity bonuses, streamlined permitting, and rehabilitation funding, to encourage and support projects offering exceptional design quality or otherwise contributing to the desired level of physical quality in the city.			X																		
• Conduct project-specific environmental review and require mitigation to protect visual character and reduce aesthetic impacts, including impacts on natural resources.			X			X										X				X	
• Implement/require measures to reduce light and glare.			X								X		X							X	X
• Implement general plan policies that address visual impacts from nearby incompatible uses.					X										X		X				
AGRICULTURAL RESOURCES																					
Impacts																					
• Conversion of agricultural land to nonagricultural uses					U						S								S		U
• Cumulative loss of agricultural land																			U		
• Conflicts between agricultural uses and adjacent land uses																			S		
• Impacts of continued grazing and farming on soil or other environmental resources																	S		S		
Mitigation Measures																					
• Implement general plan policies that designate agricultural uses as permitted uses in all open space areas.					X																
• Implement general plan programs and policies that reduce impacts on agricultural soils.											X						X				
• Prepare a cumulative impact analysis of projected losses due to the permanent conversion of south county agricultural lands																			X		
• Evaluate and adopt mechanisms (e.g., impact fees, conservation easements, and purchase of development rights) to offset impacts on prime agricultural lands.																			X		
• Implement recommendations of a study on the development of golf courses in areas zoned for agriculture to reduce impacts.																			X		

S = Significant mitigable impact U = Significant and unavoidable impact X = Mitigation measure identified in Environmental Impact Report

TABLE GROWTH E.5.1 (Continued)
SIGNIFICANT MITIGABLE (S) AND SIGNIFICANT UNAVOIDABLE (U) IMPACTS OF GROWTH IDENTIFIED BY GENERAL AND SPECIFIC PLAN ENVIRONMENTAL IMPACT REPORTS IN PROJECT AREA

Impact	JURISDICTION																				
	Belmont[a]	Brisbane[b]	East Palo Alto[c]	Foster City[d]	Fremont[e]	Hayward[f]	Menlo Park[g]	Millbrae[h]	Milpitas[i]	Mountain View[j]	Newark[k]	Palo Alto[l]	Redwood City[m]	San Bruno[n]	San Jose[o]	City of San Mateo[p]	San Mateo County[q]	City of Santa Clara[r]	Santa Clara County[s]	Stanford University[t]	Union City[u]
• Implement general plan programs and policies, and measures identified in the general plan EIR, to protect agricultural and prevent its conversion to non-agricultural uses.																			X		
AIR QUALITY																					
Impacts																					
• Conflicts with, or obstruction of, the implementation of an applicable air quality attainment plan or congestion management plan																					S
• Violation of a stationary source air quality standard or contribution to an existing or projected air quality violation			U																		
• Increases in air emissions and/or ozone precursors		U	U				U	U	U		S			U		U	S	U			
• Exposure of new sensitive land uses to toxic air contaminant or local odor emission sources										S		S			S						
• Periodic construction-related air quality impacts	S		S		S	S		S			S		S		S					S	
• Increases in exhaust emissions from traffic	U				U			U					U		U		S				
• Cumulative impacts on regional air quality in the Bay Area								U	U	U					U		U				
Mitigation Measures																					
• Implement BAAQMD- and EIR-specified control measures to mitigate construction dust and emissions.	X				X	X		X					X								
• Participate in and promote local and regional planning efforts to improve air quality.			X							X	X										
• Provide site features and implement measures to encourage use of alternative modes of travel (to single-passenger vehicles) and reduce vehicle trips. (Such measures include implementing improvements to bicycle and pedestrian circulation systems and working with local and regional planning and transportation agencies to improve public transit services.)	X	X	X					X	X	X	X		X			X	X	X			X
• Implement selected roadway and/or intersection improvements to maximize the efficiency of the circulation system.		X	X				X									X					
• Implement general plan measures to reduce soil erosion and associated air quality impacts.																	X				
• Implement general plan measures that reduce dependence on automobile use and improve the efficiency of the existing transportation system.																	X				
• Reduce negative effects caused by roadways and rail lines on visual quality, air quality and noise.										X											
• Require adequate buffers, ventilation systems, and other measures to reduce impacts of odors or toxic emissions.												X									
• Implement general plan natural resource chapter policies regarding air quality impacts.															X						
• Facilitate mixed-use development and maintain jobs/housing balance.																X					
• Reduce diesel emissions.																				X	
BIOLOGICAL RESOURCES																					
Impacts																					
• Impact(s) on/loss of special-status animal or plant species		S				S			S		S		S		S		S			S	
• Impacts on biological resources due to individual or cumulative impacts on wetlands, riparian habitat, or other sensitive habitat	S	S	S	S, U	S	S		S		S	S	S	S	U	S		S		U	S	
• Conflicts with local policies or ordinances protecting biological resources													S		S					S	
• Cumulative impacts on biological resources			S																	S	

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TABLE GROWTH E.5.1 (Continued)
SIGNIFICANT MITIGABLE (S) AND SIGNIFICANT UNAVOIDABLE (U) IMPACTS OF GROWTH IDENTIFIED BY GENERAL AND SPECIFIC PLAN ENVIRONMENTAL IMPACT REPORTS IN PROJECT AREA

Impact	JURISDICTION																				
	Belmont[a]	Brisbane[b]	East Palo Alto[c]	Foster City[d]	Fremont[e]	Hayward[f]	Menlo Park[g]	Millbrae[h]	Milpitas[i]	Mountain View[j]	Newark[k]	Palo Alto[l]	Redwood City[m]	San Bruno[n]	San Jose[o]	City of San Mateo[p]	San Mateo County[q]	City of Santa Clara[r]	Santa Clara County[s]	Stanford University[t]	Union City[u]
• Disruption of wildlife migration or travel corridors																				S	
Mitigation Measures																					
• Negotiate any necessary streambed alteration agreements with the California Department of Fish and Game.	X					X															
• Plant native species for revegetation and landscaping purposes.	X																				
• Implement the San Bruno Mountain Habitat Conservation Plan.		X																			
• Implement general plan policies and programs to protect biological resources.		X			X						X						X				
• Conduct project-specific environmental review and implement mitigation.		X	X									X	X								
• Obtain all applicable resource agency permits prior to development within areas under the jurisdiction of federal, state, or local resource agencies.			X																		
• Coordinate with all applicable resource agencies to ensure that required mitigation protocols and design modifications are incorporated during the early stages of project review.													X								
• Where impacts on special-status species may occur, coordinate with relevant resource agencies as early as possible and substantially complete the consultation prior to or in conjunction with project environmental review.			X																		
• Require project-specific surveys conducted by qualified professionals according to established protocols to determine on-site resources and appropriate site-specific mitigation measures.			X	X		X			X				X							X	
• Protect and preserve open space areas and design any improvements in open space areas to minimize adverse impacts on habitats and other open space values.				X				X		X											
• Exclude development in environmentally sensitive areas that would result in a net loss of significant wetlands.				X																	
• Avoid wetlands and replace them where avoidance is infeasible.																				X	
• Include a program in the general plan to conduct a detailed wetland delineation study of vacant sites to accurately determine the extent of jurisdictional wetlands.								X													
• Maximize open space preservation opportunities in the development review process.								X													
• Protect and restore plant and wildlife habitats.				X						X							X			X	
• Protect wildlife from the hazards of urbanization.										X											
• Implement the identified program to mitigate impacts on California Tiger Salamander.																				X	
• Develop a program to educate the public and landowners about sensitive biotic resources in the area and best management practices for preserving those resources.																			X		
CULTURAL RESOURCES																					
Impacts																					
• Disturbance of historical resource(s)		S	S		S			S	S		S		S, U		S		S			S	
• Disturbance of archaeological resource(s)			S			S		S		S	S		S		S		S	S		S	
• Disturbance of paleontological resource(s)								S		S						S	S			S	
• Disturbance of human remains								S		S						S				S	
• Disturbance of unknown subsurface cultural resources	S	S			S	S						S									
• Cumulative impacts on historical resources																			U	U	
• Cumulative impacts on historical, archaeological, or paleontological resources																	U			S	

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TABLE GROWTH E.5.1 (Continued)
SIGNIFICANT MITIGABLE (S) AND SIGNIFICANT UNAVOIDABLE (U) IMPACTS OF GROWTH IDENTIFIED BY GENERAL AND SPECIFIC PLAN ENVIRONMENTAL IMPACT REPORTS IN PROJECT AREA

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Mitigation Measures																					
• Implement general plan policies and programs and measures identified in the general plan EIR to protect cultural resources.		X			X	X		X			X	X	X		X		X	X			
• Conduct project-specific review and implement identified mitigation consistent with general plan cultural resource policies.		X	X			X			X				X								
• If any cultural resources are found, halt work and protect the site from disturbance until a qualified archaeologist / cultural resources specialist has evaluated the resources and identified appropriate site-specific mitigation.	X					X															
• If human remains are found, halt work and notify the county coroner; implement subsequent specified actions and investigations as applicable, consistent with California Public Resources Code Section 5097.98.						X															
• Identify sensitive paleontological resources prior to commencement of development activities and recover sensitive fossils.			X																		
• Conduct the proposed work consistent with the state and federal standards for historic resources.									X												
• Implement CEQA Guidelines Section 15064.5 provisions for the accidentally discovery of historic or archeological resources.									X												
• Maintain documentation of significant archeological and historical sites.										X											
• Develop standard practices or contingency plans for archeological materials that are unearthed during construction.										X											
• Support the preservation of historic buildings and structures.									X	X						X					
• Implement measures to protect historic, archaeological, and paleontological resources.																				X	
GEOLOGY AND SOILS																					
Impacts																					
• Exposure to earthquake fault rupture hazards						S												S			
• Exposure to hazards from strong seismic ground shaking	S	S	S		S	U		S		S	S							S	U		
• Exposure to seismic-related ground failure, including liquefaction		S	S			S		S			S		S					S			
• Exposure to landslides	S	S				S															
• Exposure to flooding, including flooding as a result of levee or dam failure																S					
• Soil erosion or the loss of topsoil	S	S									S		S				S				
• Cumulative impacts on soil resources																	U				
• Damage to structures or utilities caused by soils with high shrink-swell potential						S															
• Hazards, including architectural and/or structural damage, due to differential settlement								S													
• Exposure of new development on or downslope of unstable slopes to rockfall or landslide hazards	S																				
• Exposure to seismic-, geologic-, and/or flood-related hazards														U	S		S				
• Cumulative impacts associated with exposure to natural hazards																	U				
Mitigation Measures																					
• Prohibit off-road vehicle use and implement an erosion control plan.	X																				
• Prohibit grading during the rainy season (Oct. 15 - April 15).	X																				

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TABLE GROWTH E.5.1 (Continued)
SIGNIFICANT MITIGABLE (S) AND SIGNIFICANT UNAVOIDABLE (U) IMPACTS OF GROWTH IDENTIFIED BY GENERAL AND SPECIFIC PLAN ENVIRONMENTAL IMPACT REPORTS IN PROJECT AREA

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• Implement the geologic hazard policy map and engineering geology map, table of geological criteria for development, and related policies and mitigation measures.	X																				
• Implement general plan policies and programs to mitigate potential geologic and seismic hazards.		X			X			X							X		X				
• Implement general plan policies and programs to mitigate impacts on soils.											X										
• Conduct/require site-specific environmental review that characterizes site-specific soils, geology, and seismic conditions, conduct site-specific geotechnical review as applicable, and implement identified measures to mitigate project-specific impacts from expansive or corrosive soils and geologic and seismic hazards.		X	X			X		X					X								
• Use open space easements and other regulatory techniques to prohibit development and avoid public safety hazards in areas where geologic instability or faulting is identified.			X																		
• Adopt and enforce the most recent state seismic requirements and applicable standards for structural design of new development and redevelopment (e.g., the Uniform Building Code and California Building Code).			X			X				X								X			
• Promote disaster preparedness in the community with the disaster simulation program. Adopt a disaster preparedness plan and continue to conduct simulation exercises.			X																		
• Require new development within the Alquist Priolo Special Study Zone to comply with applicable regulations pertaining to fault rupture hazard.						X															
• Determine the expansion potential of clay soils on a project-specific basis. Remove or amend and compact highly expansive soils under new buildings. Drain surface water away from buildings to minimize shrink-swell potential.						X															
• Minimize disruption of vegetation during construction and implement measures to reduce soil movement, in accordance with best management practices.						X															
• Continue programs to educate residents about seismic hazards.										X											
• Develop an ordinance to upgrade unreinforced masonry buildings.										X											
• Continue to update the city's emergency preparedness plan.										X											
• Prohibit reduction in creek capacity, implement flood control measures and the San Mateo Creek capital improvement program, and conduct public information programs.																X					
• Implement County plans and policies to reduce impacts; however substantial property damage and loss of life could occur in a major earthquake.																			X		
HAZARDS AND HAZARDOUS MATERIALS																					
Impacts																					
• Release of or exposure to hazardous materials		S	S			S		S							S	S	S			S	
• Exposure to the risk of loss, injury or death involving wildland fires		S														S					
• Hazards associated with unreinforced masonry buildings		S																			
• Increased risk of structural fires and the degree of damage sustained from industrial chemical fires			S																		
• Exposure to soil and/or groundwater contamination		S						S	S	U											
• Safety hazard(s) related to aircraft overflights											S										

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TABLE GROWTH E.5.1 (Continued)
SIGNIFICANT MITIGABLE (S) AND SIGNIFICANT UNAVOIDABLE (U) IMPACTS OF GROWTH IDENTIFIED BY GENERAL AND SPECIFIC PLAN ENVIRONMENTAL IMPACT REPORTS IN PROJECT AREA

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• Potential impacts related to emergency response											S		S				S				
• Increased exposure to man-made and natural hazards																	S				
• Increased exposure to fire hazard in rural areas																	S				
• Impacts on vegetation, water and wildlife resources from elimination of vegetation to reduce fire hazards																	S				
• Cumulative effects from increased exposure to man-made hazards																	U				
Mitigation Measures																					
• Implement general plan programs and policies that address public safety hazards in the planning area.		X						X			X				X		X	X			
• Conduct project-specific environmental review and implement identified measures to mitigate identified potential hazards.		X	X						X							X		X			
• Implement measures identified in the Precise Plan EIR to reduce traffic impacts and ensure the adequacy of project-level emergency-response provisions.													X								
• Adopt and maintain a disaster preparedness plan including emergency response for accidents involving hazardous materials and promote disaster preparedness in the community.			X																		
• Continue to participate in the National Flood Insurance Administration program and investigate the availability of levee reconstruction funding.			X																		
• For proposed projects within the planning area of the airport, ensure consistency with the Airport Land Use Plan and participate in future amendments to the plan.			X																		
• Cooperate with federal, state, and local agencies to effectively regulate and manage hazardous waste.			X																		
• Prior to development of or in proximity to a reported hazardous material site, implement specified measures, including appropriate site assessment, remediation, and follow-up investigation.						X			X												
• Include programs in the general plan to map and remediate potential hazardous soils sites in the city.								X													
• Implement measures to minimize the risks from the use of or accidental exposure to hazardous materials.										X							X				
• Support NASA/Ames as the future federal operator of Moffett Field.										X											
• Implement a risk management plan.																				X	
HYDROLOGY AND WATER QUALITY																					
Impacts																					
• Degradation of surface water and/or groundwater quality		S	S					S			S						S		S	
• Increases in impervious surfaces and/or alternations to drainage resulting in exposure to flood hazards and/or the need for new drainage facilities		S	U			S	S								S			U			
• Degradation of surface water quality from construction activities and/or post-construction uses						S							S								
• Water pollution from stormwater runoff							U								S						
• Exposure of people and property to flooding						S		S		S							S				
• Increased bank erosion and bed sedimentation, risks of landslides, and impacts on new structures as a result of increased runoff from inadequately designed uphill drainage systems	S																				
• Direct and/or cumulative impacts on the hydrologic regime					S															S	
• Increased demands on groundwater resources											S										

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TABLE GROWTH E.5.1 (Continued)
SIGNIFICANT MITIGABLE (S) AND SIGNIFICANT UNAVOIDABLE (U) IMPACTS OF GROWTH IDENTIFIED BY GENERAL AND SPECIFIC PLAN ENVIRONMENTAL IMPACT REPORTS IN PROJECT AREA

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• Flood hazards, including hazards related to potential dam failure											S	S				S					
• Increases in impervious surfaces from cumulative development resulting in increasing frequency and severity of downstream flooding												U								S	
Mitigation Measures																					
• Implement general plan programs and policies that address impacts on drainage facilities and flood control channels and that control erosion and sedimentation.	X	X			X			X			X				X						
• Conduct project-specific environmental review and implement identified mitigation of construction and operational impacts. Include specified requirements such as adherence to best management erosion and sedimentation control practices and calculations to determine the adequacy of site drainage facilities and public facilities.		X				X	X						X							X	
• Require new development projects and substantial redevelopment projects to incorporate as applicable best management practices of the National Pollutant Discharge Elimination System permit and requirements of other applicable plans to control runoff pollutants and sedimentation.			X															X			
• Establish an advisory network of representatives having jurisdiction over the San Francisquito Creek to ensure the community needs for flood control and infrastructure maintenance are met.			X																		
• Identify deficiencies in local storm drainage systems and determine and implement needed improvements and maintenance.			X																		
• Implement general plan policies and programs that protect against dam failure inundation.					X																
• Cooperate with other agencies in preparing plans and developing projects to alleviate flooding potential in newly mapped floodplain areas. Require new developments in mapped 100-year flood zones to provide evidence of flood control protection and compliance with applicable regulations of flood management agencies.						X															
• Reopen the Marsh Road water storage and treatment facility, implement drainage capital improvements, and conduct hydrologic studies.							X														
• Include a policy in the general plan requiring finished floor elevations for new structures to be completed above the 8.2 feet NGVD and requiring other improvements constructed below 8.2 NGVD to be built to withstand temporary inundation.								X													
• Establish pollution control measures that keep pollutants from entering storm drain systems.										X											
• Ensure proper use, storage and disposal of toxic chemicals to prevent soil contamination.										X											
• Implement improvements and policies recommended by the Storm Drainage Task Force.	X																				
• Require ongoing technical evaluations of dam safety and cooperation with relevant entities to implement project-specific mitigation measures included in the technical studies.												X									
• Provide adequate storm drainage systems in new development in coordination with the Santa Clara Valley Water District and the San Mateo County Flood Control District.												X									
• Prohibit reduction of creek capacity.																X					
• Implement flood control measures.																X					

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SIGNIFICANT MITIGABLE (S) AND SIGNIFICANT UNAVOIDABLE (U) IMPACTS OF GROWTH IDENTIFIED BY GENERAL AND SPECIFIC PLAN ENVIRONMENTAL IMPACT REPORTS IN PROJECT AREA

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• Implement the San Mateo Creek Capital Improvement Project.																X					
• Conduct a comprehensive drainage study that includes a survey of maintenance needs for the city's creeks and channels; develop funding, maintenance, and public education programs addressing water quality and flood control issues and develop an enforcement program for illegal dumping in creeks and channels.																X					
• Raise levees to 108 feet.																X					
• Require public notification of flood hazards.																X					
• Implement general plan that reduce exposure to flood hazard.																	X				
• Manage stormwater runoff.															X					X	
• Maintain groundwater recharge.																				X	
• Protect water quality.																				X	
• Support flood control improvements that reduce flood hazards. Regulate the type, location and intensity of land uses within flood-prone areas. Require expansion of storm drainage facilities where needed to serve new development.																		X			
LAND USE & PLANNING																					
Impacts																					
• Conflict(s) with an applicable land use plan, policy, and/or regulation					S			U													
• Land use incompatibilities	S			S	S	S		U		S		S			S	S	S		S		
• Intensification of land uses or substantial changes in land use density, scale, and/or character			S	S	S			U			S				S		S		S		
• Loss of open space or agricultural lands or the premature urbanization of rural areas					S										U		S		S		
• Potential failure or underutilization of neighborhood commercial centers				S																	
• Division of an established community						S															
• Increases in the existing oversupply of jobs							U														
• Visual, traffic and other environmental impacts of constructing a bicycle connection across El Camino Real												S									
• Inefficient land use patterns																	S		S		
• Cumulative land use impacts																	U				
Mitigation Measures																					
• Implement applicable general plan land use programs and policies that address the clustering of development, resource protection, zoning code modification(s), potential impacts of intensified land uses, conflicts between incompatible land uses, impacts on open space, and/or golf course development.	X		X		X			X									X		X		
• Encourage open space dedications and assessment fees.	X																				
• Work with San Mateo and the Mid-Peninsula Open Space District to maintain a buffer between the planning area and Sugarloaf Mountain.	X																				
• Review implementation of the general plan and land use policy map to identify the effect of land development and use in the community on City revenues and costs of providing public facilities and services.			X																		
• Develop a design and improvement plan as part of the City's capital improvement plan.			X																		
• Prepare area or specific plans for neighborhoods identified in the general plan.			X																		

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TABLE GROWTH E.5.1 (Continued)
SIGNIFICANT MITIGABLE (S) AND SIGNIFICANT UNAVOIDABLE (U) IMPACTS OF GROWTH IDENTIFIED BY GENERAL AND SPECIFIC PLAN ENVIRONMENTAL IMPACT REPORTS IN PROJECT AREA

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• Provide adequate resources to enforce the zoning ordinance and other ordinances to achieve the desire level of physical quality in the city.			X																		
• Conduct project-specific environmental review, including design and architectural review as applicable, and implement identified mitigation consistent with general plan land use policies.				X		X					X	X					X		X		
• Monitor commercial and industrial development annually (and prepare a written report every two years) to determine whether land use element policies should be changed.							X														
• Preserve, protect, and enhance the character of residential, retail, and commercial districts and ensure compatibility between the residential, retail, commercial, and industrial districts.										X											
• Preserve mobile home parks, and assure safe construction of mobile and modular housing.										X											
• Ensure that zoning, building regulations and public works requirements are equitable and City processes are efficient.										X											
• Adopt and apply performance standards for review of mixed use developments.												X									
• Construct an at-grade pedestrian/bicycle crossing as specified in the general plan EIR.												X									
• Implement City Concept, Community Development, Aesthetic, Cultural, and Recreational chapter policies of the general plan.															X						
• Prevent incompatible land uses; avoid concentrations of potentially incompatible uses; adopt design policies.																X					
• Establish 20-year growth limits as recommended in the plan's urban growth boundary policy.																			X		
• Deny expansion of commercial development into viable agricultural land and emphasize in-fill to meet these needs (to be implemented by the LAFCO).																			X		
• Implement the appropriate recommendations of the agricultural preserve study																			X		
• Conduct studies and implement recommendations on recreational vehicle park needs and golf course development.																			X		
MINERAL RESOURCES																					
Impacts																					
• Impacts of mineral extraction operations on land, water, air, biological resources																	S				
• Depletion of non-renewable mineral resources																	S				
• Cumulative impacts from the depletion of non-renewable resources and permanent alteration of landforms																	U				
Mitigation Measures																					
• Promote growth management and sphere of influence planning.																	X				
• Maintain the County land use database to monitor land conversion rates, the health of the rural economy, and impacts on resources from land use changes.																	X				
• Implement general plans and policies that require identification of significant mineral resource areas and the buffering of extraction activities from incompatible land uses.																	X				

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TABLE GROWTH E.5.1 (Continued)
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NOISE																					
Impacts																					
• Exposure to or generation of excessive noise levels or groundborne vibration		S	S	S	S	S		S				S	S		S		S	S		S	
• Substantial permanent increase in ambient noise levels				S		S											S				
• Substantial temporary or periodic increase(s) in ambient noise levels						S															
• Exposure of additional residents or businesses to excessive noise levels from aircraft overflights		U																U			
• Exposure of adjacent land uses to noise from future light rail line.															S						
• Short-term noise impacts during construction	S		S			U		S		S			S		S					U	S
• Increased noise levels particularly from vehicular traffic	U	S	S		U	S	U			U	S	S		U	S, U	S					
Mitigation Measures																					
• Implement general plan programs and policies that reduce noise impacts.		X		X				X				X			X		X				
• Implement/require measures to reduce construction noise (e.g., requiring limits on construction hours, use of hospital-grade mufflers on equipment, use of sound barriers or baffles, and/or limits on the number of active building permits issued).	X					X		X					X		X					X	
• Conduct project-level environmental review and implement identified mitigation.		X	X		X	X				X			X			X		X		X	
• Use noise and land use compatibility standards to guide review of development proposals.			X	X	X							X									
• Require all new development to meet general plan and airport land commission noise attenuation standards through building code requirements.																		X			
• Enforce applicable noise insulation standards of the state building code (Title 24) and adopt and enforce local noise ordinances.			X										X								
• Implement specified measures to address traffic noise (e.g., periodic review of truck routes for noise impacts on sensitive land uses, enforcement of vehicle noise standards, limitations on truck operations, and/or installation of noise barriers)	X		X	X			X														
• Encourage other agencies to reduce noise levels generated by roadways, railways, airports, and other facilities.					X																
• Work with Caltrans to quantify and mitigate noise impacts associated with extension of state highways.					X																
• Locate noise-sensitive uses away from noise sources and less sensitive uses closer to noise sources.					X	X															
• Include incremental traffic generated by new development in the analysis of a proposed a project's contribution to traffic noise.						X															
• Evaluate proposed new developments near railroad rights of way for potential vibration impacts and incorporate engineering recommendations in development design.						X															
• Develop a noise abatement mitigation plan.																					X
POPULATION AND HOUSING																					
Impacts																					
• Substantial population and/or job growth in the area					S			U			S							U		U	
• New or increased demand for special housing needs											S										

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TABLE GROWTH E.5.1 (Continued)
SIGNIFICANT MITIGABLE (S) AND SIGNIFICANT UNAVOIDABLE (U) IMPACTS OF GROWTH IDENTIFIED BY GENERAL AND SPECIFIC PLAN ENVIRONMENTAL IMPACT REPORTS IN PROJECT AREA

Impact	JURISDICTION																				
	Belmont[a]	Brisbane[b]	East Palo Alto[c]	Foster City[d]	Fremont[e]	Hayward[f]	Menlo Park[g]	Millbrae[h]	Milpitas[i]	Mountain View[j]	Newark[k]	Palo Alto[l]	Redwood City[m]	San Bruno[n]	San Jose[o]	City of San Mateo[p]	San Mateo County[q]	City of Santa Clara[r]	Santa Clara County[s]	Stanford University[t]	Union City[u]
• Increased demand for housing and related impacts on housing affordability			S	S	S															S	
• Jobs/housing imbalances, oversupply of jobs							S														
• Failure to meet population growth projections, resulting in additional population growth in other jurisdictions.																					U
Mitigation Measures																					
• Implement general plan programs and policies that address impacts related to population growth and housing demand.			X	X	X			X			X										
• Implement regional and local land use, transportation and infrastructure plans designed to accommodate the projected growth and reduce associated environmental impacts.			X																		
• Regularly update the employment database to assess actual job development with respect to projections and apprise infrastructure planning agencies of results.					X																
• Require affordable housing of all development within the community development agency project area and provide other incentives to encourage development of affordable units.				X																	
• Regularly monitor and report to the Planning Commission the amount of commercial and industrial development being permitted, as a basis for considering changes to land use element policies. When development approaches currently projected levels, conduct a traffic analysis as specified to provide a basis for City Council consideration of changes to the land use and transportation and circulation elements.							X														
• Implement general plan land use programs and policies that address jobs/housing imbalances.									X												
• Identify additional housing sites and condition new academic space on the construction of housing.																				X	
• Implement traffic and service mitigation measures.																				X	
• Implement general plan air quality policies and programs.																		X			
PUBLIC SERVICES																					
Impacts																					
• Increased demand for fire protection services			S		S			S		S	S	S								S	
• Increased demand for police protection services			S		S					S	S	S				S				S	
• Increased demand for schools, including cumulative demand			S		S	S	U	S		S	S	U							S, U	S	
• Increased demand for parks and/or deterioration of parks and recreational facilities from increased use			S		S	S				S	S						S			S	
• Increased demand for public services other than fire and police protection, schools, and parks					S					S	S							U			
• Overcrowding of city governmental offices and/or inefficient dispersion of city services resulting from the need for additional city personnel					S																
• Economic impacts if demands on infrastructure exceed collected development impact fees		S																			
• Impacts on existing and demand for new infrastructure															S		S				
• Increased demand for public services														S	S						

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TABLE GROWTH E.5.1 (Continued)
SIGNIFICANT MITIGABLE (S) AND SIGNIFICANT UNAVOIDABLE (U) IMPACTS OF GROWTH IDENTIFIED BY GENERAL AND SPECIFIC PLAN ENVIRONMENTAL IMPACT REPORTS IN PROJECT AREA

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Mitigation Measures																					
• Implement specified general plan programs and policies and mitigation identified in the general plan EIR that address funding for and the provision and maintenance of community services and/or facilities.			X		X			X		X	X	X			X	X			X		
• Impose development impact fees to cover the costs of needed infrastructure.		X			X																
• Conduct project-specific review to assess required levels of public services and implement identified mitigation			X		X										X						
• Cooperate with school districts regarding enrollment projections, the collection of school impact fees, and/or implement other specified measures to provide for and maintain adequate educational services.			X	X	X	X		X										X	X		
• Maintain an emergency preparedness plan to maximize the efforts of emergency service providers and minimize human suffering and property damage during disasters.			X																		
• Encourage regional recreation and parks districts to plan, acquire, and/or construct new recreation and park facilities.						X															
• Encourage the incorporation of park and recreation facilities into major development projects.						X															
• Reopen closed schools, increase the use of temporary facilities, and limit development.							X														
• Implement general plan policies that address increased demands on public services.															X						
• Maintain police and fire services and school capacity.																				X	
RECREATION																					
Impacts																					
• Increased demand for new or expanded parks and/or recreational facilities			S			S						S			S		S				
• Loss and/or degradation of open space				U	S												S			U	
• Cumulative impacts on overused park facilities																	U		U		
• Inefficient or ineffective park and recreation facility operations due to duplicative or ambiguous jurisdictional roles																	S				
• Infringement of other land uses on park lands and natural habitats																	S				
• Impacts of park creation on alternative land uses																	S				
Mitigation Measures																					
• Implement general plan policies and programs to improve, expand, acquire, and/or develop park and recreational facilities			X	X	X										X		X				
• Implement various methods to acquire parkland and improve access to open space and recreational facilities			X																		
• Implement general plan land use and open space policies that address impacts on open space and the protection of sensitive lands.				X	X												X				
• Conduct planning and environmental studies for the expansion or acquisition and construction of parks and recreational facilities to meet increased demand.						X															
• Review development projects to ensure the adequate provision of park facilities.						X						X									
• Cluster development in Lathrop Development District.																				X	
• Encourage the use of less-utilized parks in the County.																			X		
• Implement park improvements and dedicate new trails.																				X	

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TABLE GROWTH E.5.1 (Continued)
SIGNIFICANT MITIGABLE (S) AND SIGNIFICANT UNAVOIDABLE (U) IMPACTS OF GROWTH IDENTIFIED BY GENERAL AND SPECIFIC PLAN ENVIRONMENTAL IMPACT REPORTS IN PROJECT AREA

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TRAFFIC AND TRANSPORTATION																					
Impacts																					
• Increased traffic relative to existing traffic and the capacity of the street system	S	U	U		S					S	U	U		U		U	S	U		S	
• Degradation of levels of service on area roads or highways	U			S, U		U	U		U			S, U	U				S				U
• Increased vehicle delays at area intersections		S							U				S, U							U	
• Increased vehicle delays at intersections in adjacent cities		U																		U	
• Declines of average speeds on individual roadway segments							S														
• Cumulative traffic impacts on roadway segments and/or intersections	U								U				S, U				U		U		
• Traffic safety impacts	S											S					S				
• Impacts on parking capacity												S					S				
• Traffic congestion interference with transit service and/or bicycle levels of service												S									
• Constraints on providing for bicycle and pedestrian travel as a result of increased competition for use of roads and highways by motor vehicles																	S				
• The loss of 40 homes for Hillsdale Boulevard widening																U					
• Construction traffic impacts																				S	
Mitigation Measures																					
• Implement general plan and/or local transportation plan programs and policies and measures identified in the general plan EIR to mitigate traffic and circulation impacts.		X	X		X	X				X	X						X				X
• Encourage adjacent jurisdictions to consent to improvements required of project developers.		X																			
• Coordinate planned development in the city with needed improvements to the regional circulation system.			X																		
• Work with transit agencies to improve local transit service, develop new transportation facilities, and encourage public transit ridership.			X	X																	
• Implement measures to encourage the use of alternative modes of travel and reduce vehicle trips.	X		X	X							X						X	X	X	X	
• Coordinate traffic signals, improve intersection capacity, and implement other operational measures to maximize the efficiency of the circulation system.			X						X											X	
• Support and participate in regional transportation planning.			X								X	X					X	X			
• Require project-specific transportation studies and implement identified mitigation measures.			X	X																X	
• Implement Transportation Systems Management Programs.				X												X		X			
• Add various combinations of turn lanes, through lanes, off- and on-ramps, and/or widen lanes at intersections where unacceptable levels of service occur.	X						X		X			X				X					
• Continue to implement the city's traffic safety program and continue to monitor, identify, and implement safety programs at high-accident intersections.												X									
• Implement measures to reduce traffic impacts on local streets.												X								X	
• Participate in regional efforts to achieve jobs/housing balance and traffic improvements.																X					
• Purchase homes at fair market value and assist resident relocation.																X					
• Expand highway capacity to relieve some bottlenecks.																			X		
• Encourage higher densities and supportive uses around transit stations.																		X			

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TABLE GROWTH E.5.1 (Continued)
SIGNIFICANT MITIGABLE (S) AND SIGNIFICANT UNAVOIDABLE (U) IMPACTS OF GROWTH IDENTIFIED BY GENERAL AND SPECIFIC PLAN ENVIRONMENTAL IMPACT REPORTS IN PROJECT AREA

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• Evaluate Zoning Ordinance parking standards to require only the minimum necessary parking.																		X			
• Implement policies that require road improvements to increase safety on rural roads.																	X				
• Implement parking provisions described in the general plan EIR.												X									
UTILITIES																					
Impacts																					
• Need for new or expanded water service or wastewater treatment facilities	S		S	S	S			S	S		S										
• Need for new or expanded stormwater drainage facilities											S					S	S				
• Increased water demand				U	S										S	U	S				
• Impacts on groundwater quality and quantity and the ability of water districts to provide adequate supply																	S				
• Potentially inequitable allocation system for excess water and inadequate emergency techniques for water service interruption																	S				
• Impacts on biological resources from surface water diversion or impoundment																	S				
• Impacts on small water systems																	S				
• Cumulative impacts on groundwater or surface waters																	U				
• Increased demand for wastewater treatment capacity				S				S					S		S	S	S			S	
• Impacts associated with inadequate sewage systems															S		S				
• Cumulative impacts related to wastewater generation and management													S				U				
• Impacts on landfill capacity					S											U	S	S			
• Impacts on water quality, hydrology, biology, public health and safety, visual quality, noise levels, air quality, soil erosion, and traffic associated with landfill operations																	S				
• Increased demand for solid waste services				S								S									
• Cumulative impacts associated with solid waste management																	U				
• Increased demand for public utilities	S									S											
• Cumulative demand on drainage facilities outside the city's control												U									
Mitigation Measures																					
• Provide additional infrastructure.	X																				
• Comply with service provider development requirements.	X																				
• Establish a technical network as specified to ensure that the community's utility-related needs are met.			X																		
• Review development projects for consistency with water and sewer infrastructure requirements established in approved development plans and agreements.			X																		
• Encourage coordination between land use and water supply planning and protection of water supply sources.															X		X				
• Implement general plan water supply policies pertaining to the use of wells in urban areas, water supply planning for rural areas, and the encouragement of conservation and reclamation.																					
• Encourage the implementation of water conservation measures.			X	X	X			X	X		X				X	X	X			X	
• Upgrade the current water distribution system to accommodate required service.			X																		

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TABLE GROWTH E.5.1 (Continued)
SIGNIFICANT MITIGABLE (S) AND SIGNIFICANT UNAVOIDABLE (U) IMPACTS OF GROWTH IDENTIFIED BY GENERAL AND SPECIFIC PLAN ENVIRONMENTAL IMPACT REPORTS IN PROJECT AREA

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• Implement Natural Resource chapter policies to mitigate potential water supply impacts.															X						
• Implement general plan policies that encourage water conservation and recharge in park and recreation facilities.																	X				
• Implement general plan policies to find an alternative disposal site to meet the city's future disposal needs.					X																
• Work with San Mateo to ensure the adequacy of the wastewater treatment plant.				X																	
• Implement general/community plan programs and policies to reduce waste and promote recycling.				X	X							X					X	X		X	
• Implement specified general plan policies and programs that address the adequacy of and improvements to the existing utility infrastructure and the potential for using recycled water.								X	X		X										
• Implement environmental management chapter policies and action programs pertaining to the provision of utilities and urban services.										X											
• Implement measures identified in the Precise Plan EIR to ensure adequate wastewater treatment and transmission capacity.													X								
• Implement general plan policies that require provision of adequate wastewater systems and coordination of wastewater management, land use, and water supply planning.															X		X				
• Improve the wastewater collection system.																				X	
• Work with water districts to secure additional supplies.																X					
• Work with the County to secure permits to use the Apanolio canyon to provide adequate landfill capacity.																X					
• Implement general plan policies that encourage buffering of landfills from more sensitive land uses.																	X				
• Implement general plan policies that address impacts associated with solid waste management.																	X				
• Implement a comprehensive sewer system study and storm drainage system study.																X					
ENERGY																					
Impacts																					
• Large and wasteful increases in energy consumption					U																
• Increased demand for energy, including electricity and natural gas	S		S					S			S						S				
• Increased demand for automobile fuel	S							S													
• Incremental increase in the use of non-renewable energy resources																	S				
• Cumulative energy-related impacts																	U				
Mitigation Measures																					
• Require compliance with California Administrative Code Title 24 (Building Code) energy conservation standards.	X		X					X													
• Encourage project proponents to incorporate energy conservation techniques in proposed projects. Provide brochures with information on energy efficient building and site design at the public counter.			X																		
• Operate construction equipment to avoid unnecessary use of fuel.	X																				
• Promote energy efficient building and site design for all new public buildings, and install energy saving devices in new public buildings and retrofit existing public buildings.	X		X														X				
• Promote retrofit programs to reduce energy usage and reduce emissions associated with energy consumption.			X																		

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TABLE GROWTH E.5.1 (Continued)
SIGNIFICANT MITIGABLE (S) AND SIGNIFICANT UNAVOIDABLE (U) IMPACTS OF GROWTH IDENTIFIED BY GENERAL AND SPECIFIC PLAN ENVIRONMENTAL IMPACT REPORTS IN PROJECT AREA

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• Implement transportation measures to improve roadway system efficiency and provide for alternative means of transportation.					X												X				
• Implement specified circulation policies concerning public transportation, bicycle, and pedestrian system improvements.								X									X				
• Implement specified general plan policies and programs concerning energy conservation in new and existing housing.								X													
• Expand general plan policies to require all new construction to conform with Title 22 and 24 standards, as well as to incorporate additional prescribed packages of energy saving building strategies as recommended by the California Energy Commission.								X													
• Require extensive landscaping of parking lots with trees to maximize shade and reduce localized warming.								X													
• Implement general plan policies related to the distribution of land use designations to minimize energy demand and maximize energy efficiency.																					
• Implement policies and programs of the general plan open space and conservation element that reduce energy-related impacts.											X										

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References – Appendix E.5

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APPENDIX E.6
Project Level Impacts of Growth

General plans aim to provide for orderly development within the planning area and incorporate policies to reduce the adverse impacts of such development, as discussed in the WSIP PEIR Chapter 7. Mitigation measures have been identified in the EIRs of adopted general plans to reduce the adverse impacts related to growth (refer to Appendix E, Section E.5, Table E.5.1). As part of WSIP PEIR analysis, a selection of EIRs of major projects currently being undertaken in the SFPUC service area were reviewed. The purpose of the review was to assess whether, at least for the small selection of EIRs reviewed, the mitigation measures identified in general plan EIRs were being implemented at the project level.

The thresholds for large projects contained in SB 610 were used to guide identification of the projects for this assessment.(i.e., residential developments with more than 500 units; retail uses with more than 500,000 square feet of floor space; office buildings with more than 250,000 square feet of floor space; hotels or motels with more than 500 rooms; industrial uses occupying more than 40 acres or having more than 650,000 square feet of floor area; and mixed-use projects that include any use or combination as large as the above uses).

The specific impacts of a project necessarily depend on its particular circumstances, such as the location and nature of the project. Nevertheless, the review of current development projects in the service area and review of impacts and mitigation measures presented in **Table E.6.1** indicates that the impacts of growth are being mitigated consistent with the measures identified to reduce those impacts in the respective general plan EIRs.

The Projects

This appendix summarizes the impacts and mitigation measures identified for the following projects:

- One Quarry Road Residential Project, Brisbane
- Electronics for Imaging, Inc., Vintage Park Development, Foster City
- Elmwood Residential Commercial Development, Milpitas
- Abbott Labs, Redwood City
- Palo Alto Medical Foundation, San Carlos

One Quarry Road Residential Project, Brisbane

The proposed project consists of the redevelopment of an existing quarry for residential and open space uses. The project site is 144.4 acres, including the Guadalupe Valley Quarry and surrounding undeveloped land; it is located northeast of the main ridge of San Bruno Mountain in unincorporated San Mateo County, approximately three-quarters of a mile west of central Brisbane. The project includes subdivision of the site and construction of 148 single-family detached residences, three condominiums totaling 61 townhouses, a main access road, and internal roadways. A 600,000-gallon water tank would be constructed on a bench in the quarry wall, and associated utilities, landscaping, and lighting would be developed to serve the project. The residential development includes a 2.7-acre city park, a 0.29-acre neighborhood tot-lot, and 13.5 acres of common landscaped space. The residential areas would occupy roughly 19 acres plus 16.5 acres of common landscaped area and parks. The remaining land would be divided between relatively undisturbed open space surrounding the residential development (58 acres) and reclaimed quarry slopes (43 acres). Impacts and mitigation measures identified in the One Quarry Road Residential Project EIR are presented in Table E.6.1. Brisbane voters rejected the project in November 2006, when project approval was placed on the city ballot as Measure B. The EIR prepared for the project nevertheless provides a means to compare project-level impact assessment and mitigation with the city's general plan EIR.

Electronics for Imaging, Inc., Foster City

The EIR prepared for this project serves as a master EIR for one project component (a proposed master plan amendment) and a project-level EIR for the other project component (the proposed construction of several phases of the proposed development). The amendment to the Vintage Park Master Plan proposes development of 750,000 to 1,000,000 square feet of space for offices, research and development, and light industry instead of the nearly 1,500 multifamily residential units and 60,000 square feet of support retail space allowed under the current master plan. The project-level development includes construction of three buildings. Impacts and mitigation measures identified in the Electronics for Imaging EIR are presented in Table E.6.1.

Elmwood Residential and Commercial Development, Milpitas

The proposed project consists of a 59-acre residential, commercial, and recreational development surrounding the Santa Clara County Elmwood Correctional Facility east of Interstate 880 and north of Great Mall Parkway in the city of Milpitas. The project includes the development of approximately 680 residential units (315 condominium units, 110 of which would be available for sale to qualified moderate-income households; 165 single-family detached homes; and 203 townhomes), 180,000 square feet of auto mall building space (to accommodate approximately three auto dealerships), six acres of public park (including Hetch Hetchy park/trail improvements, Elmwood Park, and West Able Street Public Park), and approximately 8.4 acres for two private park/recreation areas (one within the single-family home area and one within the proposed condominium area). To accommodate the proposed development, the project also proposes to amend the Milpitas General Plan, the Midtown Specific Plan, and the city's zoning map; it also proposes approval of a planned unit development map, site and architectural plans, and a use

permit for exceptions to development standards. Impacts and mitigation measures identified in the Elmwood EIR are presented in Table E.6.1.

Abbott Laboratories, Redwood City

Abbott Laboratories consists of a master-planned research center at the foot of Chesapeake Drive on Redwood City's bayfront, adjacent to the Port of Redwood City small-boat launch facility and the Stanford Rowing Club. The project proposes to remove salt processing structures and equipment and to construct approximately 541,000 square feet of manufacturing, research and development, and offices in four buildings around a central green space. The project includes an onsite multilevel parking garage, a greenbelt around a portion of the site, and a publicly accessible linear waterfront park; it would also set aside land to construct a replacement facility for the Marine Sciences Institute. The institute would be responsible for the planning and execution of its new facility within the design guidelines established in the project's master plan. The project proposes subdividing the site into eight lots: six for the proposed buildings of the Abbott Laboratories campus, a separate lot for the Marine Sciences Institute, and a common area lot for private roadways, utilities, and landscaping. The project would be constructed in three phases over a 10-year period. Impacts and mitigation measures identified in the Abbott Laboratories EIR are presented in Table E.6.1.

The Palo Alto Medical Foundation–San Carlos Center, San Carlos

The proposed Palo Alto Medical Foundation–San Carlos Center (PAMF–SCC) project involves the closure and demolition of industrial manufacturing facilities, implementation of an approved remedial action plan at the site, and construction of medical facilities. The 18.1-acre project site is located at 301 Industrial Road, northwest of the Holly Street/Highway 101 interchange in east San Carlos. Existing structures at the site include four main buildings, a wastewater treatment plant, a hazardous waste storage area, other smaller structures, and surface parking. Structures occupy approximately 42 percent of the site; areas not covered by structures are paved (except for minor landscaping along the street frontage). Following closure and decommissioning by the current owner, the site would be remediated according to the approved remedial action plan. The RWQCB would be the lead agency overseeing site remediation, with review and concurrence by the Department of Toxic Substances Control and San Mateo County. The proposed medical facility includes a 478,500-square-foot medical building (including a detached 12,500-square-foot central plant), two aboveground parking garages with approximately 1,245 spaces, and a clock tower. The medical building would house a hospital, medical offices, an ambulatory care clinic, and ancillary/supporting uses. The project would occupy approximately 7.2 acres (40 percent) of the site and would increase the area of permeable surface from zero to about 4.5 acres. Impacts and mitigation measures identified in the PAMF–SCC EIR are presented in Table E.6.1.

References – Appendix E.6

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TABLE E.6.1
SIGNIFICANT IMPACTS AND MITIGATION MEASURES IDENTIFIED
IN ENVIRONMENTAL IMPACT REPORTS OF RECENT MAJOR PROJECTS IN THE SFPUC SERVICE AREA

Impact	One Quarry Road Project (Brisbane)	Electronics for Imaging (Foster City)	Elmwood Residential and Commercial Development Project (Milpitas)	Abbott Laboratories (Redwood City)	Palo Alto Medical Foundation (San Carlos)
Aesthetics					
Impacts					
• Negative aesthetic effect or degradation of existing views	S				
• Conflicts with design guidelines previously adopted for the site		S			
• Creation of new source(s) of light and/or glare	S			S	
Mitigation Measures					
• Amend design guidelines as recommended prior to project approval		X			
• Confine illumination to the project site; shield and orient light sources to minimize their visibility from outside the site; complete and submit a photometrics site plan analysis with each of the project's building phases for review and approval by the city's community development services director				X	
• Relocate and reconfigure specified site plan features (water tank, townhouses, and single-family houses) to reduce or eliminate their visual prominence	X				
• Use nonreflective paint and nonglare fixtures	X				
• Provide appropriate structural and/or vegetative screening for sensitive adjacent uses	X			X	
Agricultural Resources					
Impacts – No significant impacts identified					
Air Quality					
Impacts					
• Construction-related air quality impacts (construction vehicle emissions and particulate matter)		S		S	S
• Fugitive dust emissions during construction	S		U		
• Operational air quality emissions from new area and mobile sources					U
• Increased regional air pollutant emissions from traffic generated by the project		U			
• Cumulative impacts on regional air quality in the Bay Area			U		U
Mitigation Measures					
• Implement BAAQMD- and EIR-specified construction dust control measures	X	X	X	X	X
• Provide site features and implement measures to encourage the use of alternative modes of travel (alternatives to private vehicles) and reduce vehicle trips		X	X		X
• Allow only natural gas fireplaces, pellet stoves, or EPA-certified wood-burning stoves; prohibit conventional open-hearth fire places			X		

S = Significant mitigable impact U = Significant and unavoidable impact X = Mitigation measure identified in Environmental Impact Report

TABLE E.6.1 (Continued)
SIGNIFICANT IMPACTS AND MITIGATION MEASURES IDENTIFIED
IN ENVIRONMENTAL IMPACT REPORTS OF RECENT MAJOR PROJECTS IN THE SFPUC SERVICE AREA

Impact	One Quarry Road Project (Brisbane)	Electronics for Imaging (Foster City)	Elmwood Residential and Commercial Development Project (Milpitas)	Abbott Laboratories (Redwood City)	Palo Alto Medical Foundation (San Carlos)
• Use reflective/high albedo roofs and light-colored construction materials to increase the reflectivity of paved surfaces and include shade trees near buildings to shield buildings from the sun and reduce local air temperature and energy demand			X		
Biological Resources					
Impacts					
• Impact(s) on sensitive or special-status animal or plant species	S		S		S
• Degradation of riparian habitat or other sensitive habitat	S		S		
• Impact(s) on protected wetlands, either individually or in combination with known or probable impacts of other activities	S		S		
• Conflicts with an adopted habitat conservation plan	S				
• Displacement of native plants, including important wildlife food plants, by invasive exotic plants	S				
• Disturbance of burrowing owls and/or permanent loss of owl habitat			S		
• Disturbance of active raptor nests, the nests of sensitive bird species, or other nesting bird species	S		S		S
• Cumulative impacts on nesting birds					S
Mitigation Measures					
• Fulfill the city's obligations under the habitat conservation plan in light of the change of site status from an unplanned to a planned parcel	X				
• Develop, implement, and monitor a varicolored lupine establishment plan in consultation with U.S. Forest Service	X				
• Oversee maintenance of slopes to maximize safety and minimize adverse impacts on butterfly food plants	X				
• Construct chain-link fences acceptable to the property owner and the California Department of Fish and Game (CDFG) along the perimeter of developed areas and along access roads to prevent people from entering sensitive habitat areas	X				
• Post interpretive signage at specified areas to educate homeowners about San Bruno Mountain habitat and the detrimental effects of exotic plants	X				
• Provide new homeowners with the current Open Space and Ecology Committee brochure and make reasonable, ongoing efforts to educate homeowners about exotic plants and the habitat of San Bruno Mountain	X				
• Indicate in conditions, covenants, and restrictions attached to individual properties that no pets will be allowed outside the owner's lot unless under the control of a responsible person by leash or other means	X				

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TABLE E.6.1 (Continued)
SIGNIFICANT IMPACTS AND MITIGATION MEASURES IDENTIFIED
IN ENVIRONMENTAL IMPACT REPORTS OF RECENT MAJOR PROJECTS IN THE SFPUC SERVICE AREA

Impact	One Quarry Road Project (Brisbane)	Electronics for Imaging (Foster City)	Elmwood Residential and Commercial Development Project (Milpitas)	Abbott Laboratories (Redwood City)	Palo Alto Medical Foundation (San Carlos)
• Revise grading plan so that stonecrop on the site is outside project's grading limits	X				
• Conduct appropriately timed survey for nesting raptors before removing any eucalyptus trees and for nesting loggerhead shrikes before removing any shrubs; establish a 250-foot buffer around any nests that are found, within which no vegetation will be removed until the young birds have fledged	X				
• Indicate in conditions, covenants, and restrictions attached to individual properties that the use on private property of any invasive non-native plant species that could displace butterfly food plants will be prohibited; provide information to the homeowners association and individual homeowners about invasive species; invite homeowners to an informational meeting conducted by a local environmental organization to educate residents about the sensitive environment adjoining the project site, and the potential impact of invasive plant species on butterfly habitat; hold annual meetings between the homeowners association and each homeowner to verify that invasive plants are not being planted; require the homeowners association to remove any invasive plants from areas for which it is responsible	X				
• Remove invasive exotic plant species found in both the revegetated and undisturbed areas of the project site; preclude the use of invasive exotic species from landscaping in common areas; and maintain common areas to ensure exotic invasive species are removed	X				
• Verify the prepared wetland delineation with the U.S. Army Corps of Engineers; apply for relevant permits, waivers, and certifications for jurisdictional wetlands determined to occur on the site	X				
• Develop and implement a mitigation plan to replace the lost watercourse consistent with requirements of the RWQCB and CDFG	X				
• Identify the species of gumplant at the site and, if it is a special-status species, include the species in the planting mix used for slope benches	X				
• Conduct appropriately timed surveys (to be conducted by a qualified botanist) to determine the presence or absence of special-status plant species; if special-status plants are detected, contact the CDFG and develop appropriate protocols for relocating the plants and conducting future monitoring at the site			X		
• Prepare a stormwater pollution prevention plan that specifies measures to minimize impacts on biological resources (in particular special-status fish species) resulting from stormwater runoff			X		
• Avoid disturbance of trees and shrubs during nesting season; if construction during nesting season cannot be avoided, conduct preconstruction surveys for nesting birds and implement protective measures if active nests are identified			X		X

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TABLE E.6.1 (Continued)
SIGNIFICANT IMPACTS AND MITIGATION MEASURES IDENTIFIED
IN ENVIRONMENTAL IMPACT REPORTS OF RECENT MAJOR PROJECTS IN THE SFPUC SERVICE AREA

Impact	One Quarry Road Project (Brisbane)	Electronics for Imaging (Foster City)	Elmwood Residential and Commercial Development Project (Milpitas)	Abbott Laboratories (Redwood City)	Palo Alto Medical Foundation (San Carlos)
• Prior to discing for fire or weed control, conduct a burrowing owl nesting/occupancy survey as prescribed by the CDFG; implement appropriate relocation protocols if burrows are identified within project impact area; provide for replacement of habitat with offsite mitigation habitat that has been approved by the CDFG; conduct preconstruction surveys no more than 30 days prior to any ground-disturbing activity			X		
• Obtain a nationwide permit from the U.S. Army Corps of Engineers, a streambed alteration agreement permit from the CDFG, and an RWQCB Section 401 water quality certification and/or waiver of discharge requirements prior to filling waters or constructing any facilities in or affecting waters at or near the site			X		
• Prior to demolition or construction near drainage channels, install appropriate exclusion fencing to prevent red-legged frogs from entering the site					X
Cultural Resources					
Impacts					
• Disturbance of archaeological resources			S	S	S
• Disturbance of paleontological resources					S
• Disturbance of architectural or historic resources				S	
• Disturbance of human remains			S		S
Mitigation Measures					
• Monitor future ground-disturbing activities (to be monitored by qualified archaeologist)			X	X	
• If any cultural resources are found, halt work in the vicinity until the find has been evaluated by a qualified archaeologist/cultural resources consultant and a mitigation plan has been developed			X		X
• If avoidance of the resource is not feasible, prepare and execute a plan for the methodical excavation and documentation of those portions of the site that would be adversely affected; conduct construction activities in the vicinity of the find in accordance with current professional standards and do not recommence until the archaeological work is completed					X
• If cultural resources are found, inform project personnel that collecting significant historical or unique archaeological resources discovered during project development is prohibited by law					X
• If any human remains are uncovered during future construction activity, halt work and notify the county coroner immediately; if the coroner determines the remains are Native American, contact the Native American Heritage Commission pursuant to state regulations			X	X	X
• Provide a photographic record of existing structures and equipment on the project site prior to demolition; submit the photographs to the Redwood City Historic Resources Advisory Committee to be used at the committee's discretion				X	

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TABLE E.6.1 (Continued)
SIGNIFICANT IMPACTS AND MITIGATION MEASURES IDENTIFIED
IN ENVIRONMENTAL IMPACT REPORTS OF RECENT MAJOR PROJECTS IN THE SFPUC SERVICE AREA

Impact	One Quarry Road Project (Brisbane)	Electronics for Imaging (Foster City)	Elmwood Residential and Commercial Development Project (Milpitas)	Abbott Laboratories (Redwood City)	Palo Alto Medical Foundation (San Carlos)
Geology and Soils					
Impacts					
• Exposure to seismic or geologic hazards	S	S	S	S	
• Substantial soil erosion or the loss of topsoil				S	
• Damage to structures or utilities caused by soils with high shrink-swell potential			S	S	
• Location of structures on strata or soil that is unstable or that would become unstable as a result of the project	S				
• Exposure of facilities, including buildings, parking structures, and underground utilities, to corrosive soils				S	
• Hazards, including architectural and/or structural damage, due to differential settlement	S	S			
• Exposure to rockfall hazards	S				
Mitigation Measures					
• Conduct earthworks and foundation design in accordance with all recommendations contained in project geotechnical reports	X				
• Base grading and foundation design on the anticipated strong seismic shaking associated with a future major earthquake on the San Andreas fault	X				
• Prepare and submit to the city for approval an earthquake preparedness and emergency response plan for all public facilities	X				
• Prepare an earthquake hazards information document prior to marketing residential units for sale	X				
• Reconfigure the proposed townhouse pad to improve fill slope stability; construct fill slopes by excavating a slot key	X				
• Limit the differential fill thickness below individual buildings as specified	X				
• Conduct a geotechnical investigation to determine the feasibility of placing the water tank at the proposed location; redesign the water storage component of the project to ensure stability of the site and post-earthquake water supply; replace the proposed single tank with three smaller tanks; and reinforce the rock cut slope surrounding the water tanks	X				
• Construct an adequate rockfall catchment along the base of the planned final quarry slopes	X				
• Incorporate all recommendations of the slope stability analysis into the project	X				
• Cut and rebench quarry slopes by mechanical means where rock conditions are suitable for ripping with heavy-duty equipment; where blasting is required, use control methods to minimize over-breaking and loosening of final rock surfaces and to protect worker safety	X				

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TABLE E.6.1 (Continued)
SIGNIFICANT IMPACTS AND MITIGATION MEASURES IDENTIFIED
IN ENVIRONMENTAL IMPACT REPORTS OF RECENT MAJOR PROJECTS IN THE SFPUC SERVICE AREA

Impact	One Quarry Road Project (Brisbane)	Electronics for Imaging (Foster City)	Elmwood Residential and Commercial Development Project (Milpitas)	Abbott Laboratories (Redwood City)	Palo Alto Medical Foundation (San Carlos)
• Install subdrains beneath the deep fills to be put in place in the southeastern portion of the site	X				
• Design and construct a retaining wall, catchment basin, or other engineered feature to retain slope debris in areas of mapped landslides; establish a geologic hazard abatement district or other mechanism approved by the city to be responsible for all bench maintenance and slope repair	X				
• Comply with all aspects of the California Surface Mining and Reclamation Act regarding approval of land uses that are incompatible with mineral production at the project site	X				
• Conduct site-specific geotechnical and soils investigation(s) as specified and incorporate all measures identified to mitigate impacts		X	X	X	
• Install cathodic protection system on the project site to protect underground metallic fittings, appurtenances, and piping from corrosion				X	
• During construction, comply with erosion and sediment control measures in accordance with local stormwater requirements, construction best management practices, and State Water Resources Control Board National Pollution Discharge Elimination System requirements				X	
Hazards and Hazardous Materials					
Impacts					
• Hazards resulting from the routine transport, use, or disposal of hazardous materials	S			S	
• Hazards associated with petroleum-contaminated soils and the potential presence of petroleum hydrocarbons and polycyclic aromatic hydrocarbons in the soil and groundwater	S				
• Exposure of construction workers or the public to hazardous materials, including lead-based paint and/or materials containing asbestos	S		S		
Mitigation Measures					
• Assess existing structures for the presence of hazardous materials (assessment to be conducted by a qualified professional); if found, remove and dispose of hazardous materials in accordance with applicable state and federal regulations	X		X		
• Test the ground-mounted electrical transformers for PCBs; if found, remove and dispose of the materials in accordance with state and federal regulations			X		
• Remediate previously identified contaminated soils to below RWQCB risk-based thresholds or thresholds developed by a site-specific human health risk assessment prepared by a qualified professional	X				
• Investigate presence and extent of contaminants in soils and groundwater; coordinate this investigation and remediation with the removal of the underground oil storage tank	X				

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TABLE E.6.1 (Continued)
SIGNIFICANT IMPACTS AND MITIGATION MEASURES IDENTIFIED
IN ENVIRONMENTAL IMPACT REPORTS OF RECENT MAJOR PROJECTS IN THE SFPUC SERVICE AREA

Impact	One Quarry Road Project (Brisbane)	Electronics for Imaging (Foster City)	Elmwood Residential and Commercial Development Project (Milpitas)	Abbott Laboratories (Redwood City)	Palo Alto Medical Foundation (San Carlos)
• Adhere to existing federal, state, and local regulations regarding management and handling of hazardous materials	X				
• Include an area evacuation and business evacuation plan as part of the business plan submitted to the county health services agency and the city fire department; in conjunction with the fire department, conduct onsite hazardous materials training as needed or at least every 18 months				X	
Hydrology and Water Quality					
Impacts					
• Increases in impervious surface area and/or the alteration of area drainage resulting in flood hazards or the need for new drainage facilities	S	S	S	S	
• Water pollution from stormwater runoff	S			S	
• Placement of structures within a 100-year floodplain			S	S	
• Degradation of surface water quality due to construction activities and/or post-construction uses	S	S	S	S	
Mitigation Measures					
• Design and implement site drainage plan, in accordance with applicable standards and requirements, to address lot grading, paved areas, site facilities, and landscaping; demonstrate adequacy of conveyance structures; and incorporate appropriate filtration and control structures to direct, control, and filter runoff	X	X	X	X	
• Reduce the amount of impervious surface to the extent feasible	X		X		
• Design detention basins to contain runoff during the design storm event and enhance water quality	X				
• Stipulate in conditions, covenants, and restrictions attached to site properties the manner in which drainage facilities are to be monitored and maintained to sustain conveyance capacity	X				
• Construct new storm drain pipe as specified to alleviate existing flood hazard and accept increased project flows	X				
• Prepare and submit to the city for approval a construction stormwater pollution prevention plan (SWPPP) that includes best management practices to reduce construction impacts on surface water quality	X				
• Prepare and implement a SWPPP that includes best management practices to reduce potential impacts on surface water quality over the life of the project	X			X	
• Prepare and distribute to all potential occupants a water quality information document prior to purchase of the housing units	X				

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TABLE E.6.1 (Continued)
SIGNIFICANT IMPACTS AND MITIGATION MEASURES IDENTIFIED
IN ENVIRONMENTAL IMPACT REPORTS OF RECENT MAJOR PROJECTS IN THE SFPUC SERVICE AREA

Impact	One Quarry Road Project (Brisbane)	Electronics for Imaging (Foster City)	Elmwood Residential and Commercial Development Project (Milpitas)	Abbott Laboratories (Redwood City)	Palo Alto Medical Foundation (San Carlos)
• Conduct a final floodplain study demonstrating that existing sheet flows through the project will be accommodated without affecting adjacent floodplains more than is allowed by the Federal Emergency Management Agency (FEMA)			X		
• Design and construct residential and commercial structures to conform with applicable city requirements for structures in a floodplain			X		
• Design the new bridge to meet creek flow standards and all other applicable standards of the U.S. Army Corps of Engineers and the city			X		
• Provide storm drain system signs and/or stenciling to discourage illegal dumping into storm drains, catch basins, and/or filled inlets	X		X		
• Implement best management practices to protect water quality, including, at a minimum, erosion control, sediment transfer reduction, and dust control measures			X		
• Require in conditions, covenants, and restrictions for all future residential development: good housekeeping practices for handling potentially harmful material and controls to prevent and reduce pollutant discharge to stormwater for common landscaped areas and open space; material disposal and recycling controls to discourage illegal dumping of unwanted material into storm drains; a prohibition against dumping waste products into storm drains; and maintenance requirements for private streets, parking lots, and storm drain facilities to control and remove pollutants			X		
• Require as a condition of approval for future commercial development that educational flyers and other materials be provided to all owners/tenants to increase understanding of water quality best management practices and ensure that measures are implemented within private and open space areas to control and limit exposure to potential pollutants			X		
• Require that commercial operators be responsible for inspection, maintenance, and repair of sediment and oil filtering devices for the pretreatment of runoff from paved areas			X		
• Construct a levee to the specified minimum elevation to satisfy FEMA requirements to prevent 100-year flood water inundation of the project site; conduct a geotechnical investigation as specified to determine whether soil material and compaction would satisfy city levee requirements				X	
• Utilize integrated pest management techniques to minimize the use of pesticide sprays as specified by the county pollution prevention program				X	
• In addition to compliance with applicable regulations, establish a construction buffer of at least 1 meter along drainage channels within which no construction activities would occur (improvement measure for less-than-significant impact)					X

S = Significant mitigable impact U = Significant and unavoidable impact X = Mitigation measure identified in Environmental Impact Report

TABLE E.6.1 (Continued)
SIGNIFICANT IMPACTS AND MITIGATION MEASURES IDENTIFIED
IN ENVIRONMENTAL IMPACT REPORTS OF RECENT MAJOR PROJECTS IN THE SFPUC SERVICE AREA

Impact	One Quarry Road Project (Brisbane)	Electronics for Imaging (Foster City)	Elmwood Residential and Commercial Development Project (Milpitas)	Abbott Laboratories (Redwood City)	Palo Alto Medical Foundation (San Carlos)
Land Use and Planning					
Impacts					
• Conflict with existing zoning designation		S			
• Conflict of parking areas and landscaping with existing utility easement		S			
• Conflicts with elements of the general plan					S/SU
• Cumulative land use impacts					SU
Mitigation Measures					
• Approve requested rezoning prior to project approval		X			
• Submit final improvement plans for review and comment to the utility with an easement through the site		X			
• Implement the measure identified in the analysis of noise impacts					X
• Implement the measure identified in the analysis of transportation impacts to reduce impacts at four specified intersections (cumulative effects at the intersections would not be reduced to a less-than-significant level)					X
• Implement the measure identified in the analysis of transportation impacts to reduce mobile-source air pollutants					X
Mineral Resources					
Impacts					
• Incompatibility of the project with mineral production at the project site	X				
Mitigation Measures					
• Comply with all aspects of the California Surface Mining and Reclamation Act regarding approval of the proposed land use and make appropriate findings regarding the benefits and disadvantages of quarry operations and the benefits to the community of new housing	X				
Noise					
Impacts					
• Short-term noise impacts during construction		S	S	S	
• Construction vibration from pile driving					U
• Cumulative construction noise and vibration					U
• Exposure to excessive noise levels (roadway noise and/or stationary noise sources)			S		S

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TABLE E.6.1 (Continued)
SIGNIFICANT IMPACTS AND MITIGATION MEASURES IDENTIFIED
IN ENVIRONMENTAL IMPACT REPORTS OF RECENT MAJOR PROJECTS IN THE SFPUC SERVICE AREA

Impact	One Quarry Road Project (Brisbane)	Electronics for Imaging (Foster City)	Elmwood Residential and Commercial Development Project (Milpitas)	Abbott Laboratories (Redwood City)	Palo Alto Medical Foundation (San Carlos)
Mitigation Measures					
• Implement management practices as specified to limit construction noise (may include limiting construction hours to minimize impacts on nearby uses, use of mufflers on equipment and maintaining equipment in good working order, locating noise sources as far as possible from nearby sensitive receptors, and limiting idling times for equipment and vehicles with internal combustion engines)		X	X	X	X
• Use hydraulically or electrically powered impact tools (e.g., jack hammers and pavement breakers) wherever feasible; where use of pneumatically powered tools is unavoidable, use an exhaust muffler on compressed air exhaust and external jackets on the tools themselves where feasible				X	
• Establish a process for responding to and tracking complaints pertaining to construction noise				X	
• If pile driving would be conducted outside specified hours (consistent with provisions for exceptions), erect plywood barriers as specified on site boundary and hire acoustical consultants to recommend additional site-specific measures to reduce pile-driving noise				X	
• Implement vibration abatement strategies to reduce vibration impacts on the adjacent residents					X
• Develop a noise attenuation plan to be implemented at the commercial portion of the site; noise control measures in the plan may include construction of noise barriers and site planning to avoid locating noise-generating operations adjacent to residential property boundaries			X		
• To reduce parking noise, construct a noise barrier fence along the northern site boundary where it adjoins single-family residences			X		
• Conduct acoustic study and implement recommendations, including noise insulation features to ensure interior noise levels do not exceed the specified threshold			X		X
Population and Housing					
Impacts					
• Potential conflicts with housing design requirements for persons with disabilities	S				
• Conflicts with affordable housing requirements or housing element designation of site for affordable housing	S	S			
• Jobs/housing imbalances (and consequent impacts on housing prices, commute times, and other effects)				S	
Mitigation Measures					
• Include in site plans units suitable for persons with disabilities	X				
• Comply with the city's affordable housing requirements either by providing the appropriate percentage of units affordable to low- and moderate-income households or by paying to the city fees in lieu of affordable housing units	X				

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TABLE E.6.1 (Continued)
SIGNIFICANT IMPACTS AND MITIGATION MEASURES IDENTIFIED
IN ENVIRONMENTAL IMPACT REPORTS OF RECENT MAJOR PROJECTS IN THE SFPUC SERVICE AREA

Impact	One Quarry Road Project (Brisbane)	Electronics for Imaging (Foster City)	Elmwood Residential and Commercial Development Project (Milpitas)	Abbott Laboratories (Redwood City)	Palo Alto Medical Foundation (San Carlos)
• Revise the housing element to provide adequate alternative housing sites, consistent with land use element designations, and remove all text related to providing housing at the project site		X			
• Pay the required fee per square foot for Phases 2 and 3 of the project if the city adopts a jobs/housing linkage program requiring such a fee before those phases are developed				X	
• Increase the residential development potential in the city through land use and zoning changes				X	
Public Services					
Impacts					
• Increased demand for fire protection services	S	S	S	S	
• Increased demand for police protection services	S	S	S	S	
• Increased use of parks, resulting in physical deterioration and increased maintenance demands			S		
• Increased demand for public services other than fire and police protection, schools, and parks	S				
• Cumulative increases in demand for police, fire, emergency, and childcare services				S	
• Cumulative increases in demand for schools				S	
Mitigation Measures					
• Incorporate fire protection design features and equipment as specified for all buildings within 50 feet of wildland; implement a 30-foot firebreak or other fire buffer program approved by the fire chief	X				
• Locate and design site structures and infrastructure to ensure adequate access by fire department vehicles and equipment		X			
• Fund additional water mains, to be installed by the city, as required by the city fire department to ensure adequate water supply for fire suppression activities				X	
• Comply with all applicable requirements of the Uniform Fire Code				X	
• Design and light parking structures to reduce auto thefts and burglary		X			
• Provide security lighting for the landscaped waterfront perimeter				X	
• Provide private security measures, including security personnel, to protect people and property at the site; submit plans for each development phase to the police department for review to identify additional design measures to enhance site security				X	
• Increase police staffing levels as indicated and provide for associated vehicles and equipment		X			

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TABLE E.6.1 (Continued)
SIGNIFICANT IMPACTS AND MITIGATION MEASURES IDENTIFIED
IN ENVIRONMENTAL IMPACT REPORTS OF RECENT MAJOR PROJECTS IN THE SFPUC SERVICE AREA

Impact	One Quarry Road Project (Brisbane)	Electronics for Imaging (Foster City)	Elmwood Residential and Commercial Development Project (Milpitas)	Abbott Laboratories (Redwood City)	Palo Alto Medical Foundation (San Carlos)
• Contribute a fair share portion of the costs associated with fire, police, park/landscape maintenance needed to serve the new residential development, as determined by a study to be conducted by the city	X		X		
• Use a qualified vector control professional to eliminate ground squirrels and feral cats from the site; submit site landscape plans to the city's vector control unit for review, for the purpose of identifying potential rat harborage areas and/or food sources, and for approval of pest proofing measures contained in the plan	X				
• Provide adequate childcare services for the children of project employees; if feasible, provide an onsite childcare facility				X	
Recreation					
Impacts – See Public Services regarding impacts on parks; no other significant recreation impacts identified					
Traffic and Transportation					
Impacts					
• Impacts related to site access roadways	S				
• Increased traffic relative to existing traffic and the capacity of the street system				U	
• Freeway traffic impacts			U	U	U
• Increased vehicle delays at area intersection(s)		S	S	S	
• Temporary construction impacts on traffic circulation and safety				S	
• Increase traffic safety concerns				S	
• Impacts on parking					S
• Cumulative traffic impacts on roadway segments and/or intersections			U	S, U	U
• Cumulative freeway traffic impacts					S
Mitigation Measures					
• Submit plans for the main and secondary access roads to the city engineer for review and concurrence with city and American Association of State Highway and Transportation Official Standards (recommended measure: design the secondary access road for two-way traffic)	X				
• Pay for signal warrant analyses at specified intersections and contribute fair share of costs of signal(s) determined by the city engineer to be needed			X		
• Working with the city and Caltrans, as applicable, make roadway and/or signal modifications, potentially including installation of turn lanes, combinations of turn lanes and through lanes, or warning signals; widening of lanes at specified intersections; and modification of traffic signal phasing		X		X	

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TABLE E.6.1 (Continued)
SIGNIFICANT IMPACTS AND MITIGATION MEASURES IDENTIFIED
IN ENVIRONMENTAL IMPACT REPORTS OF RECENT MAJOR PROJECTS IN THE SFPUC SERVICE AREA

Impact	One Quarry Road Project (Brisbane)	Electronics for Imaging (Foster City)	Elmwood Residential and Commercial Development Project (Milpitas)	Abbott Laboratories (Redwood City)	Palo Alto Medical Foundation (San Carlos)
• Contribute fair share of traffic mitigation fees to fund improvements to areas and/or roadways affected by the project			X	X	
• Submit a construction traffic management plan for review and approval by the city's engineering and construction division				X	
• Implement increasingly aggressive measures as part of the proposed transportation demand management (TDM) program				X	
• Implement a TDM program, including specified measures throughout the life of the project, with the objective of achieving the trip reductions specified in general plan Transportation Policy 9					X
• Design the main access driveway to ensure proper operation of the signalized intersection (recommended for a less-than-significant impact)					X
Utilities					
Impacts					
• Need for new or expanded water and/or wastewater treatment facilities	S		S		U
• Need for new or expanded stormwater drainage facilities	S				
Mitigation Measures					
• Provide additional infrastructure	X		X	X	
• Pay pro rata share for the installation of all needed water supply and sewer lines and for pump station improvements	X				
• Integrate water conservation measures and design features into the project's design to reduce overall water demand associated with the project (recommended for a less-than-significant impact)		X			
• Retain public ownership and responsibility for maintenance of onsite water lines, obtain approval from Estero MID for relocation of the water transmission line, and relocate it within water line easements; avoid locating structures or undertaking pile-driving activities in close proximity to water lines unless adequate shoring is provided; and avoid use of special or costly surfacing materials over the public water line easements to reduce the costs for reconstruction if future maintenance work is necessary (recommended for a less-than-significant impact)		X			
• Fund onsite improvements to the existing sewer system or lift station (recommended for a less-than-significant impact)		X			
• Purchase adequate public water system and sewer system capacities for the development; fees for this purpose cover treatment plant operations, sewage collection, and a proportional share of replacement costs for a new sewage pump station			X		

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TABLE E.6.1 (Continued)
SIGNIFICANT IMPACTS AND MITIGATION MEASURES IDENTIFIED
IN ENVIRONMENTAL IMPACT REPORTS OF RECENT MAJOR PROJECTS IN THE SFPUC SERVICE AREA

Impact	One Quarry Road Project (Brisbane)	Electronics for Imaging (Foster City)	Elmwood Residential and Commercial Development Project (Milpitas)	Abbott Laboratories (Redwood City)	Palo Alto Medical Foundation (San Carlos)
• Obtain nonpotable water supply from the city's planned recycled water program and contribute fair share of the cost of implementing the program; implement the city's landscape guidelines to reduce demand for irrigation water; implement best management practices identified by the California Urban Water Conservation Council; and retain an independent civil engineer or water specialist to monitor actual water use to ensure estimated water demand is consistent with actual demand				X	
• Include water-saving fixtures, appliances, and irrigation systems in site buildings and landscaping, and design landscaping with drought-resistant and other low-water-use plants (recommended for a less-than-significant cumulative impact on water supply)					X
• Purchase from the sewer authority sufficient dry-weather treatment capacity to accommodate the projected increase in sewage generated by the proposed project (to be performed by the city) and reimburse the city for all costs associated with this purchase (to be performed by the project applicant)				X	
• Fund one of three identified sanitary sewer improvement alternatives				X	
• Implement measures to reduce solid waste generation and encourage recycling		X		X	
• Implement measures to encourage the recycling of construction and demolition debris during the construction phase				X	X
Energy					
Impacts					
• Increased demand for energy, including electricity and natural gas				X	
Mitigation Measures					
• Require improvements to conform with all requirements of Title 24 and the Uniform Building Code to reduce energy demands (recommended for a less-than-significant impact)		X			
• Implement the specified energy conservation measures, including use of energy-efficient heating, cooling, and lighting fixtures				X	

SOURCES: City of Brisbane, 2001; City of Foster City, 1997; City of Milpitas, 2004; City of Redwood City, 2004; City of San Carlos, 2006.

S = Significant mitigable impact U = Significant and unavoidable impact X = Mitigation measure identified in Environmental Impact Report

13.2 Program Description Changes Affecting System Operations

Since publication of the Draft PEIR in June 2007, the SFPUC has modified the project descriptions of two of the facility improvement projects—the Alameda Creek Fishery Enhancement (SV-1) and Calaveras Dam Replacement (SV-2) projects—and these proposed changes would affect overall system operations (SFPUC, 2008a). These modifications were made due to the numerous comments received on the potential impacts on future steelhead fishery resources in the Alameda Creek watershed as well as to actions taken in July 2007 by other agencies in the watershed. The SFPUC has incorporated project revisions and protective measures into these two projects to reduce the WSIP's potential to affect habitat conditions for potential future-occurring steelhead in the upper watershed. The project revisions would occur regardless of steelhead presence or absence in the upper watershed, while the protective measures were designed to reduce the WSIP's potential to affect habitat conditions for potential, future-occurring steelhead in the Alameda Creek watershed in the event that man-made barriers in Alameda Creek are removed and steelhead gain access to the upper watershed.

The proposed project revisions and protective measures would provide both a long-term strategy to ensure habitat protection as well as interim measures in the event that regulatory agencies have determined steelhead to be present above the BART weir, construction of the Calaveras Dam Replacement project is complete, and the Alameda Watershed Habitat Conservation Plan is yet to be finalized. Please refer to **Section 14.9, Master Response on Alameda Creek Fishery Issues** (Vol. 7, Chapter 14) for further description of the project revisions and protective measures.

In summary, the following project revisions have been incorporated into the Alameda Creek Fishery Enhancement (SV-1) and Calaveras Dam Replacement (SV-2) projects:

- The Calaveras Dam Replacement project would include facility modifications at the Alameda Creek Diversion Dam (ACDD) to construct a new bypass structure needed to implement bypass stream flows.

- If a structural alternative involving construction of a recapture facility is selected under the Alameda Creek Fishery Enhancement project, the recapture facility would be located at the downstream end of the reach of Alameda Creek between the lower Sunol Valley and the confluence with Arroyo de la Laguna. As an alternative to the recapture facility, the SFPUC may coordinate with other water agencies to develop and implement other means of recapturing fishery enhancement flows consistent with the 1997 California Department of Fish and Game Memorandum of Understanding (CDFG MOU).[1]

The project components designed to provide protective measures for future-occurring steelhead in the upper Alameda Creek watershed would include the following:

- An operational plan to provide minimum stream flows to support steelhead spawning below the ACDD to the confluence with Calaveras Creek when precipitation naturally generates runoff and flow in the creek, including the site-specific studies needed to determine the specific minimum stream flow requirements to support steelhead spawning in this reach of the creek.

- A detailed monitoring plan to survey and document steelhead spawning, subject to review and comment by the appropriate resource agencies.

- Interim minimum flows would be implemented consistent with the 1997 CDFG MOU, with the additional requirement that these flows would be achieved through bypass flows at the ACDD at all times when flows are available in upper Alameda Creek, rather than through releases at Calaveras Dam, and with the following conditions:

  – The SFPUC would provide seasonal flow bypasses at the ACDD and/or flow releases from Calaveras Dam, either (1) without recapture or (2) with recapture at a point approximately at the downstream end of the reach of Alameda Creek between the lower Sunol Valley and the confluence with Arroyo de la Laguna, below critical riffle locations or lower in the creek, between December 1 and June 30 (combined adult and juvenile migration period) in an amount equivalent to the flow release schedule provided in the 1997 CDFG MOU.

  – As an alternative to the recapture facility, the SFPUC would coordinate with other water agencies to develop and implement other means of recapturing enhancement flows consistent with the 1997 CDFG MOU at a location downstream of the reach of Alameda Creek between the lower Sunol Valley and the confluence with Arroyo de la Laguna.

[1] Under the 1997 CDFG MOU, the SFPUC and CDFG reached agreement on the magnitude and timing of flows to be released from Calaveras Reservoir for the purposes of improving fishery habitat conditions. The MOU includes provisions for the SFPUC to divert flows from Alameda Creek to the SFPUC regional system at a suitable downstream location equivalent to the magnitude and timing of these releases; the MOU refers to this as "recapture."

In Draft PEIR Tables S.2 and 3.10 (Vol. 1, Summary, p. S-12, and Chapter 3, p. 3-50), the following text related to the location and description of these two facility improvement projects is revised to incorporate information about these recently initiated planning efforts:

No.	Project Title	Location of Preferred Project	Project Description
SV-1	Alameda Creek Fishery Enhancement	Structural Alternatives: Alameda Creek in Sunol Valley, downstream of Calaveras Dam	This project would recapture the water released as part of the Calaveras Dam project (SV-2) and return it back to the regional system for use. A number of structural and non-structural recovery alternatives are under consideration for this project, including: a water recapture facility downstream of the Sunol Valley WTP, conjunctive groundwater use, horizontal collector wells, or other groundwater recovery systems yet to be defined. Other alternative designs for this project could be developed. If a structural alternative involving construction of a recapture facility is selected, the recapture facility would be located at the downstream end of the reach of Alameda Creek between the lower Sunol Valley and the confluence with Arroyo de la Laguna. As an alternative to the recapture facility, the SFPUC may coordinate with other water agencies to develop and implement other means of recapturing fishery enhancement flows consistent with the 1997 CDFG MOU.
SV-2	Calaveras Dam Replacement	Sunol Valley, immediately downstream of existing dam and at the Alameda Creek Diversion Dam	This project would provide for the planning, design, and construction of a replacement dam at Calaveras Reservoir to meet seismic safety requirements. The new dam would provide for a reservoir with the same storage capacity as the original reservoir (96,800 acre-feet), but the replacement dam would be designed to accommodate enlargement of the dam in the future. The preferred project would include construction of: • New earthfill dam • New intake tower and new outlet valve for water releases for instream flow requirements • New or rehabilitated outlet works for seismic safety and improved operations and maintenance • New bypass structure at the Alameda Creek Diversion Dam As part of this project, Calaveras Reservoir and the proposed bypass structure at the diversion dam would be operated to release up to 6,300 acre-feet per year (5.5 mgd) of water to Alameda Creek in support of fisheries in compliance with the 1997 CDFG MOU. When flow is available in Alameda Creek, releases would be made through the proposed bypass structure at the Alameda Creek Diversion Dam and would be supplemented as necessary with releases from Calaveras Dam.

These project description modifications would generally reduce the impacts identified in the Draft PEIR, and, in some cases, would reduce impacts from potentially significant to less than significant (i.e., Impacts 5.4.7-1 and 5.4.7-2). The refined impact analyses associated with these project description modifications, including the discussions on Impacts 5.4.7-1 and 5.4.7-2, are presented in Chapter 16, Staff-Initiated Text Changes (Vol. 7).

13.3 Updated Water System Assumptions and Modeling

As described in the Draft PEIR (Vol. 3, Chapter 5, p. 5.1-9), the SFPUC utilizes a computerized water supply planning model to assist in the evaluation of its water systems operations—the Hetch Hetchy/Local Simulation Model (HH/LSM). Data from the HH/LSM were used in the Draft PEIR to evaluate the impacts of WSIP water supply and system operations on resources in the Tuolumne River, Alameda Creek, and Peninsula watersheds (Vol. 3, Chapter 5). In 2008, subsequent to publication of the Draft PEIR, the SFPUC conducted updated model runs using more recent input assumptions for several model parameters as part of its ongoing system planning and management. The revised input assumptions included the following:

- Adjusted capacity for Crystal Springs Reservoir based on recent survey data
- More accurate assumptions for Pilarcitos facilities operations
- Improved data regarding the historical hydrology in the Alameda Creek watershed
- Updated agricultural demands in the service areas of the Modesto Irrigation District (MID) and Turlock Irrigation District (TID) to be consistent with data used in recent statewide planning documents
- Refinement in the water release protocols at Don Pedro Reservoir

Review of the 2008 model output indicated that the results are generally consistent with the 2007 results used in the Draft PEIR impact analyses of water supply and system operations, and that the analyses and impact determinations presented in the Draft PEIR remain valid. With one exception, no changes in the Draft PEIR impact approach, analysis, or conclusions are necessary for the water supply and system operations impact assessments. The sole exception is the approach to the analysis of impacts on Pilarcitos watershed resources, for which only semi-quantitative data were previously available. Therefore, the 2008 data were used to conduct a refined impact analysis of the Pilarcitos watershed resources; no new impacts were identified in the refined analysis. The results of the refined impact analysis for the Pilarcitos watershed are summarized below, and the complete refined impact analysis is presented in Chapter 16, Staff-Initiated Text Changes.

In select instances, the Draft PEIR text and tables presenting the 2007 results have been updated with the 2008 results where useful to reflect this more current information; it should be noted that there are no changes in any of the impact analyses or conclusions as a result of the revised model data. In addition, review of the 2008 HH/LSM data provided additional insight in understanding the potential range and magnitude of impacts, and some revisions to the Draft PEIR text based on the updated HH/LSM modeling are included in Chapter 16, Staff-Initiated Text Changes, to provide refinement and clarification of the impact discussions. However, no staff-initiated text changes are provided in Chapter 16 to replace 2007 results with the updated 2008 results if the impact approach, analysis or conclusions are unaffected by the updated modeling.

One of the notable outcomes of the updated HH/LSM output is a refinement in the estimated magnitude of dry-year water transfers that would be required under the WSIP. The 2007 model results used in the Draft PEIR indicated that an equivalent of 23 million gallons per day (mgd) (annual average over the 8.5-year design drought) of supplemental Tuolumne River water obtained through water transfer agreements with TID and MID would be required to meet the WSIP level of service objectives (see Vol. 1, Chapter 3, p. 3-36). The updated 2008 analysis indicates that this number would be 26 mgd. Please refer to **Section 14.3, Master Response on Proposed Dry-Year Water Transfer** (Vol. 7, Chapter 14) for further explanation of this updated information.

Refined Pilarcitos Watershed Impact Analysis

The refined impact analysis for the Pilarcitos Creek watershed involved updated modeling using the HH/LSM as well as biological field reconnaissance. The refined analysis enabled a more precise identification of the potential impacts of the WSIP in that watershed. No new impacts were identified that were not documented in the Draft PEIR, but several impacts identified as potentially significant in the Draft PEIR were reevaluated and determined to be less than significant. Analysts were able to reclassify terrestrial biological and fishery impacts at Pilarcitos Reservoir and terrestrial biological impacts at Pilarcitos Creek between the reservoir and Stone Dam as less than significant. The revised impacts are reflected in Chapter 16, Staff-Initiated Text Changes.

In the Draft PEIR, a mitigation measure was proposed that would lessen or eliminate all potentially significant adverse impacts of the WSIP in the Pilarcitos Creek watershed (Measure 5.5.3-2, Revised Operations Plan for Pilarcitos Watershed Facilities). Under the revised operations plan identified in this measure and with the WSIP in place, the SFPUC would develop protocols that would enable it to operate its Pilarcitos Creek watershed facilities just as it does under the existing conditions. Future operations would mimic existing operations as closely as possible and, consequently, there would be little or no change in environment impacts. However, an attempt to develop the protocols led to the conclusion that the revised operations plan envisaged under Measure 5.5.3-2 would be technically challenging and that other more practical solutions are available.

More practical mitigation measures to replace Measure 5.5.3-2 were developed subsequent to publication of the Draft PEIR and are included in Volume 7, Chapter 16. The replacement mitigation measures would reduce the potential impacts of the WSIP in the Pilarcitos Creek watershed to a less-than-significant level. They include:

- Measure 5.5.3-2a, Low-Head Pumping Station at Pilarcitos Reservoir, which would lessen fishery and water quality impacts in Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam

- Measure 5.5.5-5, Establish Flow Criteria, Monitor and Augment Flow, which would lessen fishery impacts in Pilarcitos Creek below Stone Dam

13.4 Phased WSIP Variant

Introduction

In March 2008, the SFPUC determined that it would like the option to consider approval and implementation of a variation of the WSIP called the Phased WSIP Variant (SFPUC, 2008b; SFPUC, 2008c). The SFPUC identified this variation in order to consider a program scenario that would involve *full implementation of the proposed WSIP facility improvement projects* to ensure that the public health, water quality, seismic safety, and delivery reliability goals are achieved as soon as possible, but a *phased implementation of water supply delivery through 2030*. Phasing the water supply element of the WSIP would allow the SFPUC and its wholesale customers to focus first on implementing additional local recycled water, groundwater, and demand management actions while minimizing additional diversions from the Tuolumne River. Under this variant, the SFPUC would establish an interim, mid-term planning horizon—the year 2018. If the SFPUC adopts this variant, it would make a decision about future water supply to its customers through 2018 *only* and defer a decision regarding long-term water supply until after 2018. All WSIP goals and level of service objectives that are not related to 2030 water supply levels would be achieved under this variant, and all individual WSIP facility improvement projects proposed by the SFPUC would be constructed.

Under this variant, the SFPUC would limit average annual water deliveries supplied from its watersheds to 265 mgd. This generally represents the base-year level of supply delivered from the SFPUC watersheds through the regional water system to both the retail and wholesale customers analyzed in the Draft PEIR.[2] The SFPUC would maintain the 265 mgd average annual delivery of surface water from the SFPUC watersheds to existing levels through 2018. At the same, through 2018, the SFPUC would implement the delivery and drought reliability element of the WSIP, including proposed dry-year transfers from MID/TID coupled with the Westside Basin conjunctive use program, which would increase average annual diversions from the Tuolumne River by about 2 mgd over the existing conditions.

[2] The SFPUC watersheds that supply surface water to the regional system include the local watersheds—the Alameda Creek and Peninsula watersheds—and the Tuolumne River watershed. Under this variant, similar to existing conditions, the Tuolumne River watershed would provide approximately 85 percent and the local watersheds would provide approximately 15 percent of the water supply delivered to customers.

By 2018, the demand on the SFPUC regional water system is projected to be 285 mgd, consisting of 91 mgd for the retail customers and 194 mgd for the wholesale customers, based on the purchase requests developed by the wholesale customers as part of the WSIP planning process. To satisfy the remaining 20 mgd of demand on the regional system through 2018 while holding deliveries from the SFPUC watersheds to 265 mgd, the SFPUC proposes development of local conservation, recycled water, and groundwater projects within its service area. As proposed under the WSIP, the Phased WSIP Variant would develop 10 mgd of local supply and supply offsets through conservation, recycled water and groundwater projects in San Francisco. The SFPUC also proposes to develop an additional 10 mgd of local conservation, recycled water, and groundwater within the service area under this variant through one of the following three approaches:

- The SFPUC, wholesale customers, and Bay Area Water Supply and Conservation Agency (BAWSCA) partner to develop an additional 10 mgd in local conservation, recycled water, and groundwater within the service area; or

- BAWSCA and the wholesale customers develop an additional 10 mgd in local conservation, recycled water, and groundwater within the wholesale customer service area, independent of the SFPUC; or

- Individual wholesale customers develop 10 mgd of additional conservation, recycled water, and groundwater on their own within their individual services areas.

The SFPUC has initiated discussions with BAWSCA and the wholesale customers to determine the best approach to develop the additional 10 mgd of local supply/conservation needed under this WSIP variant to fully meet the wholesale customer needs through 2018.

By 2018, the SFPUC would reevaluate the wholesale customer delivery amount and consider whether to maintain these delivery limitations from the SFPUC watersheds through 2030 or increase them, and whether and how to provide additional supply to the wholesale customers. In the years approaching 2018, the SFPUC would update demand projections for its wholesale and retail customers and reevaluate customer water delivery needs and water supply options. As part of the process, the City and County of San Francisco (CCSF) would conduct additional environmental studies and CEQA review as appropriate to address the SFPUC's recommendation regarding water supply and proposed water system deliveries after 2018.

The following subsections describe the Phased WSIP Variant in more detail and summarize the environmental impacts associated with this variant based on the analysis in the PEIR. In summary, this variant includes the following key program elements:

- Full implementation of WSIP facility improvement projects.

- Water supply delivery to wholesale and retail regional system customers through 2018 of at least 275 mgd average annual target delivery, and up to an additional 10 mgd of conservation, recycled water, and groundwater developed in one of the three approaches described above. This includes 91 mgd for the retail customers and 184–194 mgd for the wholesale customers.

- Water supply sources include: 265 mgd average annual delivery from the SFPUC watersheds (i.e., the Tuolumne River watershed and the local watersheds), 10 mgd of conservation, water reuse, and groundwater developed by the SFPUC within San Francisco but used to meet regional system delivery needs, and up to an additional 10 mgd of conservation, water reuse, and groundwater developed in one of the three approaches described above.

- Dry-year water transfer from MID/TID of about 2 mgd coupled with the Westside Groundwater Basin conjunctive-use project to meet the drought-year goal of limiting rationing to no more than 20 percent on a systemwide basis.

- Reevaluation of 2030 demand projections, potential regional system demand (purchase requests), and water supply options by 2018, and SFPUC decision in 2018 regarding regional water system deliveries after 2018.

As further described below, the potential environmental effects of the Phased WSIP Variant fall within the range of impacts already evaluated in the Draft PEIR for the WSIP and the alternatives. This program variation is similar to the No Purchase Request Increase Alternative analyzed in the Draft PEIR. That alternative also limits average annual regional water system deliveries from the SFPUC watersheds to approximately 265 mgd, but it does so through 2030, while the Phased WSIP Variant only establishes this limit through 2018. Although the Phased WSIP Variant does not include a specific water supply proposal beyond 2018, for purposes of environmental impact analysis and comparison to the proposed WSIP and other alternatives evaluated in the PEIR, the following discussion assesses the range of water supply that could be provided under this variant through 2030. On the low end of the range, after 2018 and through 2030 under the Phased WSIP Variant, deliveries from the SFPUC watersheds could continue to be limited to 265 mgd, similar to the No Purchase Request Increase Alternative. On the high end of the range, after 2018 and through 2030, the SFPUC could propose to increase surface water deliveries from the watersheds and meet the additional projected 2030 demands of up to 15 mgd on the regional water system for a total demand of 300 mgd, which could include average annual deliveries from the SPFUC watersheds of up to 280 mgd coupled with up to 20 mgd of local conservation, recycled water, and groundwater previously implemented in the first phase by 2018. This would provide the retail customers with 91 mgd and the wholesale customers with 209 mgd in average annual deliveries. This high-end scenario would be similar to the Modified WSIP Alternative, which assumes 10 mgd of conservation, recycled water, and groundwater in San Francisco and 10 mgd of conservation, recycled water, and groundwater in the wholesale service area.

The No Purchase Request Increase Alternative is discussed in Draft PEIR Section 9.2.3 (Vol. 4, Chapter 9, pp. 9-40 to 9-47) and Section 9.3 (pp. 9-84 to 9-96). Also relevant are the analyses of the No Program Alternative (Section 9.2.2, pp. 9-23 to 9-40), the Aggressive Conservation/Water Recycling and Local Groundwater Alternative (Section 9.2.4, pp. 9-47 to 9-59), and the Modified WSIP Alternative (Vol. 4, Chapter 9, Section 9.2.8, pp. 9-78 to 9-84; and Vol. 7, Chapter 14, Section 14.10, Master Response on Modified WSIP Alternative).

Description of SFPUC and Wholesale Customer Actions

SFPUC Actions

Water Delivery

Table 13.1 summarizes the SFPUC average annual water deliveries to its retail and wholesale customers under the WSIP, the No Purchase Request Increase Alternative, and the Phased WSIP Variant. Under the Phased WSIP Variant, the SFPUC proposes to establish an interim delivery amount through the year 2018, and then to either maintain this same delivery amount through 2030 or increase it, possibly up to the level proposed under the WSIP.

TABLE 13.1
SFPUC AVERAGE ANNUAL WATER DELIVERIES UNDER THE PHASED WSIP VARIANT

Supply Source	SFPUC Regional System Average Annual Water Deliveries (mgd)		
	Existing Condition 2005	WSIP (Proposed Program) 2030	Phased WSIP Variant 2018
SFPUC Watersheds			
Retail customers[a]	91	81	81
Wholesale customers	174	209	184
Total	**265**	**290**	**265**
Local Conservation, Recycled Water, and Groundwater (not included in purchase requests)			
Retail customers	0	10	10
Wholesale customers	0	0	0 – 10 [b]
Total	**0**	**10**	**10 – 20**
Total from all sources	**265**	**300**	**275 – 285**

a The SFPUC retail customer deliveries include 1 mgd delivered to Castlewood in the Pleasanton area that is supplied by local groundwater rather than from the regional system. Thus, although this delivery amount is included in the SFPUC retail customer delivery total, 90 mgd represents the current and future deliveries to retail customers that are and will continue to be made from the regional system.

b A range is provided because 10 mgd may be provided by SFPUC in partnership with BAWSCA and wholesale customers or BAWSCA and wholesale customers may choose to separately develop this 10 mgd.

The 2030 regional system water deliveries shown in Table 13.1 for the WSIP reflect wholesale customer purchase requests of 209 mgd (see the Draft PEIR, Vol. 1, Chapter 3, pp. 3-16 to 3-22 for a discussion of the wholesale customer purchase requests developed for the WSIP). Under the WSIP, the 2030 combined retail and wholesale customer purchase requests of 300 mgd would be met with up to 290 mgd of supply from the SFPUC watersheds and 10 mgd from local conservation, recycled water, and groundwater projects developed in San Francisco and used to meet the overall regional system needs. Under the Phased WSIP Variant, the regional system target delivery for the wholesale customers in 2018 would range from 184 mgd to 194 mgd, depending on how BAWSCA and wholesale customers elected to develop the required additional

10 mgd of local conservation, recycled water, and groundwater needed. If the SFPUC and BAWSCA partnered to jointly develop the additional 10 mgd of local supply and conservation and made it part of the regional system supply portfolio, then the wholesale customer delivery target for the regional water system would be 194 mgd to match their purchase requests. If BAWSCA and/or the wholesale customers decided to develop the additional 10 mgd of conservation, recycled water, and groundwater independent of the SFPUC and not make it part of the regional system supply portfolio, then the wholesale customer delivery target from the regional system would be 184 mgd.

Although the SFPUC would only make a decision regarding water supply through 2018 under the Phased WSIP Variant, after 2018 and through 2030 it is possible that average annual deliveries to the wholesale customers could range from 184 mgd to 209 mgd, as shown in Table 13.1 (or 199 mgd, on the high end if it is an assumed additional 10 mgd of local conservation, recycled water and groundwater programs is implemented by 2018). If after 2018 the SFPUC decides to maintain the 184 mgd average annual limit on SFPUC watershed deliveries to the wholesale customers, then by 2030 the SFPUC regional water system deliveries to the wholesale customers could be up to 25 mgd less than their 209 mgd purchase request amount, although it is possible that, in combination with the additional local conservation, recycled water, and groundwater already developed during the first phase of this variant, the wholesale customers could receive up to their full 2030 purchase request amount of 209 mgd with no shortfall.

Table 13.2 (which is similar to Draft PEIR Table 9.4) summarizes the key characteristics of the Phased WSIP Variant in comparison to the WSIP and other select alternatives considered in the Draft PEIR. Under the Phased WSIP Variant, the SFPUC would continue to rely on water supply sources from local watersheds and the Tuolumne River for up to 265 mgd average annual deliveries and would continue to implement the proposed 10 mgd of conservation, water recycling, and groundwater projects in San Francisco that is included in the WSIP through 2018. An additional 10 mgd of local conservation, water recycling, and groundwater projects could be developed by the SFPUC and/or BAWSCA/wholesale customers. Information on retail and customer purchase requests after 2018 would be confirmed, and target deliveries and water supply sources would be determined.

Table 13.3 (which is similar to Draft PEIR Table 9.5) compares average annual Tuolumne River diversions and drought-year shortages for the Phased WSIP Variant and the proposed program. Under the Phased WSIP Variant, by 2018 only 2 mgd of additional water diversion from the Tuolumne River over existing levels would be needed (on an average annual basis). This limited additional diversion over existing levels would occur in order to meet the WSIP delivery and drought reliability objectives, but no additional Tuolumne River diversions would be made through 2018 for the purpose of serving demand increases.

One objective of this program variant is to minimize increased diversions from the Tuolumne River and to maintain SFPUC deliveries from its watersheds as close to current levels as possible for the near term through 2018, at which time supply delivery needs and the need for additional Tuolumne River deliveries would be reevaluated. To meet the total projected customer water

TABLE 13.2
DESCRIPTION OF PHASED WSIP VARIANT IN COMPARISON TO WSIP AND NO PURCHASE REQUEST INCREASE ALTERNATIVE
(SIMILAR TO DRAFT PEIR TABLE 9.4)

Program Element	Existing Condition	Proposed Program	No Purchase Request Increase Alternative	Phased WSIP Variant	
Planning Year	2005	2030	2030	2018	2030
Retail Customer Purchase Request (2018 / 2030)	91 mgd / NA	91 mgd / 91 mgd	91 mgd / 91 mgd	91 mgd	91 mgd (to be reevaluated by 2018)
Wholesale Customer Purchase Request (2018 / 2030)	174 mgd / NA	194 mgd / 209 mgd	194 mgd / 209 mgd	194 mgd	209 mgd (to be reevaluated by 2018)
SFPUC Regional System Target Delivery Level (annual average)	265 mgd	300 mgd	275 mgd	275 to 285 mgd	To be determined
Target Delivery from SFPUC Watersheds	265 mgd	290 mgd	265 mgd	265 mgd	To be determined
SFPUC Wholesale Customer Target Delivery (annual average for 2018 / 2030)	NA	194 mgd / 209 mgd	184 mgd / 184 mgd	184 mgd / 194 mgd	To be determined
SFPUC Water Supply Sources (during nondrought and drought periods)	▪ 265 mgd from: - Local watersheds (with Calaveras and Crystal Springs Reservoirs operating at reduced levels based on Division of Safety of Dams restrictions); and - Tuolumne River	▪ 290 mgd from: - Local watersheds (with Calaveras and Crystal Springs Reservoirs restored) - Tuolumne River, with increased average annual diversions of about 24 mgd ▪ 10 mgd from: - Recycled water/groundwater/ additional conservation in San Francisco	▪ 265 mgd from: - Local watersheds (with Calaveras and Crystal Springs Reservoirs restored) - Tuolumne River, with increased average annual diversions of about 3 mgd ▪ 10 mgd from: - Recycled water/groundwater/ additional conservation in San Francisco	▪ 265 mgd from: - Local watersheds (with Calaveras and Crystal Springs Reservoirs restored) - Tuolumne River, with increased average annual diversions of about 2 mgd ▪ 10 mgd from: - Recycled water/ groundwater/additional conservation in San Francisco ▪ 10 mgd from: - SFPUC and/or BAWSCA/wholesale customers to develop additional local conservation, recycled water, groundwater in service area	To be determined after further demand, supply studies
Other Water Supply Sources (during nondrought and drought periods)	None	None	▪ *Wholesale customers expected to pursue conservation reuse and/or supplemental supply or conservation to make up for 2030 SFPUC delivery shortfall*	▪ *See above, SFPUC and/or BAWSCA/wholesale customers to develop additional 10 mgd of local conservation, recycled water, or groundwater; or BAWSCA and/or wholesale customers to pursue other supplemental supplies*	

TABLE 13.2 (Continued)
DESCRIPTION OF PHASED WSIP VARIANT IN COMPARISON TO WSIP AND NO PURCHASE REQUEST ALTERNATIVE
(SIMILAR TO DRAFT PEIR TABLE 9.4)

Program Element	Existing Condition	Proposed Program	No Purchase Request Increase Alternative	Phased WSIP Variant
Supplemental Dry-Year Water Supply Sources (for implementation during drought periods only)	None	▪ Additional Tuolumne River diversions from TID and MID transfers of 25 mgd, average over design drought. (This diversion is accounted for in the increased average annual diversion shown above under SFPUC Water Supply Sources.) ▪ Westside Basin conjunctive use, 6 mgd (average over design drought)	▪ Additional Tuolumne River diversions from TID and MID transfers of 1 mgd, average over design drought. (This diversion is accounted for in the increased average annual diversion shown above under SFPUC Water Supply Sources.) ▪ Westside Basin conjunctive use, 6 mgd (average over design drought) ▪ *Wholesale customers expected to pursue supplemental dry-year supply (e.g., water transfer) to make up for drought period supply shortfalls*	▪ Additional Tuolumne River diversions from TID and MID transfers of 2 mgd, average over design drought. (This diversion is accounted for in the increased average annual diversion shown above under SFPUC Water Supply Sources.) ▪ Westside Basin conjunctive use, 6 mgd (average over design drought) ▪ *Wholesale customers expected to pursue supplemental dry-year supply (e.g., water transfer) to make up for drought period supply shortfalls*
Maximum Drought Rationing Policy	No defined limit, but assumed incidental rationing of up to 25%	20%	20% at reduced target delivery level	20% at reduced target delivery level
System Firm Yield	219 mgd	256 mgd	234 mgd	234 mgd
WSIP PEIR Facility Improvement Projects	None	All projects	All projects	All projects
Other Facility Improvements	None	None	None by the SFPUC *Wholesale customers expected to develop other facilities or projects to meet additional demand*	*SFPUC and/or BAWSCA/wholesale customers expected to develop other facilities or projects to meet additional demand*
Delivery, Operations, and Maintenance	As described in Chapter 2, Section 2.3	Improved to meet WSIP goals and objectives (as described in Chapter 3, Section 3.8)	Similar to proposed program (but adjusted for the reduced target delivery level)	Similar to proposed program (but adjusted for the reduced target delivery level)
Permits, Approvals, and other Decisions/Actions	As described in Chapter 2, Sections 2.4 and 2.5	▪ San Francisco Planning Commission certifies Final PEIR ▪ SFPUC adopts CEQA findings/ mitigation monitoring and reporting program and approves and adopts the WSIP ▪ Water transfer agreements with TID and MID ▪ Operating agreements with Daly City, San Bruno, and California Water Service Company for Westside Basin conjunctive-use program ▪ Water sales agreements with retail and wholesale customers (see Chapter 3, Section 3.13)	Same as proposed program except: ▪ Transfer agreements with TID and MID for 1 mgd instead of 23 mgd during drought years ▪ *Agreements with California Department of Health Services for any new drinking water sources developed by wholesale customers that would be introduced into the regional system* ▪ *Permits for any new recycled water projects developed by wholesale customers*	Same as proposed program except: ▪ Transfer agreements with TID and MID for 1 mgd instead of 23 mgd during drought years ▪ *Agreements with California Department of Health Services for any new drinking water sources developed by SFPUC and/or BAWSCA/wholesale customers that would be introduced into the regional system* ▪ *Permits for any new recycled water projects developed by SFPUC and/or BAWSCA/ wholesale customers*

Italic text indicates expected action by wholesale customers.

SOURCE: SFPUC, 2008.

TABLE 13.3
AVERAGE ANNUAL TUOLUMNE RIVER DIVERSIONS AND DROUGHT-YEAR SHORTAGES FOR THE SELECTED ALTERNATIVES[a]
(SIMILAR TO DRAFT PEIR TABLE 9.5)

Scenario	Estimated Tuolumne River Diversions Over the 82-Year Period of Hydrologic Record[b]		Drought-Year Shortages Based on 82-Year Period of Hydrologic Record				Drought-Year Shortages During Design Drought (8.5 years)		
	Average Annual Increase by the SFPUC[c] (mgd)	Average Annual Diversions by the SFPUC (mgd)	Years of Shortages (10% Shortage)	Years of Shortages (20% Shortage)	Years of Shortages (>20% Shortage)	No. of Years Drought-Year Supplies Triggered	Years of Shortages (10% Shortage)	Years of Shortages (20% Shortage)	Years of Shortages (25% to 30% Shortage)
Existing Conditions (2005)	N/A	221	6 out of 82 (1 in 14 years)	8 out of 82 (1 in 10 years)	None	N/A	1	5	1.5
Proposed Program (WSIP 2030)	24	245	6 out of 82 (1 in 14 years)	2 out of 82 (1 in 41 years)	None	24	3	3.5	None
Phased WSIP Variant (2018)	2	223	6 out of 82 (1 in 14 years)	2 out of 82 (1 in 41 years)	None	15	3	3.5	None

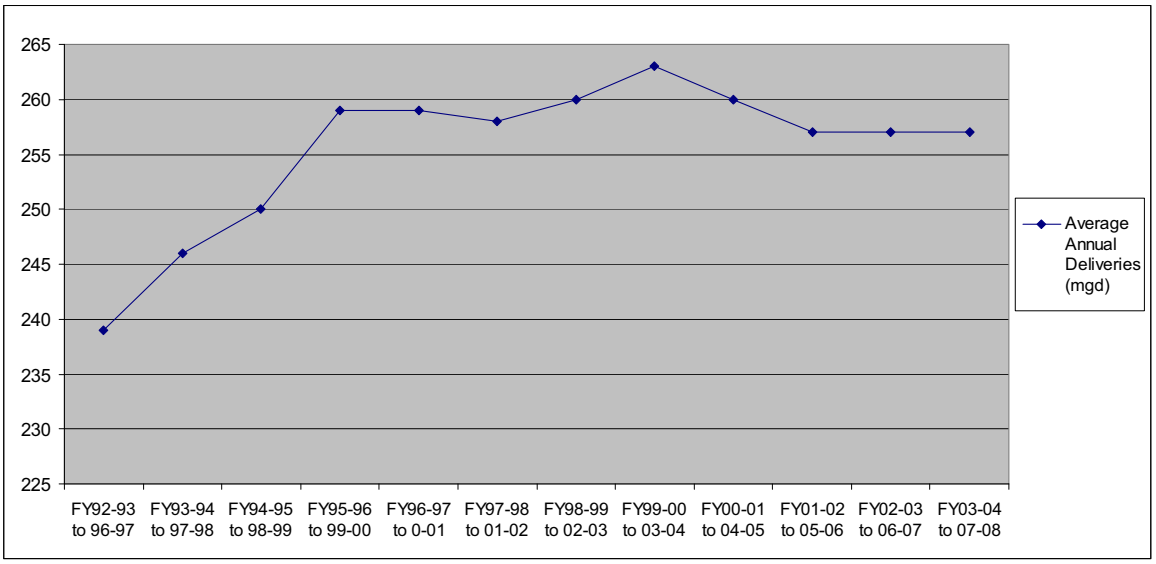
[a] Results from 2008 HH/LSM analyses using updated and refined modeling assumptions. The numbers are not directly comparable to those in Draft PEIR Table 9.5, which are based on 2007 HH/LSM analyses.
[b] Diversion levels represent the average annual amount modeled over the 82-year historical hydrology. Even with a zero average annual increase in diversions, there would still be year-to-year variations in diversions compared to the existing condition due primarily to modified system operations for maintenance and implementation of the conjunctive-use program.
[c] Represents the difference in average annual diversions modeled over 82-year historical hydrology, but does not represent year-to-year variation. Thus, even with zero average annual increase in diversions, there would still be year-to-year variations in diversions compared to the existing condition due primarily to modified system operations for maintenance and implementation of the conjunctive-use program.

delivery needs through 2018 and maintain Tuolumne River diversions at or close to current levels, the SFPUC would implement its proposed 10 mgd of in-city recycled water and groundwater projects and conservation actions plus work with BAWSCA and the wholesale customers to implement another 10 mgd of local recycled water, groundwater, and conservation actions (or BAWSCA and wholesale customers might elect to implement this additional local conservation and supply development themselves without the SFPUC). The SFPUC plans to implement projects to achieve its in-city 10 mgd by 2014 (see Draft PEIR Vol. 1, Chapter 3, p. 3-55 for a description of the proposed Groundwater Projects [WSIP project SF-2]; p. 3-56 for a description of the proposed Recycled Water Projects [WSIP project SF-3]; and Figure 3.6, p. 3-62 for the proposed implementation schedule). Since publication of the Draft PEIR, the wholesale customers have also taken steps to develop the necessary local projects (see the discussion below under the heading Wholesale Customer Actions for further information). The SFPUC will determine with BAWSCA the best way to develop the additional 10 mgd of supply (supply offsets) needed to meet the full wholesale customer needs by 2018.

In implementing the Phased WSIP Variant, the need could arise to temporarily increase deliveries from the Tuolumne River and local watersheds over the 265 mgd average annual target levels to meet customer water delivery needs in the near term, because it might not be possible to implement all of the local projects and actions in time to meet increasing customer demands. The impact analysis for the Phased WSIP Variant recognizes that, between now and 2018, deliveries from the Tuolumne River and local watersheds might increase above the 265 mgd average annual level (to a possible 275 to 285 mgd average annual) for up to a few years. By 2018, and perhaps well before, it is expected that local projects would provide sufficient local supply and conservation to bring SFPUC watershed deliveries back down to current levels, close to 265 mgd.

Under the Phased WSIP Variant, the SFPUC would monitor sales to ensure that annual average sales delivered from the SFPUC watersheds are limited to an average annual of 265 mgd through 2018. The SFPUC would measure and review annual average sales at the close of each fiscal year. **Figure 13.1** presents the five-year rolling average for the past 15 years of actual deliveries from the SFPUC watersheds (from fiscal year 1992/1993 through fiscal year 2007/2008) for the combined retail and wholesale customers. As shown on the graph, the highest five-year rolling average water delivery from the SFPUC watersheds via the regional water system to date was 263 mgd between fiscal year 1999/2000 and fiscal year 2003/2004. Since that time, this average has declined and leveled at 257 mgd for each of the past three years.

In consideration of public health and safety, the SFPUC would not cease water deliveries to customers in the event that total sales in water deliveries from the SFPUC watersheds exceed 265 mgd. However, in the event that sales from the SFPUC watersheds go above the 265 mgd average annual restriction, the SFPUC would provide financial incentives as a mechanism to encourage customers to develop the necessary local supply and conservation programs and discourage additional use of supply from the SFPUC watersheds.



SFPUC Water System Improvement Program . 203287

Figure 13.1
SFPUC Regional Water System Deliveries –
Five-Year Rolling Average

Facility Improvement Projects

Under this variant, the SFPUC would implement the same 22 facility improvement projects as proposed under the WSIP. There would be no difference in the proposed facility sizing, design, siting, or operation between this variant and the WSIP. Although the total average water deliveries from the regional water system would be less under this variant (275 to 285 mgd) than those under the WSIP (300 mgd), the facilities design and sizes would remain the same. Facility design and size are determined by several factors, and reducing the water supply delivery target alone would not reduce the required size of the proposed facilities. The SFPUC determined that individual facilities throughout the regional water system must be designed and sized to meet overall system performance objectives for seismic reliability, water delivery reliability, maintaining high water quality, and meeting water supply goals (SFPUC, 2008d). Sizing for many system components is primarily driven by the need to replenish local storage following a drought, seismic event, unplanned outage, or maintenance shutdown period such that the local system has enough stored water to meet 90 days of demand strictly from the local system; facility sizing is also determined by the need to meet water delivery demand while performing maintenance or in the event of an emergency outage.

Wholesale Customer Actions

The wholesale customers have obligations, through laws, contracts, and other legal instruments, to provide water service to their customers. As described in the Draft PEIR (Vol. 1, Chapter 3, pp. 3-16 to 3-22), the wholesale customers, in conjunction with the SFPUC, conducted a comprehensive assessment of future water use within their service areas and identified the amount

of water needed from the SFPUC, in addition to increased water conservation, to meet customer needs through 2030. The SFPUC wholesale customer purchase requests for 2030, developed as part of the WSIP, total 209 mgd. By approximately 2018, wholesale customer demand on the SFPUC regional system is projected to increase to 194 mgd.

Under the Phased WSIP Variant, the wholesale customers would receive 184 mgd on an average annual basis from the SFPUC watersheds until 2018. The SFPUC is proposing to obtain the remaining 10 mgd needed to meet the projected 194 mgd wholesale customer demand through the development of additional local conservation, recycled water, and groundwater projects. As described above, this additional 10 mgd increment of supply/conservation could either be developed jointly by the SFPUC and BAWSCA and become part of the regional system supply portfolio or it could be developed independently by BAWSCA and/or the wholesale customers and remain separate from the regional system supply portfolio. The SFPUC is meeting with BAWSCA to discuss the best way to develop this additional increment of supply.

How the 265 mgd Limit on Deliveries from the SFPUC Watersheds Could Affect the Wholesale Customers

The ability of each individual wholesale customer to implement additional demand management and/or secure additional water supplies varies. Sixteen of the 27 wholesale customers rely on the SFPUC for 100 percent of their supply (see **Table 13.4**). Only eleven of the 27 wholesale customers have other sources of supply in addition to the SFPUC deliveries: nine have other sources of surface water, groundwater, and/or local recycled water supply and two others have only local recycled water supply. **Table 13.5** (which is the same as Draft PEIR Table 7.2) indicates which agencies have sources of supply other than the SFPUC. The Alameda County Water District (serving Fremont, Newark, and Union City) has a combination of local groundwater (including direct pumping and use of groundwater resources as well as desalination of brackish groundwater from its salinity intrusion barrier well system along the bay shoreline), imported surface water supply from the Delta delivered through the State Water Project (SWP), and local recycled water, in addition to its SFPUC supply. California Water Service Company (three districts), Coastside County Water District, Daly City, and Mountain View each have one or more local resources, including groundwater, surface water, and/or recycled water. Palo Alto and Redwood City both have some local recycled water.

In the South Bay, eight of the SFPUC wholesale customers also lie within the Santa Clara Valley Water District (SCVWD), and some of these customers receive supply from both the SCVWD and the SFPUC. The SCVWD is a special district under state law and is required to serve the inhabitants of its service area. SCVWD is both a state water contractor receiving imported water from the Delta via the SWP and a federal water contractor receiving Delta water from the Central Valley Project (CVP). In addition, the SCVWD manages local surface and groundwater resources for its customers and actively manages a conjunctive-use program that includes groundwater replenishment with imported surface water to manage groundwater use. SFPUC wholesale customers that also receive water from the SCVWD include Stanford University (which also has some local surface water resources), Mountain View, Sunnyvale (which also has local groundwater and recycled water), Santa Clara (which also has substantial local groundwater

TABLE 13.4
SFPUC WHOLESALE CUSTOMERS – SUPPLY SOURCES

SFPUC Wholesale Customers	
Customers Relying on the SFPUC for 100% of Supply	**Customers with Other Supply Sources**
California Water Service (Mid-Peninsula)	Alameda County Water District
City of Brisbane	California Water Service (Bear Gulch and South San Francisco)[a]
City of Burlingame	Coastside County Water District [a]
City of East Palo Alto	City of Daly City
Estero Municipal Improvement District	City of Milpitas
Guadalupe Valley Municipal Improvement District	City of Mountain View [a]
City of Hayward	City of Palo Alto [a]
Town of Hillsborough	City of Redwood City [a]
City of Menlo Park	City of Santa Clara
Mid-Peninsula Water District	Stanford University
City of Millbrae	City of Sunnyvale
North Coast County Water District	
Purissima Hills Water District	
City of San Bruno	
City of San Jose (North)	
Skyline County Water District	
Westborough Water District	

[a] These wholesale customers receive 25 percent or less of their supply from other sources; the SFPUC provides 75 percent or more.

resources and recycled water), and Milpitas (which also has local recycled water). Palo Alto and Purissima Hills Water District lie within the SCVWD service area but do not receive water from the SCVWD. In total, the SFPUC provides about 54 mgd, or 56.4 percent, of the supply to meet the demand of these eight SCVWD customers.

In summary, for five of the 11 customers who have other sources of water supply in addition to the SFPUC supply, the other supply sources make up 25 percent or less of their supply and the SFPUC provides the remaining 75 percent of supply or more. Hence, only a few of the wholesale customers have other substantial sources of supply besides the SFPUC.

Supply shortfalls from the SFPUC regional water system could also affect individual wholesale customers differently because of differences in their supply agreements with the SFPUC. As discussed in the Draft PEIR (Vol. 1, Chapter 2, pp. 2-43 and 2-44, and Vol. 4, Chapter 7, pp. 7-13 and 7-14), the SFPUC currently holds individual agreements with its wholesale customers. A Master Water Sales Agreement between the CCSF and each of the wholesale customers establishes wholesale water rates, cost allocation, water supply allocation, and use of local water. Under the Master Sales Agreement, the CCSF has agreed that the wholesale customers may collectively purchase up to 184 mgd on an average annual basis, subject to reductions in the event

TABLE 13.5
SUMMARY OF 2030 DEMAND PROJECTIONS, WATER SUPPLY ASSUMPTIONS, AND SFPUC PURCHASE ESTIMATES
(SAME AS DRAFT PEIR TABLE 7.2)

Customer	A 2030 Projected Demand (with Plumbing Code Savings) (mgd[a])	B 2030 Projected Conservation Savings (mgd[a])	C 2030 Demand Adjusted for Conservation (mgd[a]) (A - B)	D 2030 Projected Use of Recycled Water (mgd[a])	E 2030 Projected Use of Ground-water Sources (mgd[a])	F 2030 Projected Use of Other Surface Water Sources (mgd[a])	G 2030 Projected Demand Adjusted for Use of Other Sources and Conservation (mgd[a]) (C - D - E - F)	H 2030 Purchase Estimates (mgd[a])	I Percent of Total 2030 Demand (with Plumbing Code Savings) met by SFPUC Purchases (H/A)	J Percent of 2030 Demand Adjusted for Conservation met by SFPUC Purchases (H/C)
Alameda County Water District	59.3	3.16	56.14	1.40	13.98	27.00	13.76	13.76	23%	25%
City of Brisbane	0.93	0.04	0.89				0.89	0.89	96%	100%
City of Burlingame	4.9	0.20	4.7				4.70	4.70	96%	100%
CWS–Bear Gulch District[b,c]	14.06	0.93	13.13			1.37	11.76	11.76	84%	90%
CWS–Mid-Peninsula District[b]	18.1	0.86	17.24				17.24	17.24	95%	100%
CWS–South San Francisco District[b]	9.9	0.56	9.34		1.37		7.97	7.97	81%	85%
Coastside County Water District[d]	3.2	0.18	3.02		0 – 0.30	0 – 0.48	2.24 – 3.02	2.24 – 3.02	70 – 94%	74 – 100%
City of Daly City[e]	9.1	0.44	8.66		1.34 – 3.76		4.90 – 7.32	4.90 – 7.32	54 – 80%	57 – 85%
City of East Palo Alto	4.8	0.16	4.64				4.64	4.64	97%	100%
Estero MID[f]	6.8	0.00 – 0.60	6.2 – 6.8				6.20 – 6.80	6.20 – 6.80	91 – 100%	100%
Guadalupe Valley MID[f]	0.81	0.10	0.71				0.71	0.71	88%	100%
City of Hayward	28.7	0.76	27.95				27.95	27.95	97%	100%
Town of Hillsborough	3.9	0.20	3.7				3.70	3.70	95%	100%
City of Menlo Park	4.7	0.16	4.54				4.54	4.54	97%	100%
Mid-Peninsula Water District	3.8	0.10	3.70				3.70	3.70	97%	100%
City of Millbrae[g]	3.3	0.08 – 0.11	3.19 – 3.27				3.19 – 3.22	3.19	97%	99 – 100%
City of Milpitas	17.7	0.61	17.09	1.77		7.13	8.19	8.20	46%	48%
City of Mountain View	14.8	0.24 – 1.21	13.59 – 14.56		0.05	1.30	12.24 – 13.21	13.20	89%	91 – 97%
North Coast County Water District	3.8	0.00 – 0.19	3.62 – 3.80				3.62 – 3.80	3.61 – 3.80	95 – 100%	100%
City of Palo Alto[h]	14.4	0.60	13.76	0.76			13.00	13.00	91%	94%
Purissima Hills Water District	3.3	0.08	3.22				3.22	3.22	98%	100%
City of Redwood City[i]	13.4	0.59 – 1.02	12.38 – 12.81	0 – 1.00			11.38 – 12.81	11.60 – 12.60	87 – 94%	94 – 98%
City of San Bruno	4.5	0.19	4.32				4.32	4.30	96%	100%
City of San Jose (North)[i]	6.5	0.16	6.34				6.34	6.34	98%	100%
City of Santa Clara	33.9	1.00	32.90	4.00	19.99	4.00	4.91	4.90	14%	15%
Skyline County Water District	0.31	0.01	0.30				0.30	0.30	97%	100%
Stanford University	6.8	0.70	6.10			1.90	4.20	4.20	62%	69%
City of Sunnyvale	26.8	0.70	26.10	1.50	2.60	9.90	12.10	12.10	45%	46%
Westborough Water District[k]	1.03	see note k	1.03				1.03	1.03	100%	100%
Total, Wholesale Service Area	**324**	**13 – 15**	**308 – 311**	**9.4 – 10.4**	**39.3 – 42.1**	**52.6 – 53.1**	**203 – 209**	**204 – 209**	**63 – 65%**	**66 – 67%**
SFPUC Retail Service Area[l]	**93.4**	**0 – 4**	**89.4 – 93.4**	**0 – 4**	**2.5 – 4.5**	**0**	**81 – 91**	**80 – 91**	**86 – 97%**	**89 – 97%**
TOTAL	**417**	**13 – 19**	**398 – 404**	**9.4 – 14.4**	**41.8 – 46.6**	**52.6 – 53.1**	**284 – 300**	**284 – 300**	**68 – 72%**	**71 – 74%**

NOTE: Numbers may not sum due to rounding.

a mgd = million gallons per day.
b CWS = California Water Service Company.
c CWS–Bear Gulch District includes the former Los Trancos County Water District.
d The upper range purchase estimate assumes loss of all local water sources (surface water and groundwater) and the lower range estimate assumes continuation of local sources; both estimates assume Level B water conservation.
e The purchase estimate range reflects a range of potential groundwater usage established under a pilot project, from the sustainable yield (3.76 mgd) to the lowest annual production yield (1.34 mgd), according to Daly City's best estimate of 2030 water purchases (SFPUC, 2004).
f MID = Municipal Improvement District.
g 2030 conservation savings is based on URS 2004c and the City's UWMP as confirmed by the City (Popp, 2007).
h 2030 demand and conservation savings are based on information provided by the City of Palo Alto to the SFPUC (City of Palo Alto, 2005a).
i In November 2005, Redwood City informed the SFPUC that it would be purchasing its low-range estimate of 11.6 mgd due to anticipated implementation of 1 mgd of recycled water in 2030 (City of Redwood City, 2005a). The high-range purchase estimate total of 300 mgd published in URS 2004b remains the SFPUC 2030 purchase estimate total for planning purposes, to be consistent with the previous and ongoing WSIP studies. The purchase estimate range originally submitted apparently reflects the average of the City's estimated conservation savings range plus the originally estimated range of recycled water use.
j Portion of north San Jose only.
k Demand and purchase estimates are based on Westborough Water District's 2005 UWMP, as requested by the District in a letter to the SFPUC (Westborough Water District, 2007). The UWMP discusses ongoing and planned future demand management programs but does not quantify conservation savings in relation to the demand and purchase estimate. The District's original estimate of water purchases indicated conservation savings of 0.020 mgd (SFPUC, 2004).
l The low range of the SFPUC retail customer purchase estimate reflects the identified groundwater, recycled water, and conservation programs totaling 10 mgd in San Francisco that are included as part of the WSIP proposed water supply option.

SOURCES: URS, 2004a; URS, 2004b; URS, 2004c; URS, 2006; SFPUC, 2004; SFPUC, 2007; City of Palo Alto, 2005a; Popp, 2007; City of Redwood City, 2005a; Westborough Water District, 2005 ; Westborough Water District 2007.

of a drought, water shortage, earthquake or other natural disaster, or rehabilitation and maintenance of the system; the 184 mgd amount is referred to as the "supply assurance." The agreement also requires that the wholesale customers employ best efforts to use all sources of water owned or controlled by them, including groundwater. The terms of individual agreements vary among the wholesale customers. In general, there are individual supply assurances for each wholesale customer with two exceptions (see Vol. 5, Appendix E, Table E.1.1, p. E.1-2 for each customer's existing supply assurance from the SFPUC regional water system). The wholesale customers have varying amounts of their individual supply assurance remaining. All but two wholesale customers are under their current supply assurance by some amount, and two agencies have exceeded their individual supply assurance caps; however, collectively, the wholesale customers remain below the 184 mgd supply assurance cap established by the Master Sales Agreement.

The first exception to the SFPUC's supply assurance contracts involves the City of Hayward and the Estero Municipal Improvement District (Estero MID) (serving primarily Foster City and some portions of San Mateo County). Contracts with these two agencies do not specify a limit on purchases from the SFPUC. For these two agencies, the CCSF has agreed to meet all of their water needs in excess of other water sources owned or controlled by them. The agreement with Estero MID expires in 2011, while the agreement with the City of Hayward has no termination date. A specified amount (28 mgd) of the total 184 mgd wholesale customer supply assurance has been set aside by the wholesale customers to meet the long-term supply needs of Hayward and Estero MID. However, Hayward alone projects that it will need to purchase up to 28 mgd from the SFPUC by 2030 (just under 10 mgd more than its fiscal year 2001/2002 delivery purchase). Estero MID has requested purchase of up to 6.8 mgd by 2030. Thus, the combined usage for these two agencies is projected to exceed the 28 mgd reserved for them. If this occurs, then the other wholesale customers would have to reduce their purchases in order to accommodate Hayward and Estero MID deliveries. The Master Sales Agreement provides a method for proportional reduction in the other wholesale customers' supply guarantee in the event that Hayward and Estero MID exceed the supply amount reserved for them.

The second exception to the SFPUC supply assurance contracts involves the Cities of San Jose and Santa Clara. The SFPUC sells water to these two entities on a temporary, interruptible basis; neither city has a supply assurance contract with the SFPUC. As a result, deliveries to these two cities are not accounted for in the 184 mgd supply assurance cap established in the Master Sales Agreement. In fiscal year 2001/2002, these two cities purchased a combined total of 8.26 mgd from the SFPUC system. As part of the WSIP planning and development process, they submitted a request to purchase an additional 2.98 mgd, for a combined total 2030 purchase request of 11.24 mgd. The SFPUC serves northern San Jose, while the remainder of San Jose is served by the SCVWD. The City of Santa Clara receives less than 20 percent of its supply from the SFPUC. Within Santa Clara, however, the SFPUC supply constitutes nearly 90 percent of water supply to the northern part of the city (north of Highway 101), which is largely isolated from the rest of the city's water system. For Santa Clara to serve this area from a source other than the SFPUC, it would not only need to secure the additional supply but also to extend major new infrastructure. Similarly, in San Jose, the SFPUC supply serves the northern San Jose area. Although San Jose and Santa Clara lie within the SCVWD, the District does not have available supply or the necessary treatment

plant capacity or infrastructure reaching these areas that could provide service to compensate for a reduction in SFPUC deliveries; major new facilities would need to be constructed to serve these areas.

In the future under the Phased WSIP Variant through 2018, the Cities of San Jose and Santa Clara could face partial or complete SFPUC water delivery reductions as the other wholesale customers with supply assurance contracts increase their deliveries up to their supply assurance limits and Hayward and Estero MID continue to increase their purchase requests beyond a combined 28 mgd. The San Francisco Planning Department received letters from the SCVWD, the City of San Jose, the City of Santa Clara, and BAWSCA concerning the proposed Phased WSIP Variant (see Vol. 8, Appendix M for copies of these letters). Each of these agencies expressed concern that neither San Jose nor Santa Clara have good alternative treated water supply sources, and that increasing local groundwater pumping would have environmental consequences associated with over-pumping. Historically, over-pumping of groundwater was an issue for these communities and resulted in appreciable land subsidence that was remedied through a combination of actions, including the use of surface water supplies from the SFPUC to reduce the need for pumping. (Refer to the discussion below under the heading Environmental Effects of the Phased WSIP Variant for further information on the potential environmental effects of groundwater pumping increases by San Jose and Santa Clara.)

If SFPUC supplies to San Jose and Santa Clara were interrupted due to increased demand among the remaining wholesale customers, these entities could rely entirely on the SCVWD to meet the portion of their existing demand now being met by the SFPUC. As noted in the SCVWD water supply planning documents, the District relies on the SFPUC to continue to meet the supply needs of these two customers in the future. The SCVWD has not made plans to serve these customers from the supplies that they manage. Similarly, if any of the other customers do not have their demand increases met through the SFPUC, then these customers could increase their reliance on the SCVWD to meet that portion of increased demand.

Water Supply Options

As discussed in the Draft PEIR for the No Purchase Request Increase Alternative (and the No Program Alternative), if the SFPUC does not fully meet the wholesale customer purchase requests, it is assumed that the wholesale customers, either individually or collectively, would pursue supplemental supply sources and/or additional conservation and/or water recycling projects to make up the shortfall in SFPUC water deliveries under this scenario. BAWSCA represents the SFPUC wholesale customers and has the authority to pursue and secure water supplies on behalf of the wholesale customers as well as to coordinate recycled water and conservation projects to benefit its members.

Local Options

Draft PEIR Section 9.2.4, Aggressive Conservation/Water Recycling and Local Groundwater Alternative (Vol. 4, Chapter 9, pp. 9-47 to 9-59) and Section 9.2.8, Modified WSIP Alternative (Vol. 4, Chapter 9, pp. 9-78 to 9-84) provide a discussion of the additional, potential conservation,

recycled water, and groundwater projects that could be implemented by the wholesale customers beyond those projects accounted for in their 2030 purchase request. This information is summarized below. These projects could potentially be implemented to develop the additional 10 mgd of local supply and/or conservation required under the Phased WSIP Variant by 2018, assuming these projects are feasible (see **Table 13.6**, below, which is the same as PEIR Table 9.11). Most of the projects have been developed on a very conceptual level and have technical, institutional, and financial issues to overcome prior to implementation; and contain uncertainties with regard to water quality issues, end-users, long-term sustainable yield, and production rates. The SFPUC is interested in working with BAWSCA and the wholesale customers in the further development of local conservation, recycled water, and/or groundwater projects to meet the full customer supply needs through 2018. The SFPUC is considering the creation of financial mechanisms to support actions in the wholesale customer service areas as well as direct participation in local projects (SFPUC, 2008c).

In March 2008, BAWSCA authorized a study, called the BAWSCA Water Conservation/Recycling Implementation Plan, to identify the specific conservation actions needed to secure an additional 10 mgd of supply savings through conservation savings and reclamation by 2030, as was indicated to by BAWSCA in its comments on the Draft PEIR (see Vol. 6, Section 12.3, Comment L_BAWSCA1-53). BAWSCA moved in August 2008 to secure a consultant to prepare the plan, which is scheduled to be completed by the end of June 2009. The plan will include a 10-year implementation plan showing proposed actions, schedules, costs, and funding alternatives to achieve the combined commitments shared by BAWSCA and its member agencies to achieve a total of 58 mgd of water conservation and recycling between 2001 and 2030 (BAWSCA, 2008b). The commitment to develop 10 mgd of local recycled water and conservation is in addition to the amount the wholesale customers previously committed to in the development of their 2030 purchase requests as part of the WSIP planning process (BAWSCA, 2008a).

As discussed in the Draft PEIR analysis of the Aggressive Conservation/Water Recycling and Local Groundwater Alternative (Vol. 4, Chapter 9, pp. 9-47 to 9-59), studies to date suggest that it would be difficult for the wholesale customers to develop sufficient local conservation, reuse, and groundwater projects to meet their full 2030 needs. Thus, after 2018, if the SPFUC decides to continue limiting deliveries from its watersheds to 265 mgd, it could be difficult for the SFPUC, BAWSCA, and the wholesale customers to develop sufficient additional local supply through groundwater, recycled water, and conservation to satisfy projected 2030, long-term demands. With respect to the potential for additional local groundwater development, the wholesale customers with appreciable groundwater resources (i.e., Daly City, Santa Clara, Sunnyvale, and Alameda County Water District) are already maximizing or planning to maximize their use of this supply, while other customers have no or only a limited potential for groundwater development. As shown on Table 13.6, the wholesale customers identified potential groundwater projects totaling just under 3 mgd. The wholesale customers with groundwater resources risk the potential for overdrafting their local aquifers if they increase the use of this resource. This is a particular concern for South Bay communities such as San Jose and Santa Clara that have a history of over-pumping groundwater, land subsidence, and loss of aquifer storage capacity.

TABLE 13.6
POTENTIAL REGIONAL RECYCLED WATER, GROUNDWATER, AND CONSERVATION PROJECTS
(SAME AS DRAFT PEIR TABLE 9.11)

Location/Jurisdiction	Type of Supply	Description	Low-Range Yield (mgd)	High-Range Yield (mgd)
Category 1 – Projects Likely to be Implemented				
City of Daly City	Recycled Water	Expansion of recycled water uses from an existing facility to irrigate an additional park and landscape medians	-	0.01
North Coast County Water District/San Francisco	Recycled Water	Various irrigation uses for school grounds and highway uses	0.15	0.58
		Subtotal Category 1	**0.15**	**0.6**
Category 2 – Eligible Projects in Early Planning Stages				
Mountain View	Recycled Water	Irrigation and industrial usage – joint project with City of Palo Alto	-	1
Various	Conservation	Eight conservation measures to be implemented by a regional body	2.3	5.7
Various	Conservation	Seven additional conservation measures to be implemented by a regional body	0.6	1.5
Palo Alto	Recycled Water	Irrigation in Palo Alto and East Palo Alto	-	1
Cal Water–Mid-Peninsula	Groundwater	New well in Mid-Peninsula District for potable use	-	1
Cal Water–Bear Gulch	Groundwater	New well shared with Menlo Park for potable use	-	1
East Palo Alto	Groundwater	Reestablish use of existing well	-	0.5
Redwood City	Recycled Water	Expand recycled water system for use by additional customers outside of service area	2.2	4.5
South San Francisco and San Bruno	Recycled Water	Replace current groundwater irrigation uses with recycled water	-	0.3
		Project Overlap Adjustment[1]		(1.5)
		Subtotal Category 2	**5.1**	**15**
Category 3 – Potentially Eligible Projects for Future Consideration				
Menlo Park	Groundwater	Groundwater well for emergency use	Unknown	Unknown
Sunnyvale	Recycled Water	Extend existing recycled water project	-	0.7
Various	Conservation	Eight additional conservation measures to be implemented by a regional body	0.5	1.4
Burlingame	Groundwater	Rehabilitate existing well	-	0.02
Burlingame	Recycled Water	Irrigation of commercial landscaping	-	0.25
		Project Overlap Adjustment		(0.14)
		Subtotal Category 3	**0.5**	**2.23**
Total			**5.75**	**~19**

[1] Project overlap adjustment represents the amount of potential conservation program savings overlap with respect to other projects to avoid double counting.

SOURCE: SFPUC, 2007b.

Imported Supply and/or Desalination Options

Other options for potential supplemental water sources that the wholesale customers could pursue to make up for the SFPUC water delivery shortfall that could occur under this variant are seawater or brackish water desalination and surface water transfers, potentially coupled with conjunctive groundwater use and/or additional surface water storage. These potential supplemental supply options are discussed in the Draft PEIR, primarily in Section 9.2.2, No Program Alternative (Vol. 4, Chapter 9, pp. 9-25 to 9-40), but also in Section 9.2.3, No Purchase Request Increase Alternative (Vol. 4, Chapter 9, pp. 9-40 to 9-47).

Regarding water purchases or transfers, statewide trends indicate that while urban water use is increasing, agricultural water use is decreasing, in part because agricultural water users are selling water rights or contracts to urban agencies (DWR, 2005). Potential sources of supplies for the wholesale customers include water-rights holders north of the Delta, in the Delta, or south of the Delta. The agencies with the rights to the greatest quantities of water in the state—the U.S. Bureau of Reclamation (USBR) and California Department of Water Resources (DWR)—would not be sources of new water supply contracts/agreements because of their commitments to existing contractors and to the protection, restoration, and enhancement of fish and wildlife habitat. The wholesale customers and/or BAWSCA could face challenges to water purchases and transfers pertaining to restrictions associated with entitlements, contracts, and water rights; permitting requirements; effects caused by the cessation of water application to an area (e.g., land fallowing, economic impacts); Delta pumping restrictions; and wheeling arrangements[3] (Johnson and Loux, 2004). Existing water delivery infrastructure could theoretically be used through agreements with other agencies (such as the DWR, USBR, SFPUC, SCVWD, East Bay Municipal Utility District, or Alameda County Water District) to convey water to the wholesale customers, if and when system capacity is available. Construction or expansion of interties or connecting pipelines in urban areas would likely be required.

Since the Draft PEIR was released in June 2007, a series of events has affected the feasibility of executing water transfers that involve moving water from or through the Sacramento–San Joaquin River Delta. These events are primarily related to endangered species issues and include: the DWR's 10-day shutdown of the State Water Project (SWP) Delta diversions in the summer of 2007 to protect delta smelt; the Judge Wanger decision in late 2007 regarding delta smelt("Wanger 2007 Decision"), which imposed interim export pumping restrictions tied to flow conditions on Old and Middle Rivers in the Delta; the Judge Wanger decision to invalidate the Biological Opinion for the coordinated operations plan for the CVP and SWP known as the OCAP (Operations Criteria & Plan) on anadromous fish, including steelhead, winter-run and spring-run salmon, and green sturgeon (Wanger Decision 2008); the Endangered Species Act reconsultation now in progress for the OCAP, which will establish revised long-term operating requirements for the CVP and SWP operations to protect endangered species (replacing both the Wanger 2007 and Wanger 2008 decisions); and the proposed Bay Delta Conservation Plan, which includes alternatives for substantially modifying conveyance facilities and operations for the state and federal water systems that now use the Delta for conveyance, and for which the state and

[3] Wheeling arrangements are agreements to use existing infrastructure owned by a third party to transport/convey water from a source to a customer.

federal environmental review processes have recently been initiated (spring 2008). This series of events has made the potential for securing a water transfer from an entity north of the Delta less feasible now than it was when the Draft PEIR was published.

Another potential source of supplemental water for the wholesale customers could be increased agricultural water conservation in the San Joaquin Valley such that surface water conserved in these agricultural areas could then be delivered to the Bay Area. BAWSCA and some of its member agencies have proposed the implementation of additional agricultural water conservation beyond that included in the Modified WSIP Alternative (refer to Vol. 7, Chapter 14, **Section 14.10, Master Response on Modified WSIP Alternative**). According to these proposals, the water saved would accumulate in Don Pedro Reservoir and could be used to increase flows in the Tuolumne River below La Grange Dam or could be conveyed to water users in the Bay Area via a water exchange agreement with TID and MID. The SFPUC regards any project intended to increase agricultural water conservation beyond the level needed to reduce the impacts of the WSIP to a less-than-significant level to be separate from the WSIP. Any such agreements would be undertaken independently of the WSIP. If the Modified WSIP Alternative, or this element of it, is selected as the preferred course of action, the SFPUC would work with TID, MID, or another water agency to develop the transfer of conserved water that is included in the Modified WSIP Alternative. BAWSCA could choose to pursue a separate agricultural water conservation project to augment this transfer, but if the SFPUC were to participate in the project, it would be considered a distinct action from the WSIP or any alternative/variant of the WSIP. This is one option BAWSCA and its member agencies could pursue in order to secure a supplemental supply.

Use of seawater or brackish water desalination technologies to supplement supplies would involve the construction and operation of a desalination plant and related infrastructure. Such a project could occur on a local or regional level. For example, the Alameda County Water District has developed a local desalination facility to treat brackish groundwater pumped from local wells to blend with other drinking water supplies. The SFPUC is currently participating in a study on a potential regional desalination facility that might serve multiple Bay Area communities. The Draft PEIR includes a description of the facilities and environmental impacts of desalination in Section 9.2.6, Year-round Desalination at Oceanside Alternative (Vol. 4, Chapter 9, pp. 9-66 to 9-74) and Section 9.2.7, Regional Desalination for Drought Alternative (Vol. 4, Chapter 9, pp. 9-74 to 9-78). Desalination represents a potential new local source of water.

Ability to Meet Program Objectives

Table 13.7 (similar to Draft PEIR Table 9.6) summarizes the ability of the Phased WSIP Variant to meet the program objectives as compared to the WSIP and select other alternatives. Through 2018, the Phased WSIP Variant would meet many, but not all, of the program objectives. Given the proposed 265 mgd annual average limitation on deliveries from the SFPUC watersheds, the wholesale customers would receive up to 184 mgd from the SFPUC watersheds and would need to quickly develop an additional 10 mgd of local supply and conservation by 2018. Because the Phased WSIP Variant has not already identified specific local projects for implementation to secure the additional 10 mgd needed to fully meet the wholesale customer demand through 2018,

TABLE 13.7
SUMMARY OF ABILITY OF ALTERNATIVES TO MEET PROGRAM OBJECTIVES[a]
(SIMILAR TO DRAFT PEIR TABLE 9.6)

Objectives	Proposed Program	No Program Alternative	No Purchase Request Increase Alternative	Phased WSIP Variant
Water Quality				
Design improvements to meet current and foreseeable future federal and state water quality requirements?	Yes	Yes	Yes	Yes
Provide clean, unfiltered water originating from Hetch Hetchy Reservoir and filter all other surface water sources?	Yes	Yes	Yes	Yes
Continue to implement watershed protection measures?	Yes	Yes	Yes	Yes
Seismic Reliability				
Complies with current seismic standards?	Yes	No	Yes	Yes
Capable of delivering basic service to all regions in the service area following a major earthquake?	Yes	No	Partial	Partial
Facilities restored to meet average-day demand within 30 days of a major earthquake?	Yes	No	Partial	Partial
Delivery Reliability				
Provides operational flexibility to allow for planned maintenance without service interruptions?	Yes	No	Yes	Yes
Provides operational flexibility and system capacity to replenish local reservoirs, as needed?	Yes	No	Yes	Yes
Capable of minimizing risk of service interruption due to unplanned facility upsets or outages?	Yes	No	Yes	Yes
Capable of serving average 2030 demand of 300 mgd with one planned shutdown of a major facility and one unplanned facility outage?	Yes	No	Partial	Partial
Water Supply				
Meets average annual purchase requests of 300 mgd during nondrought years for system demands through 2030?	Yes	Partial	No, 275 mgd	No, 275–285 mgd
Meets 20% systemwide rationing limit during droughts?	Yes	No	Partial	Partial
Meets system firm yield of 256 mgd?	Yes	No	No	No
Diversifies water supply options during nondrought and drought periods?	Yes	No	Yes	Yes
Improves use of new water sources and drought management, including use of groundwater, recycled water, conservation, and transfers?	Yes	No	Yes	Yes

TABLE 13.7 (Continued)
SUMMARY OF ABILITY OF ALTERNATIVES TO MEET PROGRAM OBJECTIVES[a]
(SIMILAR TO DRAFT PEIR TABLE 9.6)

Objectives	Proposed Program	No Program Alternative	No Purchase Request Increase Alternative	Phased WSIP Variant
Sustainability				
Manages natural resources and physical systems to protect watershed ecosystems?	Yes	Yes	Yes	Yes
Meets current and anticipated legal requirements for protection of fish and other wildlife habitat?	Yes	Yes	Yes	Yes
Manages natural resources and physical systems to protect public health and safety?	Yes	No	Yes	Yes
Cost-effectiveness				
Ensure cost-effective use of funds?	Yes	No and likely greater cost	Unknown, but greater cost	Unknown, but greater cost
Maintains gravity-driven system?	Yes	Yes	Yes	Yes
Implement regular inspection and` maintenance program for all facilities?	Yes	No	Yes	Yes

NOTES:

[a] This assessment is based on SFPUC actions under each alternative only and does not account for the actions that BAWSCA and/or the wholesale customers might take in order to make up for any shortfall in the regional system's ability to meet the program objectives. See text for a discussion of the ability of each alternative to meet the objectives. In general, the terms in the table are used as follows:

Yes: Indicates that the alternative would fully meet the sub-objective at an equivalent level to the WSIP.

Partial: Indicates that the alternative could meet the objective in part, but it would not fully meet the objective at an equivalent level to the WSIP due to variation associated with the alternative, such as the reduced delivery targets, additional facility requirements, and associated issues. Both the No Purchase Request Increase Alternative and the Phased WSIP Variant would include the full set of WSIP facilities. Thus, the facilities would be capable of delivering and managing supplies to fully meet the 2030 WSIP objectives, but the proposed supply scenarios under these alternatives would not; as a result, these alternatives/variants would only partially meet the full WSIP objective.

No: Indicates that the alternative would not meet the sub-objective.

Facility Construction and Operation Impacts

WSIP Facility Improvement Projects

The Phased WSIP Variant would have the same impacts associated with proposed facility construction and operation as the WSIP. The 22 facility improvement projects proposed under the WSIP would also be implemented under the Phased WSIP Variant to meet the intent of the water quality, seismic reliability, delivery reliability, and water supply goals of the WSIP. All four of these goals are factored into the decision on how to size the WSIP's individual facility improvement projects. Even if the average annual diversions from the Tuolumne River were to remain within the current historical levels, the SFPUC would move forward with all projects as identified and sized under the WSIP in order to provide improved reliability and operational flexibility to perform the maintenance that has been deferred in the past and that is necessary in the future (SFPUC, 2008d).

Other Facilities Potentially Developed by the Wholesale Customers

The types of projects that the wholesale customers might pursue to reduce demand and/or supplement the surface water supplies delivered by the regional water system from the SFPUC watersheds, and the potential facility and operations impacts associated with such projects are discussed in the Draft PEIR in Section 9.2.2, No Program Alternative (Vol. 4, Chapter 9, pp. 9-34 to 9-37) and Section 9.2.4, Aggressive Conservation/Water Recycling and Local Groundwater Alternative (Vol. 4, Chapter 9, pp. 9-55 to 9-57).

In general, certain types of impacts are common to water supply transfers/acquisition and include: the cessation of water application to lands irrigated by the water being transferred; changes related to flows, fisheries, and water quality; and impacts caused by the use of existing or the construction of new infrastructure. Typically, the water-rights holder previously applied the water to agricultural land. If water is taken from agricultural customers, rather than implementing agricultural conservation measures, the transfer can result in the conversion of agricultural land to nonagricultural land. Beneficial environmental effects (related to retiring drainage-impaired lands, reducing the application of pesticides, etc.) can also occur. The need for new facilities and/or changes in the operations of existing facilities depend on the source of supply (e.g., the Tuolumne River through transfers with TID and MID, water-rights holders north of the Delta, in the Delta, or south of the Delta), the quantity of supply, the means of conveyance, and any additional storage requirements. Construction or expansion of interties or connecting pipelines could be required, potentially resulting in impacts similar to those described for the WSIP pipeline projects. The types of impacts associated with water supply acquisition projects are summarized in **Table 13.8** (which is the same as Draft PEIR Table 9.10). Depending on the facilities needed to convey the supplemental supplies to the wholesale customer service areas, the construction and operation of such facilities could result in a full range of construction and operational impacts similar to those described in Chapter 4 (Vol. 2) for the WSIP facilities in the South Bay and Peninsula areas (such as traffic, air quality, noise, energy use, waste disposal, and vibration).

TABLE 13.8
SUMMARY OF POTENTIAL IMPACTS AND MITIGATION STRATEGIES ASSOCIATED WITH REPRESENTATIVE WATER SUPPLY ACQUISITION PROJECTS
(SAME AS DRAFT PEIR TABLE 9.10)

Actions Associated with Water Supply Acquisition Projects	Potential Impacts	Mitigation Strategy
Supplemental Water Supply Source		
Increased Water Use Efficiency/Conservation (e.g., conversion to drip irrigation); tiered water pricing	Reduced groundwater recharge. Exposure of soils to wind erosion leading to air quality impacts. Could lead to increased groundwater pumping.	None required. See below regarding increased groundwater pumping.
Conversion of More Water-Intensive to Less Water-Intensive Crops, Land Fallowing	Land fallowing could create pressure to convert land to urban uses and loss of agricultural land. Economic impacts to community.	Include consideration of farming interests in decision-making process for transfer.
Increased Groundwater Pumping/Conjunctive Use of Groundwater	Groundwater level reductions and overdraft if there is insufficient sustainable yield to accommodate increased pumping. Water quality issues include decreased aesthetic quality in drinking water (hardness, tastes, odors), health risk from potential contaminants in groundwater basin.	Determine sustainable yield of the basin, implement monitoring program, regulate groundwater pumping to preserve safe yield, provide treatment and/or blending if necessary to remove contaminants and control taste and odor. Local assistance programs for remediation of affected wells.
Delta Diversions	Potential impacts on sensitive Delta fisheries including: winter-run, spring-run Chinook salmon, Delta smelt, steelhead trout, and Delta splittail.	Compliance with existing and future pumping requirements related to threatened and endangered species protection.
	Changes in Delta inflow, outflow. Potential impacts on flows associated with wheeling Delta transfers through the Delta, resulting in secondary impacts on Delta fisheries and other biological resources.	Transfer would require review/approval by applicable regulatory agencies. Analysis of flow impacts and commitment to minimize adverse secondary impacts on biological resources (e.g., through transfer timing, pumping restrictions).
	Water quality for the Delta and downstream water users (including salinity, bromides, potential contaminants from agricultural and industrial runoff, taste and odor problems, disinfection byproducts, and temperature).	Compliance with existing and future applicable water quality control. Regulations. Treatment to bring up to water quality equitable to Tuolumne River.
	Water quality for the Delta and downstream water users (including salinity, bromides, and temperature).	Transfer would require review/approval by applicable regulatory agencies. Analysis of flow impacts and commitment to minimize adverse impacts on other water users (e.g., through transfer timing, pumping restrictions).

TABLE 13.8 (Continued)
SUMMARY OF POTENTIAL IMPACTS AND MITIGATION STRATEGIES ASSOCIATED WITH REPRESENTATIVE WATER SUPPLY ACQUISITION PROJECTS

Actions Associated with Water Supply Acquisition Projects	Potential Impacts	Mitigation Strategy
Facilities Required		
Conveyance	Mostly temporary impacts from construction of pipelines, valves, and pumps (disturbance of soils, surface water quality, biological resources, cultural resources, air quality, traffic, noise, land use, hazardous materials, aesthetics).	Most impacts associated with facility construction could be mitigated to a less-than-significant level with the types of measures identified in Chapter 6. As is the case with the proposed WSIP facilities, some impacts (e.g., short-term noise and traffic) could be unavoidable.
Pumping	Noise, energy consumption, air pollutant emissions from energy consumption.	Muffle noise. Use energy-efficient pumps and alternative energy sources.
Treatment	Temporary construction impacts, including land use, traffic, noise and air quality impacts. Potential long-term impacts could include increase in energy consumption, air pollutant and greenhouse gas emissions from energy consumption.	Use standard construction mitigations. Use energy-efficient pumps and alternative energy sources.
Groundwater Basin Storage of Surface Water	Potential degradation of groundwater quality, hydrofracturing (injection).	Pretreatment, groundwater quality monitoring, groundwater basin modeling, modifications to recharge and pumping practices.
Storage – Development of New Offstream Storage	Temporary and long-term impacts from construction of dam, pipelines, pumps, and appurtenant features (direct and indirect impacts on wetland and upland fish and wildlife and attendant habitat; impacts related to cultural resources, air quality, traffic, noise, land use, aesthetics, etc.).	Most impacts associated with facility construction could be mitigated to a less-than-significant level with the types of measures identified in Chapter 6. Some impacts would likely be unavoidable.

If desalination technologies were used to supplement supplies, implementation of a desalination project to augment wholesale customer water supplies would result in the full range of construction impacts at the proposed facility location (such as traffic, air quality, noise, and vibration) as well as operational impacts related to aquatic resources, water quality, energy consumption, air quality, visual resources, land use and planning, traffic, and greenhouse gas emissions. The programmatic impacts of construction and operation of a desalination facility are described in the Draft EIR under WSIP Variant 2, Regional Desalination for Drought (Vol. 4, Chapter 8 (pp. 8-24 to 8-32).

Similar to the Aggressive Conservation/Water Recycling and Local Groundwater Alternative, the Phased WSIP Variant could also result in construction and operation of extensive additional recycled water and groundwater facilities in the wholesale customer service areas; thus, collective impacts in the Bay Division and Peninsula Regions and associated cumulative effects would occur. The types of impacts associated with implementation of the local recycled water and groundwater projects are summarized in **Table 13.9** (which is the same as Draft PEIR Table 9.12) and generally relate to construction of new infrastructure, water quality, and groundwater resources, and operational uses of energy and long-term air quality emissions.

Water Supply and Systems Operations Impacts

Tables 13.10, **13.11**, and **13.12** show the significance of the environmental impacts of the Phased WSIP Variant in the Tuolumne River, Alameda Creek, and Peninsula watersheds compared to the potentially significant impacts identified for the WSIP. Under the Phased WSIP Variant, the SFPUC would limit deliveries from the SFPUC watersheds to 265 mgd on an average annual basis, which would include 184 mgd to the wholesale customers and 81 mgd to the retail customers. In 2018, the SFPUC would decide whether to continue this limit on deliveries from the SFPUC watersheds or to increase it after completing further demand and supply option studies. The impact summary tables show the significance of impacts for the Phased WSIP Variant as the SFPUC proposes to implement it through 2018, and also for a potential 2030 implementation scenario that includes an increase in deliveries from the SFPUC watersheds up to the full level provided under the WSIP. The effects of the Phased WSIP Variant through 2018 would be similar to those described for the No Purchase Request Increase Alternative. For the 2030 scenario, while the SFPUC plans to reconsider water demand and water supply and make a later decision about the appropriate amount of SFPUC watershed deliveries after 2018, this 2030 scenario represents a potential "worst-case" impact assessment with respect to the potential level of effect on the SFPUC watersheds, particularly the Tuolumne River watershed, that might occur under the Phased WSIP variant. For this 2030 scenario, the impacts of the Phased WSIP Variant are the same as those of the Modified WSIP Alternative, since it assumes that 20 mgd of local conservation, recycled water, and groundwater projects would be implemented by 2018.

Tuolumne River Watershed

The significant impacts of the WSIP and the Phased WSIP Variant in the Tuolumne River watershed are shown in Table 13.10. Overall, the impacts of the Phased WSIP Variant through 2018 would be less than the impacts of the WSIP.

TABLE 13.9
SUMMARY OF POTENTIAL IMPACTS AND MITIGATION STRATEGIES FOR RECYCLED WATER AND GROUNDWATER PROJECTS
(SAME AS DRAFT PEIR TABLE 9.12)

Potential Impact	Mitigation Strategy
Groundwater Resources. Potential for increased groundwater pumping, groundwater level reductions, and overdraft if there is insufficient sustainable yield to accommodate increased pumping.	Determine sustainable yield of the basin, implement monitoring program, regulate groundwater pumping to preserve safe yield.
Surface Water, Groundwater Quality, and Public Health Issues. Recycled water applied to the irrigated lands would infiltrate through the subsurface levels, potentially affecting surface and groundwater quality. Groundwater may have contaminants with potential health effects. Groundwater lowers the aesthetic quality of the water through increased hardness, and potential for tastes and odors.	Comply with Title 22 Water Recycling Criteria. Groundwater may require disinfection, treatment and/or blending.
Energy use. Operation of both recycled water and groundwater projects would require increased energy use for treatment and distribution, and pumping. Increased energy production to support these activities along with plant operation would, in turn, generate additional air pollutant emissions, including greenhouse gases emissions.	Energy efficiency measures.
Treatment. Temporary construction impacts (disturbance of soils, surface water quality, biological resources, cultural resources, air quality, traffic, noise, land use, hazardous materials). Potential long-term impacts could include odor, depending on treatment processes and location relative to sensitive receptors. Plant operations could also generate long-term noise, traffic, and visual impacts depending on facility site location(s)and increased energy consumption and air pollutant emissions. **Pumping.** (groundwater pumping station)	Most impacts associated with facility construction could be mitigated to a less-than-significant level with the types of measures identified in Chapter 6. As is the case with the proposed WSIP facilities, odor control features (scrubbers) could reduce any odor impacts to a less-than-significant level.
Conveyance. Mostly temporary impacts from construction of pipelines, valves, and pumps (disturbance of soils, surface water quality, biological resources, cultural resources, air quality, traffic, noise, land use, hazardous materials, aesthetics).	Most impacts associated with facility construction could be mitigated to a less-than-significant level with the types of measures identified in Chapter 6. As is the case with the proposed WSIP facilities, some impacts (e.g., short-term noise and traffic) could be unavoidable.
Storage. Temporary construction impacts (disturbance of soils, surface water quality, biological resources, cultural resources, air quality, traffic, noise, land use, hazardous materials) and potential long-term impacts based on site-specific characteristics (e.g., slope stability, location within a scenic viewshed).	Most impacts associated with facility construction could be mitigated to a less-than-significant level with the types of measures identified in Chapter 6. As is the case with the proposed WSIP facilities, some impacts (e.g., short-term noise and traffic) could be unavoidable. Prepare and implement recommendations from a geotechnical study, implement measures to reduce visual contrast with surroundings (e.g., backfilling, earth-tone paint).

TABLE 13.10
SUMMARY OF SIGNIFICANT WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR PHASED WSIP VARIANT – TUOLUMNE RIVER WATERSHED

Impact	Impact Description	Proposed Program – 2030	Phased WSIP Variant – 2018[a]	Phased WSIP Variant – 2030 Scenario[b]
Section 5.3.6, Fisheries				
Impact 5.3.6-4: Effects on fishery resources along the Tuolumne River below La Grange Dam.				
	In wet or above-normal years when Don Pedro Reservoir is being filled, changes in the timing and duration of releases from the reservoir would decrease average monthly flows along the lower Tuolumne River beneath La Grange Dam. The greatest average flow reductions would occur during June and could result in elevated water temperatures. Changes in stream flow and water temperature would result in a reduction in the linear extent of suitable habitat for rearing Chinook salmon and oversummering steelhead/rainbow trout, potentially causing adverse affects on these fish populations in the lower Tuolumne River.	PSM	LS when average annual deliveries from the watersheds are maintained at 265 mgd or less; PSM if deliveries exceed 265 mgd	PSM
Section 5.3.7, Terrestrial Biological Resources				
Impact 5.3.7-2: Impacts on meadow/alluvial features along the Tuolumne River below O'Shaughnessy Dam.				
▪ Sensitive habitats	Delayed snowmelt releases, reductions in flow, and the resulting reduction in groundwater recharge would result in an incremental reduction in the extent and diversity of wetland and riparian habitats, including sensitive wetland and riparian habitats in the Poopenaut Valley.	PSM	PSM	PSM
▪ Key special-status species	A reduction in wetland and riparian habitat would reduce suitable breeding habitat for key special-status species potentially occurring along this reach (e.g., foothill yellow-legged frog, California red-legged frog, and willow flycatcher), the populations of which are already critically reduced in the Sierra Nevada.	PSM	PSM	PSM
▪ Other species of concern	A reduction in the extent and diversity of wetland and riparian habitats would reduce habitat quality and extent for animal and plant species of concern.	PSM	PSM	PSM
▪ Common habitats and species	All habitats affected by the WSIP are considered sensitive. The WSIP could affect a large number of common animal species that depend on sensitive meadows and larger riparian areas for food and cover.	PSM	PSM	PSM
Impact 5.3.7-6: Impacts on biological resources along the Tuolumne River below La Grange Dam.				
▪ Sensitive habitats	Delayed spring releases and reductions in average and total flow (particularly during and following an extended drought) below La Grange Dam would reduce or eliminate suitable conditions for the recruitment of some riparian species along the river.	PSM	LS when average annual deliveries from the watersheds are maintained at 265 mgd or less PSM if deliveries exceed 265 mgd	PSM

TABLE 13.10 (Continued)
SUMMARY OF SIGNIFICANT WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR PHASED WSIP VARIANT – TUOLUMNE RIVER WATERSHED

Impact	Impact Description	Proposed Program – 2030	Phased WSIP Variant – 2018[a]	Phased WSIP Variant – 2030 Scenario[b]
Section 5.3.7, Terrestrial Biological Resources (cont.)				
▪ Key special-status species	Because of the known presence of key special-status species and the very limited amount of remaining suitable habitat along this reach of the Tuolumne River, this incremental impact would be potentially significant.	PSM	LS when average annual deliveries from the watersheds are maintained at 265 mgd or less PSM if deliveries exceed 265 mgd	PSM
▪ Other species of concern	Species of concern that would be adversely affected by changes in the extent and quality of suitable riparian habitat include western pond turtle, several bat species, and a wide variety of riparian- and marsh-associated bird species.	PSM	PSM	PSM
▪ Common habitats and species	The populations of common species that depend on riparian habitat could be adversely affected by the alteration of habitat.	PSM	PSM	PSM

LS = Less than Significant, no mitigation required
SM or PSM = Significant or Potentially Significant, can be Mitigated to less than significant
SU or PSU = Significant Unavoidable or Potentially Significant Unavoidable, cannot be mitigated to less than significant

[a] Under the Phased WSIP Variant through 2018, the SFPUC would limit the average annual SFPUC watershed deliveries to 265 mgd (approximately current levels).
[b] While the SFPUC would not make a decision about regional system deliveries for 2030 until 2018, for purposes of impact analysis a potential "worst-case" 2030 scenario was evaluated for the Phased WSIP Variant that assumes SFPUC watershed deliveries would increase after 2018 up to the 280 mgd level proposed under the Modified WSIP Alternative.

TABLE 13.11
SUMMARY OF SIGNIFICANT WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR PHASED WSIP VARIANT – ALAMEDA CREEK WATERSHED

Impact	Impact Description	Proposed Program – 2030	Phased WSIP Variant – 2018[a]	Phased WSIP Variant – 2030 Scenario[b]
Section 5.4.1, Stream Flow and Reservoir Water Levels				
Impact 5.4.1-2: Effects on flow along Alameda Creek below the diversion dam.				
	In all year types, system operations under the WSIP would increase diversions from Alameda Creek to Calaveras Reservoir between the months of December and May, nearly eliminating low and moderate (1 to 650 cubic feet per second) flows in Alameda Creek downstream of the diversion dam and substantially reducing many higher (greater than 650 cubic feet per second) flows that have occurred since 2002. The resultant reduction in stream flows and alteration of the stream hydrograph is considered an adverse effect.	SU	SU	SU
Section 5.4.5, Fisheries				
Impact 5.4.5-3: Effects on fishery resources.				
	Following implementation of the Calaveras Dam Replacement project (SV-2), operation of Calaveras Reservoir and the Alameda Creek Diversion Dam would be restored to pre-2002 conditions. A substantial increase in diversions from Alameda Creek to Calaveras Reservoir would reduce flows in this stretch of the creek, despite proposed bypass flows at the diversion dam. Diversion of most or all flows during late winter and spring months would reduce the ability of resident rainbow trout to spawn and for eggs to incubate; additional monitoring would be needed to determine the effectiveness of proposed bypass flows. In addition, the increased diversion of flows to the reservoir would divert fish from Alameda Creek to the reservoir, prevent fish passage to downstream reaches of the creek, and increase the potential for fish entrainment since there are currently no screens on the diversion.	PSM	PSM	PSM
Section 5.4.6, Terrestrial Biological Resources				
Impact 5.4.6-1: Impacts on riparian habitat and related biological resources in Calaveras Reservoir.				
▪ Sensitive habitats	Increased reservoir storage elevations would result in inundation and permanent loss of seasonal wetlands, seeps, perennial freshwater marsh, and riparian habitat that have established since 2002.	PSM	PSM	PSM
▪ Key special-status species	Since 2002, foothill yellow-legged frogs have occupied approximately 10,000 linear feet of stream channel along Arroyo Hondo between the maximum reservoir elevation mandated by the Division of Safety of Dams and the spillway elevation. Higher maintained reservoir levels would reduce the length of this high-quality habitat along the creek and adversely affect existing populations of foothill yellow-legged frog.	PSM	PSM	PSM
Impact 5.4.6-2: Effects on riparian habitat and related biological resources along Alameda Creek from below the diversion dam to the confluence with Calaveras Creek.				
▪ Key special-status species	A reduction in the frequency, duration, and magnitude of flows below the diversion dam would reduce the total available aquatic breeding habitat and food sources for California red-legged frog and foothill yellow-legged frog populations that currently occupy this reach of Alameda Creek.	PSM	PSM	PSM

TABLE 13.11 (Continued)
SUMMARY OF SIGNIFICANT WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR PHASED WSIP VARIANT – ALAMEDA CREEK WATERSHED

Impact	Impact Description	Proposed Program – 2030	Phased WSIP Variant – 2018[a]	Phased WSIP Variant – 2030 Scenario[b]
Section 5.4.6, Terrestrial Biological Resources (cont.)				
Impact 5.4.6-3: Effects on riparian habitat and related biological resources along Calaveras Creek from Calaveras Reservoir to the confluence with Alameda Creek.				
▪ Key special-status species	Future outlet works at Calaveras Dam would have the capacity to make higher-volume releases than under existing conditions. Depending on the timing and volume of operational releases, they could adversely affect the reproductive success of special-status amphibian species along this reach (e.g., California red-legged frog and foothill yellow-legged frog).	PSM	PSM	PSM
Impact 5.4.6-4: Effects on riparian habitat and related biological resources along Alameda Creek from Calaveras Creek to San Antonio Creek.				
▪ Key special-status species	Depending on annual rainfall and localized site conditions along this creek segment, changes in winter and summer flows along this reach could result in both beneficial and adverse impacts on habitat for California red-legged frog and foothill yellow-legged frog populations.	PSM	PSM	PSM
Section 5.4.7, Recreational and Visual Resources				
Impact 5.4.7-1: Effects on recreation.				
	Operations under the WSIP would substantially reduce flows along Alameda Creek in the Sunol Regional Wilderness during winter and early spring months and adversely affect the recreational experience for hikers. *(Note: The Draft PEIR determined this impact to be PSM, but due to the change in the project description of the Calaveras Dam Replacement project (SV-2), this impact determination is revised to LS.)*	LS	LS	LS
Impact 5.4.7-2: Visual effects.				
	WSIP-induced reductions in stream flows along Alameda Creek would substantially change the quality of visual resources in the Sunol Regional Wilderness. *(Note: The Draft PEIR determined this impact to be PSM, but due to the change in the project description of the Calaveras Dam Replacement project (SV-2), this impact determination is revised to LS.)*	LS	LS	LS

LS = Less than Significant, no mitigation required
SM or PSM = Significant or Potentially Significant, can be Mitigated to less than significant
SU or PSU = Significant Unavoidable or Potentially Significant Unavoidable, cannot be mitigated to less than significant

[a] Under the Phased WSIP Variant through 2018, the SFPUC would limit the average annual SFPUC watershed deliveries to 265 mgd (approximately current levels).
[b] While the SFPUC would not make a decision about regional system deliveries for 2030 until 2018, for purposes of impact analysis a potential "worst-case" 2030 scenario was evaluated for the Phased WSIP Variant that assumes SFPUC watershed deliveries would increase after 2018 up to the 280 mgd level proposed under the Modified WSIP Alternative.

TABLE 13.12
SUMMARY OF SIGNIFICANT WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR PHASED WSIP VARIANT – PENINSULA WATERSHED

Impact	Impact Description	Proposed Program – 2030	Phased WSIP Variant – 2018[a]	Phased WSIP Variant – 2030 Scenario[b]
Section 5.5.3, Surface Water Quality				
Impact 5.5.3-2: Water quality in Pilarcitos Reservoir and along Pilarcitos Creek.				
	Proposed operations would generally be within the same range as existing conditions, although replacement Measure 5.5.3-2a would cause Pilarcitos Reservoir to be drawn down earlier in the summer compared to existing conditions. Water temperature could increase and dissolved oxygen content could be reduced. *(Note: The Draft PEIR determined this impact to be PSM, and with the refined impact analysis for the Pilarcitos Creek watershed, this impact determination remains PSM due to impacts resulting from implementation of a replacement mitigation measure.)*	PSM	LS	PSM
	During dry years, summertime releases from Pilarcitos Reservoir to Pilarcitos Creek would be reduced to reservoir inflow at an earlier date than they are under the existing condition. This would increase the temperature of instream flows between Pilarcitos Creek and Stone Dam and reduce the creek's ability to support designated cold freshwater habitat along this reach.	PSM	LS	PSM
	During wet and above-normal years, the volume of spills over Stone Dam would be reduced compared to the existing condition.	LS	LS	LS
Section 5.5.5, Fisheries				
Impact 5.5.5-1: Effects on fishery resources in Crystal Springs Reservoir.				
	Elevated water levels in Crystal Springs Reservoir would inundate approximately 1,500 linear feet of trout spawning habitat upstream of the reservoir along Laguna and San Mateo Creeks.	PSU	PSU	PSU
Impact 5.5.5-4: Effects on fisheries resources in Pilarcitos Reservoir.				
	Proposed operations would be within the same range as existing conditions, although replacement Measure 5.5.3-2a would cause Pilarcitos Reservoir to be drawn down earlier in the summer compared to existing conditions. This would reduce the volume and quality of coldwater habitat available for resident fish species. *(Note: The Draft PEIR determined this impact to be PSM, and with the refined impact analysis for the Pilarcitos Creek watershed, this impact determination remains PSM due to impacts resulting from implementation of a replacement mitigation measure.)*	PSM	LS	PSM
Impact 5.5.5-5: Effects on fisheries resources along Pilarcitos Creek below Pilarcitos Reservoir.				
	Under the WSIP, the extended period of no or very little flow in Pilarcitos Creek below Pilarcitos Reservoir during summer months of dry years would result in significant impacts on resident trout, other resident fish species and aquatic resources, and habitat quality and availability for anadromous steelhead. Increased drawdown of Pilarcitos Reservoir would increase the temperature of releases in summer and fall and reduce the quality and availability of habitat for coldwater fish species.	PSM	LS	PSM

TABLE 13.12 (Continued)
SUMMARY OF SIGNIFICANT WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR PHASED WSIP VARIANT – PENINSULA WATERSHED

Impact	Impact Description	Proposed Program – 2030	Phased WSIP Variant – 2018[a]	Phased WSIP Variant – 2030 Scenario[b]
	A reduction in the frequency and magnitude of spills over Stone Dam would reduce flows along the lower reach. Reduced instream flows during winter months would adversely affect migratory fish habitat.	PSM	LS	PSM
Section 5.5.6, Terrestrial Biological Resources				
Impact 5.5.6-1: Impacts on biological resources in Upper and Lower Crystal Springs Reservoirs.				
▪ Sensitive habitats	Implementation of the Lower Crystal Springs Dam Improvements project (PN-4) would raise average monthly water levels in Crystal Springs Reservoir and result in a short-term reduction in the overall extent of freshwater marsh as the reservoir fills. Proposed changes in operations would maintain maximum reservoir levels during summer for longer periods than under existing conditions, which could affect the composition and structure of riparian habitats. In addition, sensitive upland habitats that are unable to tolerate these longer periods of inundation would be lost.	PSM	PSM	PSM
▪ Key special-status species	Elevated reservoir levels would inundate existing populations of special-status plant species, including serpentine-associated fountain thistle and Marin western flax, and their habitat could be permanently lost. The extent of available habitat for San Francisco garter snake and California red-legged frog would be temporarily reduced during reservoir refill, but wetland habitat that would establish at higher elevations could be more extensive. Raised reservoir levels would provide greater opportunities for largemouth bass and other predators to access frogs and snakes. Periodic drawdown during planned maintenance could adversely affect San Francisco garter snake foraging habitat.	PSM	PSM	PSM
▪ Other species of concern	Changes in wetland habitat due to reservoir refill and proposed operations would adversely affect reptile and bird species of concern, particularly if permanent changes in the composition of wetland vegetation occur. Permanent loss of upland habitat, including upland trees, grassland, and coastal scrub, would result in significant impacts on several bird and mammal species of concern. Serpentine- and grassland-associated plant species unable to tolerate extended periods of inundation would be lost.	PSM	PSM	PSM
▪ Common habitats and species	Due to the extent of area involved, impacts on common habitats and species would be significant.	PSM	PSM	PSM
Impact 5.5.6-4: Impacts on biological resources in Pilarcitos Reservoir.				
▪ Key special-status species	Proposed operations would be within the same range as existing conditions, although replacement Measure 5.5.3-2a would cause Pilarcitos Reservoir to be drawn down earlier in the summer compared to existing conditions. This would affect the extent of suitable habitat for California red-legged frog and San Francisco garter snake due to earlier reservoir drawdown in some years. Special-status species that utilize adjacent upland vegetation would not be affected. *(Note: The Draft PEIR determined this impact to be PSM, and with the refined impact analysis for the Pilarcitos Creek watershed, this impact remains PSM due to impacts resulting from implementation of a replacement mitigation measure.)*	PSM	LS	PSM

TABLE 13.12 (Continued)
SUMMARY OF SIGNIFICANT WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR PHASED WSIP VARIANT – PENINSULA WATERSHED

Impact	Impact Description	Proposed Program – 2030	Phased WSIP Variant – 2018[a]	Phased WSIP Variant – 2030 Scenario[b]
Impact 5.5.6-5: Impacts on biological resources along Pilarcitos Creek.				
▪ Sensitive habitats	In summer months of dry years, an extended period of no or little flow in Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam could stress riparian vegetation, but existing vegetation appears to be adapted to periods of dryness. *(Note: The Draft PEIR determined this impact to be PSM, but due to the refined impact analysis for the Pilarcitos Creek watershed, this impact determination is revised to LS.)*	LS	LS	LS

LS = Less than Significant, no mitigation required
SM or PSM = Significant or Potentially Significant, can be Mitigated to less than significant
SU or PSU = Significant Unavoidable or Potentially Significant Unavoidable, cannot be mitigated to less than significant

[a] Under the Phased WSIP Variant through 2018, the SFPUC would limit the average annual SFPUC watershed deliveries to 265 mgd (approximately current levels).
[b] While the SFPUC would not make a decision about regional system deliveries for 2030 until 2018, for purposes of impact analysis a potential "worst-case" 2030 scenario was evaluated for the Phased WSIP Variant that assumes SFPUC watershed deliveries would increase after 2018 up to the 280 mgd level proposed under the Modified WSIP Alternative.

The WSIP would result in a reduction in the average annual volume of water released from O'Shaughnessy Dam and a change in the pattern of monthly and daily releases to the Tuolumne River below the dam (Draft PEIR, Vol. 3, Chapter 5, Section 5.3.1). The reduced release volume and altered flow regime would affect fisheries and terrestrial biological resources in the river below O'Shaughnessy Dam. Various quantitative factors or metrics were considered in determining the significance of the WSIP's impacts on fisheries and terrestrial biological resources. Several of the metrics relate to conditions in May, the month in which the effects of the WSIP would be the greatest in the reach of the river below O'Shaughnessy Dam. The following factors were evaluated over the 82-year hydrologic record:

- WSIP-caused reduction in average annual releases from O'Shaughnessy Dam
- Average WSIP-caused delay in May releases (in days)
- Maximum WSIP-caused delay in May releases (in days)
- Frequency of more than two-day delay in May releases caused by the WSIP
- Percentage reduction in May releases in all hydrologic years due to the WSIP
- Percentage reduction in May releases in dry years due to the WSIP
- Increase in the number of months when only minimum required releases are made as a result of the WSIP

These factors were considered together to arrive at significance conclusions with respect to the WSIP's impacts on fisheries and terrestrial biological resources in the Tuolumne River below O'Shaughnessy Dam, as shown in Table 13.10.

The WSIP would also result in a reduction in the average annual volume of water released from La Grange Dam and a change in the pattern of monthly and daily releases to the Tuolumne River below the dam. The reduced release volume and altered flow regime would affect fisheries and terrestrial biological resources in the river below La Grange Dam (see Vol. 3, Chapter 5, Section 5.3.1). A similar procedure (as was described above for the reach of the river below O'Shaughnessy Dam) was used to determine the significance of WSIP impacts on fisheries and terrestrial biological resources in the reach of the river below La Grange Dam. However, several of the metrics used in the analysis relate to conditions in June, because June is the month in which the effects of the WSIP would be greatest in this reach of the river.

Under the Phased WSIP Variant, while average annual deliveries from the SFPUC watersheds would be limited to 265 mgd such that there would be no increase in diversion from the Tuolumne River to serve additional demand, there would be a small increase in average annual Tuolumne River diversions of 2 mgd in order to implement the WSIP delivery and drought reliability elements for system customers through 2018. As a result of this small increase in average annual Tuolumne River diversion, like the WSIP, the Phased WSIP Variant with the 265 mgd delivery limitation from the SFPUC watersheds would result in a reduction in the average annual volume of water released from O'Shaughnessy Dam to the Tuolumne River, potentially affecting monthly and daily release patterns, (Vol. 3, Chapter 5, Section 5.3.1). Under the WSIP, the reduced volume and changed release pattern would have a potentially significant impact on

the terrestrial biological resources of streamside meadows and other alluvial features in the reach of the river between Hetch Hetchy and Don Pedro Reservoirs, particularly in the sensitive Poopenaut Valley (Vol. 3, Chapter 5, Section 5.3.6). Although flow changes would be much less with the Phased WSIP Variant through 2018 than with the WSIP, the impacts of the Phased WSIP Variant on terrestrial biological resources was still determined to be *potentially significant* because of the sensitivity of biological resources in the Poopenaut Valley. Accordingly, under the Phased WSIP Variant with the 265 mgd delivery limitation from the SFPUC watersheds, the SFPUC would still need to implement Mitigation Measure 5.3.7-2, Controlled Releases to Recharge Groundwater in Streamside Meadows and Other Alluvial Deposits (Vol. 4, Chapter 6, pp. 6-49 and 6-50) to reduce potentially significant impacts on biological resources.

As described in the previous paragraph, under the Phased WSIP Variant there would be a small increase in average annual diversions from the Tuolumne River of 2 mgd in order to implement the delivery and drought reliability elements of the WSIP through 2018. As a result, like the WSIP, the Phased WSIP Variant would result in a reduction in the average annual volume of water released from La Grange Dam to the Tuolumne River and a change in monthly and daily release patterns, although again, it would be a much smaller reduction. Under the WSIP, the reduced volume and changed release pattern would have a potentially significant adverse impact on fisheries and terrestrial biological resources in the Tuolumne River below La Grange Dam. Flow changes with the Phased WSIP Variant with the 265 mgd delivery limitation from the SFPUC watersheds would be much less than those under the WSIP, and the impacts of the Phased WSIP Variant on fisheries and terrestrial biological resources were determined to be less than significant. However, as previously discussed in the description of the Phased WSIP Variant, while the SFPUC proposes to limit average annual deliveries from its watersheds to 265 mgd (approximately the current level), it recognizes that it might be necessary to allow a short-term increase in watershed deliveries beyond 265 mgd (up to 275 mgd) while the SFPUC and/or BAWSCA and the wholesale customers implement the local conservation, recycled water, and groundwater projects needed to meet increasing demands through 2018. For the purpose of impact analysis, it was assumed conservatively that watershed deliveries could increase above 265 mgd for a few years until all of the local projects needed to generate the required 20 mgd of local supply and conservation have been fully implemented. In addition, a conservative, worst-case assumption of a short-term increase in watershed deliveries to 275 mgd was used. If the 265 mgd limit on watershed deliveries were exceeded, then there could be potentially significant impacts on the lower Tuolumne River during that time, until average annual diversions were reduced to 265 mgd (representing existing conditions). Although the impacts on the lower Tuolumne River would be of lesser magnitude than those of the WSIP (which assumed a watershed delivery level of 290 mgd) and would be temporary (on the order of a few years), the potential effects of the Phased WSIP Variant on fisheries and terrestrial biological resources in this reach of the river are conservatively considered to be *potentially significant*. The SFPUC would monitor annual water deliveries from its watersheds, and, if average annual deliveries from the SFPUC watersheds exceeded the 265 mgd limit, the SFPUC would implement Mitigation Measure 5.3.6-4a, Avoidance of Flow Changes by Reducing Demand for Don Pedro Reservoir Water, or 5.3.6-4b, Fishery Habitat Enhancement and Measure 5.3.7-6, Lower Tuolumne River Riparian Habitat Enhancement. The SFPUC would continue to implement the necessary

there is less certainty that this variant could meet the SFPUC's water supply objective compared to the WSIP. It appears feasible to develop additional local conservation, recycled water, and groundwater to provide another 10 mgd, but there is substantial additional work to be completed in order to develop, review, approve, and implement these local actions and projects by 2018. Thus, due to this uncertainty, the table indicates that Phased WSIP Variant would only *partially* achieve those objectives associated with fully meeting customer purchase requests. The Phased WSIP Variant would meet the drought reliability objective at the reduced water supply delivery level.

The Phased WSIP Variant would fully meet the WSIP level of service goal for water quality (although the SFPUC would not be responsible for the quality of any supplemental water supply pursued by the wholesale customers under this scenario). Seismic reliability would be improved over existing conditions; however, because this variant would limit water supply to the SFPUC customers through 2018, this option would not meet the WSIP objective of providing 300 mgd average-day demand through 2030.

Delivery reliability of the regional system would be similar to that under the WSIP; however, this variant would only partially meet those objectives because it would not meet the average annual projected demand of 300 mgd in 2030 under maintenance or outage conditions but instead would meet a reduced target delivery set for 2018. Similar to the WSIP, comprehensive and regular repair and maintenance of the regional system would occur under this variant without service interruptions, and the risk of service interruptions due to unplanned facility upsets or outages would be minimal. Facilities would be in place to replenish local reservoirs as needed to prepare for drought, and the system would remain predominantly gravity-driven.

The Phased WSIP Variant would achieve the WSIP's water supply level of service goal during nondrought periods through the year 2018, but would not achieve the 2030 WSIP program goal. This variant would meet the WSIP objective of limiting drought-year rationing to a maximum of 20 percent systemwide, but it would achieve this objective at the reduced delivery level only.

Environmental Impacts of the Phased WSIP Variant Compared to those of the WSIP

The environmental effects of the Phased WSIP Variant would be similar to those described for the No Purchase Request Increase Alternative if the SFPUC decides to continue limiting average annual water deliveries from the SFPUC watersheds to 265 mgd beyond the year 2018. If the SFPUC decides in 2018 to increase water deliveries from the SFPUC watersheds to the wholesale customers, then the environmental impacts would be the same or similar to those evaluated for the WSIP or the Modified WSIP Alternative.

measure(s) until the average annual SFPUC watershed deliveries are 265 mgd or less. Similar to the WSIP, implementation of Measure 5.3.6-4a is the preferred mitigation approach, and for the Phased WSIP Variant, the amount of conserved water required to reduce the impact to less than significant would be proportional to the amount of increased diversions from the Tuolumne River contributing to exceeding the 265 mgd restriction.

Alameda Creek Watershed

The significant impacts of the WSIP and the Phased WSIP Variant in the Alameda Creek watershed are shown in Table 13.11. The impacts of the Phased WSIP Variant, both with and without the 265 mgd limitation on SFPUC watershed deliveries, and the impacts of the WSIP would be the same or very similar. The reason the impacts in the Alameda Creek watershed would be the same or similar is that they would result primarily from facility improvements and restoration of the historical reservoir capacity at Calaveras Reservoir rather than from demand increases. Facility improvements would be the same for the WSIP and the Phased WSIP Variant.

Peninsula Watershed

The significant impacts of the WSIP and the Phased WSIP Variant in the Peninsula watershed are shown in Table 13.12. The impacts of the Phased WSIP Variant, both with and without the 265 mgd limitation on SFPUC watershed deliveries, and the impacts of the WSIP in the San Mateo Creek watershed would be the same or very similar. The reason the impacts in this watershed would be the same or similar is that they would result primarily from implementation of the facility improvement projects and restoration of Crystal Springs Reservoir capacity rather than from demand increases. Facility improvements would be the same for the WSIP and the Phased WSIP Variant.

With both the WSIP and the Phased WSIP Variant under the “worst-case” 2030 scenario (without the 265 mgd delivery limitation from the SFPUC watersheds), Pilarcitos Reservoir would be drawn down at an earlier date in some summers than it is under the existing condition (Vol. 3, Chapter 5, Section 5.5.1). As a result, releases to Pilarcitos Creek from the reservoir would be reduced to reservoir inflow earlier in the year than under the existing condition. The flow reduction in the creek between Pilarcitos Reservoir and Stone Dam would have a significant adverse impact on water quality and fisheries. In addition, under the WSIP and the 2030 Phased WSIP Variant scenario, the volume of wintertime spills over Stone Dam would be reduced compared to the existing condition. The reduction in the volume of spills would have an adverse impact on fisheries in Pilarcitos Creek below Stone Dam. These same phenomena would occur with the Phased WSIP Variant through 2018 with the 265 mgd delivery limitation, but their magnitude would be much less than with the WSIP. Consequently, the impacts of the Phased WSIP Variant through 2018 on water quality and fisheries in Pilarcitos Creek were determined to be less than significant. Under the Phased WSIP Variant through 2018, no mitigation measures would be needed in the Pilarcitos Creek watershed.

Secondary Effects of Growth

The Phased WSIP Variant would have the same growth-inducement potential through 2018 as the WSIP because the SFPUC (possibly with the cooperation of BAWSCA and the wholesale customers) would provide the additional water supply to meet 2018 purchase requests. However, depending on the decision on water supply in 2018, this variant could result in less growth inducement if the SFPUC decides to maintain the 265 mgd restriction on deliveries from the SFPUC watersheds, or on the high end, it could result in the same growth-inducement potential as the WSIP if it decides to fully meet a 2030 purchase request of 300 mgd. Similar to the WSIP, any growth-inducement increment attributable to this variant would be considered significant and unavoidable.

References – Introduction to Responses and WSIP Revisions

Bay Area Water Supply and Conservation Agency (BAWSCA), Meeting Minutes from Board of Directors Meeting, Held at Foster City Community Building, Foster City, CA, March 20, 2008a.

Bay Area Water Supply and Conservation Agency (BAWSCA), Request for Proposals for a Water Conservation/Recycling Implementation Plan, July 18, 2008b.

California Department of Water Resources (DWR), *Preparing for California's Next Drought, Changes Since 1987–92*, July 2000.

Johnson, Karen E. and Loux, Jeff, *Water and Land Use: Planning Wisely for California' Future*, 2004.

San Francisco Public Utilities Commission (SFPUC), Memorandum from Ed Harrington, General Manager, SFPUC and Michael P. Carlin, Assistant General Manager – Water, SFPUC to Diana Sokolove, Major Environmental Assessment, San Francisco Planning Department regarding Calaveras Dam Replacement Project and Alameda Creek Fishery Enhancement Project Description, July 16, 2008a.

San Francisco Public Utilities Commission (SFPUC), Letter from Susan Leal, SFPUC General Manager, to Diana Sokolove, Senior Planner at San Francisco Planning Department, RE: SFPUC Programmatic Environmental Impact Report (PEIR) for Water System Improvement Program (WSIP), dated March 21, 2008b.

San Francisco Public Utilities Commission (SFPUC), Letter from Ed Harrington, SFPUC General Manager, to Diana Sokolove, Senior Planner at San Francisco Planning Department, RE: Analysis of Variant to Water System Improvement Program (WSIP) Programmatic Environmental Impact Report (PEIR), dated May 2, 2008c.

San Francisco Public Utilities Commission (SFPUC), Memorandum from Michael P. Carlin, Assistant General Manager – Water, SFPUC to Diana Sokolove, Major Environmental Assessment, SF Planning Department regarding Water System Improvement Program Facilities Capacity, July 29, 2008d.

14.3 Master Response on Proposed Dry-Year Water Transfer

14.3.1 Introduction

Overview

This master response addresses questions about the proposed dry-year water transfer included as part of the WSIP's water supply option. Commenters raised questions regarding the feasibility of the proposed transfer; whether the Turlock Irrigation District (TID) and/or the Modesto Irrigation District (MID) have agreed to such a transfer; and the validity of evaluating the proposed transfer when no official agreement among the agencies has been made. This master response is organized by the following subtopics:

14.3.2 Description of Dry-Year Water Transfer Assumptions Analyzed in the PEIR
14.3.3 CEQA Review of the Proposed Dry-Year Transfer

Commenters also raised questions about proposed Mitigation Measure 5.3.6-4a, Avoidance of Flow Changes by Reducing Demand for Don Pedro Reservoir Water, which would lessen the environmental impacts of the dry-weather transfer on the lower Tuolumne River, downstream of La Grange Dam. Comments on Mitigation Measure 5.3.6-4a are addressed in **Section 14.7, Master Response on Lower Tuolumne River Issues**, and comments on the water transfer of conserved water included as part of the Modified WSIP Alternative are addressed in **Section 14.10, Master Response on Modified WSIP Alternative** (Vol. 7, Chapter 14).

Commenters

Commenters that addressed this topic include:

Federal Agencies

- None

State Agencies

- None

Local and Regional Agencies

- Bay Area Water Supply and Conservation Agency – L_BAWSCA1
- City of Palo Alto – L_PaloAlto
- Modesto Irrigation District – L_MID
- Modesto Irrigation District and Turlock Irrigation District – L_MIDTID1
- Tuolumne Utilities District – L_TUD1 and L_TUD3

Groups

- Citizens Advisory Committee to SFPUC – SI_CAC2
- California Native Plant Society, East Bay Chapter _ SI_CNPS-EB2
- Restore Hetch Hetchy – SI_RHH1
- Tuolumne River Trust/Clean Water Action/Sierra Club, San Francisco Bay Chapter – SI_TRT-CWA-SierraC
- Tuolumne River Trust –SI_TRT8, SI_TRT10

Citizens

- Clark, Anne & Katherine Howard – C_Clark1
- Day, Joseph – C_DayJ

PEIR Section Reference

The Draft PEIR describes the dry-year water transfer in Vol. 1, Chapter 3, Section 3.6.2, pp. 3-36 to 3-39. Because the dry-year transfer is an integral part of the proposed WSIP water supply and system operations, it was included in the modeling for the future with-WSIP condition. The impacts of the WSIP water supply and system operations on water resources in the Tuolumne River watershed are described in Vol. 3, Chapter 5, Section 5.3.1, pp. 5.3.1-1 to 5.3.1-39, and the impact analysis includes the effects of the dry-year water transfer. Modeling data for the future with-WSIP condition used in the Draft PEIR are presented in Vol. 5, Appendices H1 and H2, and results of the updated modeling conducted after publication of the Draft PEIR and used in the refined analyses provided in the Comments and Responses document are presented in Vol. 8, Appendix O. All model results include the effects of the dry-year transfer as part of the proposed program.

14.3.2 Description of Dry-Year Water Transfer Assumptions Analyzed in the PEIR

Comment Summary

This section of this master response responds to all or part of the following comments:

L_BAWSCA1-44	L_MIDTID1-23	SI_RHH1-07
L_BAWSCA1-46	L_TUD1-09	SI_TRT8-07
L_BAWSCA1-47	L_TUD3-03	SI_TRT10-02
L_PaloAlto-07	SI_CAC2-01	SI_TRT-CWA-SierraC-68
L_MIDTID1-05	SI_CAC2-04	SI_TRT-CWA-SierraC-178
L_MIDTID1-06	SI_CAC2-08	C_Clark1-05
L_MIDTID1-15	SI_CNPS-EB2-05	C_DayJ-01

Summary of Issues Raised by Commenters

- There is no formal agreement on a dry-year transfer with TID and/or MID.

- The dry-year transfer may not be feasible because no agreement for such a transfer has been executed.
- The details of the proposed dry-year transfer should be fully described.

Response

The City and County of San Francisco (CCSF), TID, and MID hold rights to Tuolumne River water. TID and MID are senior to the CCSF for some of their direct and storage water rights. The Raker Act granted rights-of-way to the CCSF to construct the Hetch Hetchy Project on federal lands provided certain conditions were met, including recognition of TID's and MID's senior water rights (Vol. 1, Chapter 2, pp. 2-33 and 2-34). To meet these conditions, the CCSF is required at certain times to release certain flows from its reservoirs in the upper Tuolumne River watershed for use by TID and MID.

The CCSF's reservoirs in the upper Tuolumne River watersheds are not sized to capture the CCSF's full entitlement of Tuolumne River water. When the Don Pedro Project was built in the early 1970s, the CCSF contributed to the project's cost to receive the right to "prepay" TID and MID for water the CCSF would otherwise have to release from its upstream reservoirs to meet its Raker Act obligations. The water bank acts as "virtual storage" that allows the CCSF to use a greater portion of the Tuolumne River water to which it is entitled. All water stored in Don Pedro Reservoir belongs to TID and MID, and the CCSF cannot divert water directly from the reservoir. The Don Pedro Reservoir water bank is described further in the Draft PEIR (Vol. 1, Chapter 2, pp. 2-37 to 2-39).

When inflow to Don Pedro Reservoir exceeds the TID's and MID's Raker Act entitlements and there is space available in the water bank, the excess water is credited to the CCSF's water bank account. When the CCSF would otherwise have to release water from its reservoirs in the upper Tuolumne River watershed to fulfill its Raker Act obligations to TID and MID, the CCSF's water bank account in Don Pedro Reservoir is debited so that TID and MID receive their full entitlement of Tuolumne River water. This water banking arrangement enables the CCSF to divert and store more water in Hetch Hetchy Reservoir than it otherwise would, preserving the water for use in the Bay Area.

As described in the Draft PEIR (Vol. 1, Chapter 3, pp. 3-33 to 3-39), the SFPUC's existing water supply sources are insufficient to satisfy the WSIP water supply goal of no greater than 20 percent systemwide rationing during droughts under current (2005) demand (purchase requests). This shortage will become more severe by 2030 with the projected increase in purchase requests. Under the WSIP, the SFPUC would establish supplemental dry-year water sources, one of which would be a transfer of water from TID and MID. Although the SFPUC would only need the dry-year transfer fairly infrequently, the transfer would need to occur administratively every year because at the beginning of a year it would not be possible to know when hydrologic circumstances would make a transfer necessary. The proposed dry-year water transfer under the WSIP would occur as follows. Each year TID and MID would transfer ownership of a block of water in Don Pedro Reservoir to the SFPUC. In many years, the SFPUC would be able to meet its customers' needs without using the transferred water, and ownership of the water would likely

revert to TID and MID. Occasionally, the SFPUC would need the transferred water, which it would secure by decreasing releases from its reservoirs in the upper Tuolumne River watershed and using the block of water in Don Pedro Reservoir to meet its Raker Act obligations to TID and MID. This would enable the SFPUC to increase its diversions from Hetch Hetchy Reservoir during droughts, and, in combination with the Westside Basin conjunctive-use program, to meet customer purchase requests while limiting rationing to 20 percent systemwide, thereby achieving the WSIP level of service objective for deliveries during droughts.

The Hetch Hetchy/Local Simulation Model was used to estimate the size of the transfer needed to limit rationing to 20 percent systemwide during droughts. In the Draft PEIR, the size of the necessary transfer was estimated to be 25,765 acre-feet per year (23 million gallons per day) averaged over the 8.5-year design drought (Vol. 1, Chapter 3, p. 3-36). As described in Section 13.3 (Vol. 7, Chapter 13), the input assumptions for the model were improved and updated after publication of the Draft PEIR. Using the improved and updated input assumptions, the size of the necessary transfer was estimated to be 29,350 acre-feet per year (26 million gallons per day) averaged over the 8.5-year design drought. Due to the combination of updated input assumptions to the model, the overall level of diversions from the Tuolumne River remained unchanged, even with the revised size of the dry-year transfer. As discussed in Section 13.3, review of the updated model results confirmed that the change in the size of the transfer would not have any direct effect in terms of the environmental consequences of the WSIP. The original modeling for the Draft PEIR and the updated modeling produced similar results, and the PEIR conclusions with respect to the significance of the WSIP's environmental impacts remain valid.

Although the dry-year transfer described above is proposed as part of the WSIP, no agreement to make such a transfer has been executed among the CCSF, TID, and MID. In fact, as explained below in Section 14.3.3, it would be improper to enter into such an agreement in the absence of completed CEQA review.

The CCSF has cooperatively worked with TID and MID for many years in analyzing water supply availability from the Tuolumne River watershed, and the SFPUC's studies indicate that there could be water available for a dry-year transfer without a loss of water to these agencies. The CCSF understands that neither TID nor MID have confirmed the availability of water for this transfer or made any commitments to the CCSF for such a transfer. If the San Francisco Planning Commission certifies the Final PEIR and the SFPUC adopts the WSIP, CCSF staff will pursue a formal agreement with TID and MID for the proposed dry-year transfer. Nonetheless, agreements or approvals from TID or MID regarding the proposed water transfer are not required, nor could final agreements be executed, prior to certification of the PEIR and adoption of the WSIP (or any alternative or variation of it). The absence of such agreements does not affect the validity of the environmental analysis presented in the Draft PEIR. Reasonable assumptions were made in the Draft PEIR with respect to the SFPUC's ability to secure a dry-year water transfer from TID and MID, and they provided sufficient information to perform the environmental analysis.

14.3.3 CEQA Review of the Proposed Dry-Year Transfer

Comment Summary

This section of this master response responds to all or part of the following comments:

L_MID-02	L_MIDTID1-28	C_Clark1-05
L_MIDTID1-05	L_TUD1-09	
L_MIDTID1-23	SI_TRT-CWA-SierraC-58	

Summary of Issues Raised by Commenters

- The dry-year transfer is insufficiently defined for CEQA purposes.
- The PEIR develops and supports alternatives and mitigation measures that are based on the assumed success of these transfer agreements.
- The proposed dry-year transfer would result in an additional drawdown of water from the Tuolumne River.

Response

As described in the Draft PEIR (Vol. 1, Chapter 3, p. 3-36), the dry-year transfer as proposed would be made from TID and MID to the SFPUC. In the Draft PEIR analysis, it was assumed that water owned by TID and MID and stored in Don Pedro Reservoir would be the source of the dry-year transfer. This assumption resulted in the greatest reduction in storage in Don Pedro Reservoir and the greatest impacts on the Tuolumne River, thereby depicting a worst-case scenario for CEQA purposes. As such, the impact analysis of the dry-year transfer presented in the Draft PEIR is conservative and adequate for CEQA review of the WSIP.

It is possible that TID and MID would provide some or all of the water for the dry-year transfer by conserving water or otherwise changing water management practices within their service areas. If this were the case, the environmental impacts on the Tuolumne River would be less than those described in the Draft PEIR. (The conserved water transfer is included in Mitigation Measure 5.3.6-4a and the Modified WSIP Alternative; for more information, refer to **Section 14.7, Master Response on Lower Tuolumne River Issues**, and **Section 14.10, Master Response on Modified WSIP Alternative**, respectively.)

The CCSF acknowledges that no agreement is in place for a dry-year transfer of water from TID and MID. For further information, please refer to Section 14.3.2, above.

It is appropriate to analyze the environmental effects of the proposed dry-year transfer before a formal agreement is made because neither TID and MID nor the CCSF can enter into or approve such an agreement before CEQA review is completed. Because the details of the dry-year water transfer were not known, the Draft PEIR evaluated a worst-case scenario of water supply and system operations impacts on the lower Tuolumne River, as noted above.

If an agreement for a dry-year water transfer was to be made among TID and MID and the SFPUC, as described in the Draft PEIR, additional project-level CEQA review would not be required. The transferring agencies, TID and MID, would serve as responsible agencies for CEQA compliance and could use the PEIR to make their own findings as required by CEQA Guidelines Section 15096. If the characteristics of the dry-year transfer were not as described and analyzed in the Draft PEIR, then additional CEQA review would likely be required. TID and/or MID would be the lead agency for the subsequent, project-specific CEQA review. However, the environmental impacts on the Tuolumne River and associated resources of any dry-year transfer considered as an alternative to the transfer described in the Draft PEIR would likely be less than those of the transfer included in the WSIP and analyzed in the Draft PEIR.

14.5 Master Response on Water Resources Modeling

14.5.1 Introduction

Overview

This master response addresses questions about the water resources model used for the impact analysis of proposed WSIP water supply and system operations. Commenters raised questions about the model itself, the appropriateness of its use for the Draft PEIR, the assumptions used in the modeling analysis, and the model output. This master response is organized by the following subtopics:

14.5.2 Model Availability
14.5.3 Model Time Interval
14.5.4 Use of Year Type Averages
14.5.5 Model Validation
14.5.6 Modeling Assumptions
14.5.7 Model Limitations for Pilarcitos Creek Watershed
14.5.8 Units of Measure
14.5.9 Model Results for Tuolumne River Diversions

Commenters

Commenters that addressed this topic include:

Federal Agencies

- None

State Agencies

- None

Local and Regional Agencies

- Modesto Irrigation District and Turlock Irrigation District – L_MIDTID
- Alameda County Water District – L_ACWD

Groups

- Republicans for Environmental Protection, Protection Commissioner – SI_CAREP
- California Native Plant Society – SI_CNPS
- California Native Plant Society, Santa Clara Valley Chapter – SI_CNPS-SCV1
- California Native Plant Society, Willis L. Jepson Chapter – SI_CNPS-WLJ
- Center for Resource Solutions – SI_CRS
- Environmental Defense – SI_EnvDef
- Northern California/Nevada Council of the Federation of Fly Fishers Steelhead Committee – SI_NCFFSC

- Pacific Institute – SI_PacInst
- Coalition for San Francisco Neighborhoods – SI_SFNeigh
- Sierra Club – SI_SierraC6, SI_SierraC7
- Tuolumne River Trust – SI_TRT3, SI_TRT6, SI_TRT7, SI_TRT8, SI_TRT9, SI_TRT10
- Tuolumne River Trust/Clean Water Action/Sierra Club, San Francisco Bay Chapter – SI_TRT-CWA-SierraC

Citizens

- Allison, Rita – C_Allis
- Berkowitz, Allan – C_Berko
- Beviacqua, John – C_Bevia
- Bourke, Sean – C_Bourk
- Boutin, Dolores – C_BoutiD
- Chiapella, Lynn – C_Chiap
- Collin, Robert – C_Colli
- Davey, Mary – C_Davey
- Duperrault, Fred – C_Duper
- Gelman, Robert – C_Gelma
- Hamilton-Lam, Kimberly – C_Hamil
- Hoffman, Jeff – C_Hoffm
- Kim, Michelle – C_Kim
- Lee, Aldora – C_Lee
- Maddock, Tyana – C_Maddo
- Madou, Ramses – C_Madou
- Mindelzun, Naomi – C_MindeN
- Mindelzun, Robert – C_MindeR
- Okuzumi, Margaret – C_Okuzu
- Raffaeli, Paul – C_Raffa
- Schmidt, Ron – C_SchmiR
- Schriebman, Judy – C_Schri
- Symons, Barbara – C_Symon
- Thollaugh, Julia – C_Tholl
- Unreadable commenter name – C_Unreadable4

The PEIR addresses this topic area in Vol. 3, Chapter 5, Section 5.1.4, pp. 5.1-7 to 5.1-18. Additional information on the model and the detailed modeling results are contained in Vol. 5, Appendices H1 and H2, with further updated model information in Vol. 8, Appendix O.

14.5.2 Model Availability

Comment Summary

This section of this master response responds to all or part of the following comments:

L_MIDTID-01

Summary of Issues Raised by Commenters

- TID and MID requested that the model used in the analysis be made available to them so they could check the assumptions, and requested a 60-day comment period after receipt of the model.

Response

In response to the request by TID and MID, on October 4, 2007 the San Francisco Planning Department sent both agencies a CD containing hydrologic model output as well as related files to help them understand the data. In addition, a meeting was held on November 28, 2007 to discuss the Hetch Hetchy/Local Simulation Model (HH/LSM) and its use for the Draft PEIR;

representatives from TID, MID, the SFPUC, and the PEIR consultant team (representing the San Francisco Planning Department) attended the meeting. The SFPUC representative described how the HH/LSM was used to analyze the WSIP water supply and system operations and to estimate its effects on Tuolumne River flows, and identified the assumptions used in the analysis. A slide presentation was made and hard copy of the presentation provided to meeting attendees (included as an attachment to **Response L_MID-TID1**). The meeting was conducted informally, and the TID and MID attendees asked questions throughout the presentation.

The SFPUC representative noted that the assumptions and modeling approach used in the HH/LSM for TID and MID are consistent with the assumptions and approach used by the California Department of Water Resources (DWR) and the U.S. Bureau of Reclamation (USBR) in their modeling of the San Joaquin River using CalSim II, the statewide model developed by these agencies for planning purposes. The assumptions and approach used in the HH/LSM are also consistent with those used in modeling for MID's municipal water treatment plant.

At the end of the meeting, the TID and MID representatives indicated that the SFPUC representative had satisfactorily answered all of their questions with respect to the HH/LSM. The SFPUC transmitted an executable copy of the model to the Districts on December 21, 2007.

The San Francisco Planning Department declined to extend the comment period on the Draft PEIR as requested by the Districts.

14.5.3 Model Time Interval

Comment Summary

This section of this master response responds to all or part of the following comments:

L_ACWD-11	SI_TRT-CWA-SierraC-83	SI_TRT-CWA-SierraC-175
SI_TRT-CWA-SierraC-46	SI_TRT-CWA-SierraC-101	SI_TRT-CWA-SierraC-110
SI_TRT-CWA-SierraC-48	SI_TRT-CWA-SierraC-105	SI_TRT8-05
SI_TRT-CWA-SierraC-49	SI_TRT-CWA-SierraC-107	C_Hughe1-01
SI_TRT-CWA-SierraC-50	SI_TRT-CWA-SierraC-141	C_Hughe2-02
SI_TRT-CWA-SierraC-53	SI_TRT-CWA-SierraC-158	
SI_TRT-CWA-SierraC-82	SI_TRT-CWA-SierraC-167	

Summary of Issues Raised by Commenters

- The HH/LSM predicts monthly average values of river flow, which are inappropriate for analyzing environmental elements that may be affected by hourly, weekly, or daily flows (biological resources) or peak flows (geomorphology) that occur rarely.

Response

The impact analysis in the Draft PEIR used a combination of approaches as deemed appropriate for the specific impact and resource being analyzed. The analysis of WSIP water supply and system operations (Vol. 3, Chapter 5) was based on modeled monthly flow data using the

HH/LSM and supplemented with data derived from operational records and stream flow gages as needed. As described in the Draft PEIR (Vol. 3, Chapter 5, pp. 5.1-7 to 5.1-18), the HH/LSM is a state-of-the-art model of the regional water system developed by the SFPUC for water supply planning and is the best available tool for predicting reservoir releases/spills under various operating scenarios. It was used in the Draft PEIR to estimate the effects of the WSIP water supply and system operations on river and creek flows downstream of SFPUC reservoirs compared to the existing condition. The SFPUC has been improving and refining the model during more than 10 years of use (see Section 14.5.5, Model Validation, below), but like all models that simulate complex systems, it involves various simplifying assumptions, including the use of a monthly time-step.

As described below, monthly flow estimates derived from the HH/LSM output provide an accurate depiction of conditions in most cases and are appropriate for use in assessing impacts. During many months of the year, large portions of the regional system operations often do not vary on a daily or weekly basis. For those time periods, the HH/LSM results were useful and appropriate in assessing impacts on fish, wildlife, and riparian vegetation. However, for other times of the year, reservoir operations require adjustments more frequently than once per month due to circumstances such as changing hydrological and meteorological conditions. For the impact analysis during those periods, the HH/LSM data were supplemented with operational and daily flow records to estimate flow changes and to assess impacts. A more detailed description of how HH/LSM data were used in combination with other data in the impact analysis is presented below.

For the impact analysis of resources in the Tuolumne River between Hetch Hetchy and Don Pedro Reservoirs, monthly flow estimates derived from the HH/LSM provide an accurate depiction of actual conditions for most months of the year. Flow in this reach of the river consists entirely of releases from Hetch Hetchy Reservoir. During the late summer, fall, winter, and early spring, dam operators typically release only the required minimum instream flow. Currently, this condition exists about 84 percent of the time; with the WSIP, it would occur about 85 percent of the time. During periods when only minimum releases are being made, the release rate does not vary on a day-to-day or week-to-week basis. The SFPUC operators adjust the release rate monthly as necessary to comply with the minimum release schedule, which is specified in terms of monthly releases. Consequently, the monthly flows estimated using the HH/LSM and presented in the Draft PEIR provide an accurate characterization of flow in the Tuolumne River below O'Shaughnessy Dam more than 80 percent of the time. During such times, flow in the river below the dam varies very little, and the daily, weekly, and monthly average flow rates are essentially the same; as a result, the flow estimates from the HH/LSM are useful in assessing impacts on fish and riparian vegetation and wildlife.

The HH/LSM results for monthly reservoir releases during the snowmelt period do not provide a complete characterization of river flow because dam operators may adjust releases to the river more frequently than once per month. At the beginning of the snowmelt period, when storage in Hetch Hetchy Reservoir is at its seasonal minimum, operators typically use most of the inflowing snowmelt to fill the reservoir, releasing only the minimum required to the river below O'Shaughnessy Dam. Once the reservoir has filled, or it becomes apparent that the reservoir will

fill based on projections of inflow, operators begin to release more than the minimum required to the river below the dam. The release rate may be adjusted every few days based on the volume of water flowing into the reservoir and the volume of water exiting the reservoir via the Canyon Tunnel. Consequently, monthly averages alone do not provide a good characterization of river flow during the snowmelt period. Therefore, the HH/LSM analysis for the snowmelt period was supplemented by performing a second analysis based on operational records of representative years, which enabled daily flows to be estimated. The estimates of daily flows in the Tuolumne River below O'Shaughnessy Dam in 1999 are shown in Draft PEIR Figure 5.3.1-10 (Vol. 3, Chapter 5, p. 5.3.1-28). For the snowmelt period, daily flow information was used in assessing impacts on fish and riparian vegetation and wildlife.

Circumstances in the Tuolumne River below La Grange Dam are similar to those in the river below O'Shaughnessy Dam. Flow in this reach of the river consists entirely of releases from La Grange Dam. During the late summer, fall, winter, and early spring, dam operators typically release only the required minimum instream flow. Currently, this condition occurs about 73 percent of the time; with the WSIP, it is estimated to occur about 74 percent of the time. Releases in excess of the minimum required occur primarily during the late spring snowmelt period, but may also occur in the late fall and winter as operators adjust storage in Don Pedro Reservoir in response to rainfall and to maintain compliance with flood storage requirements. When releases in excess of the minimum required are necessary, operators may adjust releases daily, and so the average monthly flow estimates from the HH/LSM do not by themselves provide a good characterization of flow in the river. Consequently, the analysis using the HH/LSM was supplemented by performing a second analysis based on TID's operational records, which enabled daily flows to be estimated (TID operates Don Pedro Reservoir and La Grange Dam). The estimates of daily flows in the Tuolumne River below La Grange Dam in 2000 are shown in Draft PEIR Figure 5.3.1-13 (Vol. 3, Chapter 5, p. 5.3.1-37). Again, for the snowmelt period, daily flow information was used in assessing impacts on fish and riparian vegetation and wildlife.

The HH/LSM was also used in the Draft PEIR to analyze the effects of the WSIP on local watersheds in the Bay Area, including watersheds of Alameda, San Mateo, and Pilarcitos Creeks. In each case, the average monthly flow estimates derived using the monthly time-step model were supplemented by performing additional analysis based on U.S. Geological Survey (USGS) gage data and/or operational records that provide insight into daily flows. Section 5.4.1 (Vol. 3, Chapter 5, pp. 5.4.1-10 to 5.4.1-33) relies on HH/LSM results in combination with daily flow gage data from the USGS, including instantaneous data (15-minute readings) from 1997 to 2007, to fully and appropriately analyze the effects of the WSIP on flows in Alameda Creek; this overall data, in turn, is used to analyze effects on downstream fish and riparian resources.

Estimates of monthly river flows derived from the HH/LSM output are only marginally useful for the assessment of impacts on geomorphology. Channel form and sediment transport are most influenced by peak flows, which the HH/LSM does not estimate. When estimates of peak flows were needed, they were derived through a statistical analysis of long-term flow gaging records.

It should be noted that the SFPUC's use of a monthly time-step model such as the HH/LSM is typical of many water systems. Water managers conventionally use monthly time-step models to simulate water system operations for planning purposes. For example, the CalSim II model used by the DWR and USBR for statewide water planning is a monthly time-step model. If monthly time-step model output does not reflect a water manager's experience or expectations, the manager may use professional judgment in refining and extrapolating from model results to provide insight into weekly or daily operations. Models with a shorter time interval than monthly typically tier off the results of a monthly time-step model. Models with a shorter time-step are not widely developed or used because monthly time-step models are sufficient for most planning purposes.

Monthly time-step models are also often used in CEQA documents. Two examples of CEQA documents that used CalSim II are the Draft EIR on the Monterey Amendment to the State Water Project Contracts (DWR, 2007) and the Environmental Water Account EIS/EIR (DWR and USBR, 2003).

14.5.4 Use of Year Type Averages

Comment Summary

This section of this master response responds to all or part of the following comments:

SI_SierraC6-03	SI_TRT-CWA-SierraC-102	C_Hughe2-02
SI_TRT-CWA-SierraC-47	SI_TRT-CWA-SierraC-110	
SI_TRT-CWA-SierraC-82	SI_TRT-CWA-SierraC-141	

Summary of Issues Raised by Commenters

- River flow data from the model are sorted into year types and presented as averages within year types; the use of averages within year types is inappropriate for the purpose of for environmental analysis because it conceals extreme values and understates impacts.

Response

The HH/LSM estimates reservoir releases in every month of the 82-year hydrologic record, which enables estimates to be made of river flow in 984 individual months. There is no single perfect way to examine and present data of this type. The data are voluminous and difficult to interpret without simplification, and describe highly variable phenomena—that is, river flow, reservoir storage, and other hydrologic information. Data from each month can be averaged, and the result provides a piece of information that helps to roughly characterize the phenomena. At the other end of the scale, each individual monthly flow estimate can be examined to provide a more refined characterization, but one that is limited to a single month in an 82-year period. According to the technical specialists who run the model, the most practical approach is to use some combination of averaging data and examining data from individual months. This was the approach used for the Draft PEIR, as described below. It was also used for the Monterey Amendment EIR and the Environmental Water Account EIS/EIR referred to above in Section 14.5.3.

Averaging data within year types often provides insight into how a water system operates under different hydrologic conditions. For example, Draft PEIR Table 5.3.1-5 shows estimated monthly flows in the Tuolumne River below O'Shaughnessy Dam (Vol. 3, Chapter 5, p. 5.3.1-26). The table indicates that flow in the river in October, November, and December of all hydrologic year types is about the same, but that average monthly flow in June of wet years may be as high as 4,500 cubic feet per second (cfs)—about 20 times greater than in dry years. Although this information helps to characterize the pattern of river flows, it is recognized that conditions in any one wet or dry year may deviate considerably from the average. Draft PEIR Figure 5.3.1-9 shows reservoir releases in each month in the 984-month hydrologic record (Vol. 3, Chapter 5, p. 5.3.1-23). As the figure shows, although the average monthly flow in June of wet years averages 4,500 cfs, it can be as great as 7,500 cfs on rare occasions.

The monthly data used to create Table 5.3.1-5 and Figure 5.3.1-9 (Vol. 3, Chapter 5, pp. 5.3.1-5 and 5.3.1-23) are provided in the Draft PEIR (Vol. 5, Appendix H2-1). Monthly flow data derived from the HH/LSM were supplemented by information on daily flows shown in Figures 5.3.1-10 and 5.3.1-13 of the Draft PEIR (Vol. 3, Chapter 5, pp. 5.3.1-28 and 5.3.1-37). The monthly and daily flow data were used in combination to determine environmental impacts.

14.5.5 Model Validation

Comment Summary

This section of this master response responds to all or part of the following comments:

SI_TRT-CWA-SierraC-47	SI_TRT-CWA-SierraC-100	SI_TRT-CWA-SierraC-102
SI_TRT-CWA-SierraC-52	SI_TRT-CWA-SierraC-101	SI_TRT-CWA-SierraC-158

Summary of Issues Raised by Commenters

- The model's error and accuracy should be specified.

Response

The evaluation of physics-based hydrologic models such as the HH/LSM (i.e., models relying on the physics of water movement) is generally based on three different measures: calibration, verification, and validation. Calibration of a model is needed when the hydrologic parameters required to simulate the water movement are not available, and the model must use those parameters during simulations; however, because historical stream flow and water demand data are explicitly incorporated in and formulated as part of the HH/LSM, separate calibration (as is typically required for a numerical model) was not required for the HH/LSM.

Verification refers to the accuracy of computations in a model; however, because the HH/LSM is not a numerical model based on complex equations, verification related to numerical stability is not an issue. The HH/LSM is a simple mass-balance model designed with checks and balances to ensure that the basic principle of "conservation of mass" is maintained (i.e., that all water is accounted for in the system at all times, and that inflow balances with outflow and storage). The

HH/LSM is a linked-node model wherein an input of water to one part of the system—such as inflow to a reservoir—must balance with the output/storage from that same part of the system—such as the combination of releases from the reservoir, evaporation or losses from the reservoir, and a change in storage in that same reservoir. Similarly, water diverted into a pipeline must be accounted for through releases from that same pipeline. This system of checks and balances provides a built-in verification of the underlying mass-balance principle that forms the basis for the HH/LSM.

Validation refers to how well the output of the model matches the experimental or observed data. The HH/LSM is a long-term planning model that provides a simulation of water system operations over a range of hydrologic conditions. It is based on a consistent set of physical and institutional constraints (e.g., reservoir and pipeline capacities, flow requirements below reservoirs, and unimpaired runoff) and a systematic set of operational protocols that direct the operation of the water system. The model was designed to inform and direct the *long-term planning* of the system and not its *short-term operations*. Consequently, comparing absolute values of simulated operations with actual reservoir storage at the end or beginning of every hydrologic year has not been the objective of the HH/LSM.

Therefore, validation of the accuracy of the HH/LSM relates to how well the model portrays SFPUC water system operations within the context of the model's purpose. The complex operational rules incorporated into the model are based on historical data and the experience of operators, and thus achieve the best possible representation of the system for reliable and efficient system planning. In other words, the operational rules incorporated into the model are not hypothetical. The HH/LSM has been continuously refined for more than 10 years based on the modelers' expert knowledge as well as SFPUC system operators' periodical review of the model output. The model has produced reasonable and consistent results that have been confirmed by system operators and validate not only the results of the model but also the representation of the system. This continuous refinement of the HH/LSM, based on periodic review of the accuracy of the model by system modelers and operators, encompasses the generally expected validation requirements for this type of mass-balance model. For example, as described in Section 13.3 (Vol. 7, Chapter 13), the SFPUC conducted updated model runs in 2008 following publication of the Draft PEIR using more recent input assumptions for several model parameters as part of its ongoing system planning and management. And, as discussed in that section, the resulting output data were generally consistent with the 2007 data used in the Draft PEIR. The refined HH/LSM results were incorporated as appropriate into the Comments and Responses document.

In addition, the HH/LSM has been externally verified and validated on a number of occasions. The model was used in support of an application to amend the license for the Don Pedro Project, which was submitted to the Federal Energy Regulatory Commission (FERC) in 1993 and 1994. FERC approved the use and results of the model. The model was reviewed again in 2005, as part of the *Water Supply Improvement Program Assessment* (Parsons-CH2MHILL, 2005). The model review focused on each element of the HH/LSM to determine if the model input data, assumptions, operational criteria, and results were within the expected range of practice for this type of model application. The review included verification and validation of input hydrology,

system demands, reservoir target, storage levels and capacities, transmission system flow capacities, general operations criteria, and simulation procedure logic. The reviews concluded that the comparison of HH/LSM results with historical operations provides a reasonable simulation of system deliveries and reservoir storage values for the existing SFPUC regional water system. Similarly, as applied to the long-term planning purposes for which the model was designed, the reviews also concluded that the representation of the existing SFPUC system is reasonably incorporated by procedural simulation logic. Such external reviews have additionally and independently validated the HH/LSM.

In conclusion, use of a model to simulate actions in a water system is a valid and widely used practice employed by many water agencies in the United States, including the DWR, and model results can provide adequate and acceptable data for both system planning purposes as well as for environmental analysis. The SFPUC considers the HH/LSM results to reasonably portray the current and anticipated operation of the regional water system under the scenarios developed in the PEIR, and the San Francisco Planning Department has determined that the HH/LSM is a reasonable and appropriate tool to use in assessing environmental impacts of the proposed WSIP water supply and system operations on resources in the Tuolumne River, Alameda Creek, and Peninsula watersheds.

14.5.6 Model Assumptions

Comment Summary

This section of this master response responds to all or part of the following comments:

SI-TRT-CWA-SierraC-10	SI-TRT-CWA-SierraC-69	SI_TRT-CWA-SierraC-177
SI_TRT-CWA-SierraC-30	SI_TRT-CWA-SierraC-70	SI_TRT-CWA-SierraC-188
SI_TRT-CWA-SierraC-55	SI-TRT-CWA-SierraC-76	
SI-TRT-CWA-SierraC-68	SI-TRT-CWA-SierraC-79	

Summary of Issues Raised by Commenters

Questions regarding the model assumptions for:

- Future water demand and water conservation/recycling
- Future hydrology
- Future TID/MID diversions from the Tuolumne River
- Future instream flow releases at La Grange Dam

Response

Future Water Demand and Water Conservation/Recycling

For discussion of assumptions related to water demand and future water conservation and recycling, please refer to **Section 14.2, Master Response on Demand Projections, Conservation, and Recycling** (Vol. 7, Chapter 14). Those assumptions were incorporated into the HH/LSM input as part of the system customer purchase request/demand.

Future Hydrology

In the modeling performed for the Draft PEIR, future hydrology was assumed to be a recurrence of the historical hydrology. Although there is inherent uncertainty regarding whether historical hydrology will be repeated in the future—especially given the evolving information on the potential effects of global climate change—the use of historical data over 82 years provides a wide enough range of interannual variation to address the future hydrology with climate change effects expected by 2030 for the purposes of the PEIR. Use of historical hydrologic data is still the conventional practice in water supply system modeling, although many water agencies are examining potential climate change effects on future hydrology as well as on future water supply planning and management. Please refer to **Section 14.11, Master Response on Climate Change** (Vol. 7, Chapter 14) for more information on the effects of global climate change as it relates to the Draft PEIR impact analysis.

Although the modeling for the WSIP relied on historical hydrologic data, the SFPUC's water supply planning does assume that future droughts could be more severe than historical droughts. The SFPUC chose a design drought more severe than any drought in the hydrologic record because of San Francisco's unusual vulnerability in droughts and its experiences during earlier droughts. Most agricultural water agencies and many municipal water agencies have both surface and groundwater supply sources. During droughts, these agencies can increase pumping from their groundwater sources to make up for any shortfall in surface water supplies. When planning for the future, these agencies typically establish their design drought based on the historical record. If the historical record proves to be unreliable, and droughts more severe than those in the historical record occur, these agencies can turn to their groundwater supplies or, in the case of the agricultural water agencies, fallow some land. In this way, these agencies can avoid severe economic losses.

Unlike these agencies, however, the SFPUC depends almost exclusively on surface water supplies, and its water rights are restricted in a manner that means little or no water is available to the SFPUC from its primary source, the Tuolumne River, in very dry years. As a result, the risk of a severe water shortage, with the attendant economic losses, is much greater for the SFPUC's retail and wholesale customers who rely solely on the regional system for their water than for most other urban or agricultural communities. Because of these circumstances, the SFPUC must take a more conservative posture than many water agencies when it chooses a design drought. Although the SFPUC's design drought was not selected with climate change in mind, it does provide the SFPUC with a margin of safety in water supply planning if the climate becomes drier.

Future TID/MID Diversions from the Tuolumne River

The assumptions regarding water diversions by the SFPUC, TID, and MID used in the Draft PEIR analysis of the WSIP are consistent with the assumptions used by the DWR in developing the *California Water Plan*; these data were used as input to the HH/LSM studies used in the Draft PEIR analysis. TID and MID's water use rates were based on a DWR model which, for a given crop pattern, estimates the amount of water farmers will need to grow crops in a given month, taking account of precipitation and evapotranspiration. Part of the farmers' water needs in the TID and MID service areas is met with groundwater and the remainder is supplied from the

Tuolumne River. Depending on conditions in Don Pedro Reservoir, TID and MID may not be able to supply all of the surface water that farmers need every year. Under existing conditions, the model estimates that TID and MID need to divert an average of 867,000 acre-feet per year at La Grange Dam for crop irrigation and delivery system operation.

With respect to future diversions of Tuolumne River water by TID and MID at La Grange, the analysis in the Draft PEIR assumed that the future (2030) need for water for agricultural irrigation would be the same as the present need. This assumption was based on the projection that agricultural lands in the TID and MID service areas are already fully developed, and so agricultural water use would not be expected to increase. Municipal use of Tuolumne River water in the TID and MID service areas is expected to increase considerably by 2030, but the increase would be offset by a reduction in agricultural use of Tuolumne River water.

Until recently, TID and MID provided surface water exclusively to agricultural users, and the municipalities in the TID and MID service areas obtained their water from groundwater wells. Farmers in the service areas obtained surface water from TID and MID and groundwater from wells. Because some of the wells in the TID and MID service areas are contaminated with small amounts of agricultural chemicals, they are more suitable for agricultural use than municipal use. The municipalities, together with TID and MID, have developed plans for regional surface water systems that would supply high-quality Tuolumne River water to municipal water users and reduce the municipal use of wells. Tuolumne River water flowing in the Turlock and Modesto Canals would be diverted to water treatment plants and, after treatment, delivered to municipal water users.

As described in the Draft PEIR (Vol. 3, Chapter 5, pp. 5.7-10 and 5.7-11), MID's municipal water treatment plant, which has a capacity of 30 million gallons per day (mgd) and serves the city of Modesto, was put in service in 1994. Its capacity is currently being expanded to 60 mgd, and the expanded plant will be in service in 2009. TID's water treatment plant is under construction and will have a capacity of 42.5 mgd. The plant will serve the city of Turlock and several other communities and will be operational in 2010. As municipalities increase their use of surface water and decrease their use of groundwater, more groundwater would become available for agricultural use. Agricultural users would increase their use of groundwater and decrease their use of Tuolumne River water.

Some reduction in agricultural water use and an increase in municipal water use is also expected as agricultural lands are converted to residential and commercial areas. But agricultural land and housing subdivisions use roughly equivalent amounts of water, so the land use change would not have much effect on overall water use.

A commenter notes that MID's urban water management plan indicates the District's demand for municipal water will increase by 70 percent by 2030, and that this figure seems inconsistent with the assumption of no increase in diversions by MID and TID at La Grange Dam. However, any projected increased use of Tuolumne River water to serve projected urban growth in the MID service area or to serve customers switching from groundwater to Tuolumne River water would be offset by a corresponding reduction in agricultural use of Tuolumne River water, as described above.

Although global climate change could cause an increase in future agricultural water use in the TID and MID service areas, other factors such as land use conversion and agricultural market forces make it too speculative at this time to quantify potential changes in agricultural water demand. Please refer to **Section 14.11, Master Response on Climate Change** (Vol. 7, Chapter 14) for further discussion.

Future Instream Flow Releases at La Grange Dam

The SFPUC assumed that the required instream releases at La Grange Dam in support of fisheries would remain the same as the current releases. Continuation of the current releases is a reasonable future scenario, and any other assumption would be speculative. For further discussion of instream releases, please refer to **Section 14.7, Master Response on Lower Tuolumne River Issues** (Vol. 7, Chapter 14, Section 14.7.4).

14.5.7 Model Limitations for Pilarcitos Creek Watershed

Comment Summary

This section of this master response responds to all or part of the following comments:

SI_TRT-CWA-SierraC-79

Summary of Issues Raised by Commenters

- The model limitations for the Pilarcitos Creek watershed should be explained.

Response

Model limitations for the Pilarcitos Creek watershed are described briefly in the Draft PEIR (Vol. 3, Chapter 5, p. 5.1-14). The analysis in the Draft PEIR used the best available information from the 2007 HH/LSM model runs, even though it did not fully represent operations at Pilarcitos Reservoir. This element of the HH/LSM has been modified, and updated model runs have been conducted that provide an improved representation of that system, as described in Chapter 13, Section 13.3 of this document. The updated model runs did not identify any environmental impacts that were not reported in the Draft PEIR, but they did enable the impacts to be better described. Some text changes have been made in the sections of the Draft PEIR that describe the impacts of the WSIP in the Pilarcitos Creek watershed (see the staff-initiated text changes for Section 5.5 in Vol. 7, Chapter 16).

Although the modifications to the model improved the HH/LSM's ability to simulate storage in Pilarcitos Reservoir and flows in Pilarcitos Creek, the changes to the model assumptions in the Pilarcitos system have a negligible effect on other elements of the SFPUC water system. This is because storage in Pilarcitos Reservoir represents only about 0.5 percent of the SFPUC's total water storage capacity, and water production from its watershed represents only about 1.2 percent of the deliveries under the WSIP.

14.5.8 Units of Measure

Comment Summary

This section of this master response responds to all or part of the following comments:

L_MID-TID1-04 SI_TRT-CWA-SierraC-81

Summary of Issues Raised by Commenters

- Requests for the use of consistent units of measure in the Draft PEIR.

Response

No single unit of flow is the best descriptor of a hydrologic element in all cases. In describing their overall operations, agricultural water agencies typically use acre-feet per year as their primary unit, whereas municipal water agencies use million gallons per day (expressed as an average of all days in the year). Flow in rivers, on the other hand, is usually expressed in cubic feet per second. The Draft PEIR uses the units that were appropriate for the particular circumstances. However, it is recognized that readers may want to convert one unit to another for comparison purposes. Conversion factors are included in the Draft PEIR at the end of the glossary and acronyms (Vol. 1, p. xxxviii) and are as follows:

1 million gallons per day = 1,120 acre-feet per year = 1.55 cubic feet per second

14.5.9 Model Results for Tuolumne River Diversions

Comment Summary

This section of this master response responds to all or part of the following comments:

SI_CAC2-06	SI_TRT8-07	C_Hoffm-01
SI_CAREP-01	SI_TRT9-01	C_Kim-01
SI_CNPS-01	SI_TRT10-01	C_Lee-02
SI_CNPS-SCV1-05	SI_TRT-CWA-SierraC-81	C_Maddo-01
SI_CNPS-WLJ-01	C_Allis-01	C_Madou-01
SI_CRS-02	C_Berko-01	C_MindeN-01
SI_EnvDef-03	C_Bevia-01	C_MindeR-01
SI_PacInst-84	C_Bourk-01	C_Okuzu-01
SI_NCFFSC-01	C_BoutiD-01	C_Okuzu-02
SI_SFNeigh-02	C_BramlD2-01	C_Raffa-03
SI_SierraC6-01	C_Chiap-03	C_SchmiR-01
SI_SierraC7-01	C_Colli-03	C_Schri-01
SI_TRT3-01	C_Davey-01	C_Symon-01
SI_TRT6-01	C_Duper-01	C_Tholl-01
SI_TRT7-01	C_Gelma-01	C_Unreadable4-01
SI_TRT8-01	C_Hamil-01	

Summary of Issues Raised by Commenters

- Confusion regarding the magnitude of increased diversions from the Tuolumne River compared to the increase in purchase requests in 2030.

Response

Many comments indicated confusion about the estimates provided in the Draft PEIR for the increase in customer purchase requests by 2030 compared to the increase in Tuolumne River diversions under the WSIP. The confusion derives from PEIR statements regarding a *25 mgd increase in purchase requests* and a *27 mgd increase in diversions from the Tuolumne River*. As explained below, these two estimates are different, since they represent distinct, though related, system parameters. For clarification, these system parameters are defined as follows:

- *Purchase requests* represent the customer demand for water from the SFPUC regional system; this term is used interchangeably with *demand on the regional system*. This concept differs from simple "demand," since demand for some customers is served by sources other than the SFPUC regional system.

- *Diversions* represent water from the supply sources (such as the Tuolumne River or Alameda Creek) that is transferred either to customers or to storage.

- *Deliveries* represent the portion of diversions that is transmitted to customers.

Purchase Requests

On an average annual basis, customer purchase requests from the regional water system are currently 265 mgd and, by 2030, are projected to be 300 mgd—an increase of 35 mgd over the existing condition (Vol. 1, Chapter 3, p. 3-33). Under the WSIP, 10 mgd of this increase in purchase requests would be met by recycled water, groundwater, and conservation in San Francisco, and the adjusted purchase requests under the WSIP would be 290 mgd. The SFPUC proposes to serve the remaining 25 mgd of increased purchase requests from a combination of increased diversions from the Tuolumne River and improvements to the local watershed system (primarily attributable to the restoration of full capacity at Calaveras and Crystal Springs Reservoirs). In summary, the estimates for determining the average annual increase in customer purchase requests are shown in **Table 14.5-1**, below.

Deliveries

Under the existing condition, the regional system does not have sufficient water supply, stored water, or supplemental water sources to fully meet customer purchase requests during extended dry periods, at which time the SFPUC must impose rationing. Therefore, during these periods, deliveries from the regional system are less than the customer purchase requests. The HH/LSM results indicate that over the 82-year historical hydrology, the SFPUC's average annual system deliveries to customers are approximately 258 mgd of the 265 mgd in purchase requests (approximately 97 percent) due to the shortfall in deliveries when rationing is imposed during droughts. The analysis in the Draft PEIR indicated that the source of the 258 mgd in system

TABLE 14.5-1
AVERAGE ANNUAL CUSTOMER PURCHASE REQUESTS FROM THE REGIONAL SYSTEM
(average annual, mgd)

Scenario	Customer Purchase Requests
WSIP, 2030	300
Amount of purchase requests to be met with recycled water/groundwater/conservation in San Francisco	10
Adjusted purchase requests, 2030	290
Existing condition, 2005	265
Total increase in purchase requests under the WSIP to be met by Tuolumne River and local watershed supplies	25

NOTE: Data shown from Draft PEIR, Vol. 1, Chapter 3.

deliveries consists of an average annual amount of 218 mgd from the Tuolumne River and 40 mgd from the local watersheds.

Under the WSIP by 2030, the SFPUC would substantially improve overall delivery reliability and would be able to meet customer purchase requests more consistently than it currently does. However, during extended droughts, the system would still be unable to fully meet customer purchase requests, even though it would implement supplemental dry-year water sources, including water transfers from TID and MID and a conjunctive-use program in the Westside Groundwater Basin. The SFPUC would still need to impose rationing, but it would be limited to 20 percent systemwide. The HH/LSM results indicate that over the 82-year historical hydrology, the average annual system deliveries to customers under the WSIP would be approximately 287 mgd of the 290 mgd in purchase requests (approximately 99 percent), indicating improved delivery reliability over existing conditions. The Draft PEIR analysis showed that on an average annual basis, the 287 mgd would consist of 245 mgd in deliveries from the Tuolumne River and 42 mgd in deliveries from the local watersheds. The estimates for determining the average annual system deliveries from the SFPUC's water sources under existing and proposed conditions are shown in **Table 14.5-2**.

TABLE 14.5-2
SOURCE OF CUSTOMER DELIVERIES FROM THE REGIONAL SYSTEM
(average annual, mgd)

Scenario	Total System Customer Deliveries	Tuolumne River Diversions for Customer Deliveries	Local Watershed Diversions for Customer Deliveries[a]
WSIP, 2030	287	245	42
Existing Condition, 2005	258	218	40
Increase under the WSIP	29	27	2

[a] The increase in local watershed diversions under the WSIP is due to the restored capacity in Calaveras and Crystal Springs Reservoirs.

NOTE: Data shown based on 2007 HH/LSM studies; refer to Appendix H (Vol. 5).

Diversions

As indicated in Table 14.5-2, the SFPUC currently diverts an estimated annual average of 218 mgd from the Tuolumne River, and, under the WSIP, this amount would increase to 245 mgd. Thus, as stated in the Draft PEIR (Vol. 4, Chapter 9, p. 9-13), the estimated increase in diversions from the Tuolumne River for customer deliveries would be 27 mgd.

14.9 Master Response on Alameda Creek Fishery Issues

14.9.1 Introduction

This master response addresses comments on the adequacy of the impact analysis and mitigations with respect to the WSIP's effects on the steelhead fishery in Alameda Creek, as well as other comments on Alameda Creek fishery resources, including fish-related stream flows and water quality. Comments concerning fisheries in the context of climate change are addressed in part in this master response, but refer to **Section 14.11, Master Response on Climate Change** (Vol. 7, Chapter 14) for detailed discussion of climate change effects. Comments concerning riparian corridors and related aspects of terrestrial biology are addressed in part in this master response and also in the responses to individual comments (see Vol. 7, Chapter 15) pertaining to terrestrial biology.

Updated Assumptions Used in this Master Response

Since publication of the Draft PEIR, a number of changes have occurred with respect to the Draft PEIR's discussion of the potential for steelhead reestablishment in the upper Alameda Creek watershed. These changes include updated status of fish passage improvement projects, modifications to the descriptions of the Alameda Creek Fishery Enhancement (SV-1) and Calaveras Dam Replacement (SV-2) projects, and updated Alameda Creek flow modeling. This master response incorporates these changes and updated assumptions as part of the comprehensive response to the numerous comments on the Draft PEIR related to steelhead fisheries in Alameda Creek.

Changes in Steelhead Conditions

Although the presence of steelhead in Alameda Creek above the Bay Area Rapid Transit District (BART) weir is not an "existing condition" as defined by CEQA and as described in the Draft PEIR (Vol. 3, Chapter 5, pp. 5.4.5-4 to 5.4.5-11), it is a possible future condition that could occur as the result of the cumulative implementation of many planned and proposed projects and actions designed to restore steelhead in Alameda Creek. As a result of information provided by commenters regarding future projects influencing the future habitat conditions for steelhead in the Alameda Creek watershed, the Draft PEIR analysis of cumulative effects (Vol. 3, Chapter 5, pp. 5.7-52 to 5.7-67) has been updated to incorporate a discussion of cumulative impacts of the WSIP on future-occurring steelhead. This master response provides an expanded discussion of the "future cumulative scenario" in which it is assumed that the steelhead fishery has been restored above the BART weir, and then discusses the potential effects of the WSIP on potential future-occurring steelhead. Following this expanded discussion, specific text revisions to the Draft PEIR are identified.

Changes to the Calaveras Dam Replacement and Alameda Creek Fishery Enhancement Projects

Sections 13.2 and 16.2 (Vol. 7, Chapters 13 and 16, respectively) present the revised project descriptions for WSIP components affecting system operations, including changes to the Alameda Creek Fishery Enhancement (SV-1) and Calaveras Dam Replacement (SV-2) projects. Since publication of the Draft PEIR, the SFPUC has incorporated both project revisions and protective measures into these two projects to reduce the WSIP's potential to affect habitat conditions for potential future-occurring steelhead in the upper watershed (SFPUC, 2008). The project revisions would occur regardless of steelhead presence or absence upstream of the BART weir and are as follows:

- The Calaveras Dam Replacement project would include facility modifications at the Alameda Creek Diversion Dam (ACDD) to construct a new bypass structure needed to implement bypass stream flows.

- If a structural alternative involving construction of a recapture facility is selected under the Alameda Creek Fishery Enhancement project, the recapture facility would be located at the downstream end of the reach of Alameda Creek between the lower Sunol Valley and the confluence with Arroyo de la Laguna. As an alternative to the recapture facility, the SFPUC may coordinate with other water agencies to develop and implement other means of recapturing fishery enhancement flows consistent with the 1997 California Department of Fish and Game Memorandum of Understanding (CDFG MOU).

The project description modifications also include protective measures that were designed in the event that man-made barriers in Alameda Creek are removed and steelhead gain access to Alameda Creek above the BART weir. These protective measures would provide both a long-term strategy of working with federal and state agencies, as well as interim protection in the event that: (1) the National Marine Fisheries Service (NMFS) and/or the CDFG have determined steelhead to be present in Alameda Creek above the BART weir; (2) construction of the Calaveras Dam Replacement project is complete; and (3) the Alameda Watershed Habitat Conservation Plan (HCP) has yet to be finalized. The project components designed to provide protective measures for future-occurring steelhead would include the following:

- An operational plan to provide minimum stream flows to support steelhead spawning below the ACDD to the confluence with Calaveras Creek when precipitation naturally generates runoff and flow in the creek, including the site-specific studies needed to determine the specific minimum stream flow requirements to support steelhead spawning in this reach of the creek.

- A detailed monitoring plan to survey and document steelhead spawning, subject to review and comment by the appropriate resource agencies. Monitoring would occur for a minimum of five years and a maximum of 10 years following implementation of the bypass flows for steelhead. At the completion of the monitoring period, the SFPUC would provide a report describing the methods, data collected, and results used to assess the performance of the minimum stream flow in providing suitable habitat for steelhead spawning.

- Interim minimum flows would be implemented if the NMFS and/or CDFG have determined that steelhead are present in Alameda Creek above the BART weir, construction of the Calaveras Dam project is complete, and the Alameda Watershed HCP

has yet to be finalized. The interim bypass flow releases would be consistent with the 1997 CDFG MOU, with the additional requirement that these flows would be achieved through bypass flows at the ACDD at all times when flows are available in upper Alameda Creek, rather than through releases at Calaveras Dam. Any changes in bypass flows provided for in this measure would be limited by the SFPUC's ability to achieve the bypass flow schedule, taking into consideration such factors as natural annual and interannual (i.e., seasonal) variations in flow in Alameda Creek immediately above the ACDD, and the SFPUC's ability to maintain all appropriated water rights in Alameda Creek. If supplemental releases need to be made for 1997 CDFG MOU compliance due to naturally low stream flows in upper Alameda Creek, releases would be made from Calaveras Dam. Based on flow studies conducted by Hagar and Payne (ETJV, 2008), it has been determined that the performance criteria, monitoring requirements, and other specifications included in the 1997 CDFG MOU could be readily adapted to benefit steelhead as well as sensitive amphibians. The MOU flow schedule provides the following instream flows:

  – 5 cubic feet per second (cfs) between November 1 and January 14
  – 20 cfs between January 15 and March 15
  – 7 cfs between March 16 and October 31 (reduced on ramping schedule to avoid settling of fines)

- Until the studies needed to resolve the physical and institutional requirements for future steelhead migration in Alameda Creek have been completed, the following interim measure would be implemented, but only after the following conditions are met: construction of the Calaveras Dam Replacement project (SV-2) is completed; existing barriers to passage are remedied; and the NMFS and/or CDFG have determined that steelhead can migrate above the BART weir of their own volition:

  – The SFPUC would provide seasonal flow bypasses at the ACDD and/or flow releases from Calaveras Dam, either (1) without recapture or (2) with recapture at a point approximately at the downstream end of the reach of Alameda Creek between the lower Sunol Valley and the confluence with Arroyo de la Laguna, below critical riffle locations or lower in the creek, between December 1 and June 30 (combined adult and juvenile migration period) in an amount equivalent to the flow release schedule provided in the 1997 CDFG MOU.

  – As an alternative to the recapture facility, the SFPUC would coordinate with other water agencies to develop and implement other means of recapturing enhancement flows consistent with the 1997 CDFG MOU at a location downstream of the reach of Alameda Creek between the lower Sunol Valley and the confluence with Arroyo de la Laguna.

Draft PEIR Mitigation Measure 5.4.5-3a

In order to reflect the incorporation of the project revisions and additional protective measures into the Calaveras Dam Replacement project (SV-2) component of the WSIP, Draft PEIR Mitigation Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek (Vol. 4, Chapter 6, pp. 6-52 and 6-53), has been modified to be implemented in conjunction with the bypass flows at the diversion dam proposed as part of the Calaveras Dam Replacement project (and described above) to meet the 1997 CDFG MOU flow requirements (see Vol. 7, Chapter 16 for specific text changes).

Updated Flow Modeling

Subsequent to publication of the Draft PEIR, the SFPUC conducted updated model runs with the Hetch Hetchy/Local Simulation Model (HH/LSM)[1] to reflect more recent input assumptions for several model parameters as part of its ongoing system planning and management. Revised model assumptions and data are discussed in Section 13.3 (Vol. 7, Chapter 13), and new model output is shown in Appendix O (Vol. 8) of this PEIR. With respect to Alameda Creek, the updated model runs resulted in generally minor changes in flows and reservoir operations compared to the data presented in the Draft PEIR. The results of the updated model runs are integrated into the responses to comments, updated analyses, and protective measures.

Master Response Organization

This master response is organized by the following subtopics:

14.9.2 Steelhead Fishery – Existing Conditions in Alameda Creek
14.9.3 Impacts on Steelhead in Lower Alameda Creek below the BART Weir
14.9.4 Steelhead – Future Fishery Scenario and Potential Cumulative Effects
14.9.5 Other Fish Species and Aquatic Habitat in Alameda Creek
14.9.6 Climate Change and Cumulative Effects on Future Fish Passage and Fish Habitat

Comments on Alameda Creek fishery issues were received from the following entities:

Federal Agencies

- None

State Agencies

- California Department of Fish and Game – S_CDFG2

Local and Regional Agencies

- Alameda County Flood Control and Water Conservation District – L_ACFCWCD
- Alameda County Water District – L_ACWD
- East Bay Regional Park District – L_EBRPD
- Zone 7 Water Agency – L_Zone7

Groups

- Alameda Creek Alliance – SI_ACA1, SI_ACA2
- California Native Plant Society, East Bay Chapter – SI_CNPS-EB2
- Environmental Defense – SI_EnvDef
- Golden West Women Flyfishers – SI_GWWF2
- Northern California/Nevada Council of the Federation of Fly Fishers Steelhead Committee – SI_NCFFSC

[1] The Draft PEIR (Vol. 3, Chapter 5, pp. 5.1-9 to 5.1-17) analyzed the WSIP's impacts on river and steam flow using a computerized mathematical simulation model developed by the SFPUC. This model, the HH/LSM, simulates the operations of the regional water system using a monthly time-step.

Citizens

- None

PEIR Section Reference

The Draft PEIR evaluates impacts on fisheries and habitat in Alameda Creek, presents mitigation measures to reduce or eliminate impacts, and discusses future fishery habitat enhancement projects in the following locations: Vol. 1, Summary, Table S.6, p. S-53; and Vol. 3, Chapter 5, Section 5.4.1 (stream flow), Section 5.4.3 (water quality), Section 5.4.5 (fisheries), and Section 5.7.3 (cumulative impacts).

The Draft PEIR addresses issues concerning Alameda Creek fisheries-related legal issues and water rights in the following locations: Vol. 1, Chapter 2, Section 2.4.2 (regulatory requirements); Section 2.5.1 (institutional considerations); Table 2.3 (SFPUC water resources policies); Vol. 2, Chapter 4, Section 4.6 (biological resources); Vol. 3, Chapter 5, Section 5.2 (plans and policies) and Section 5.4.5 (fisheries).

14.9.2 Steelhead Fishery – Existing Conditions in Alameda Creek

Introduction

This section of the master response addresses comments concerning the existing conditions in Alameda Creek for steelhead and rainbow trout, including their regulatory status and the SFPUC's current and ongoing stewardship and management efforts towards steelhead restoration. It also discusses flow requirements for steelhead with consideration of other native stream-dependent species. This section is organized by the following subtopics:

- Biological Distinctions and Regulatory Status for Steelhead and Rainbow Trout
- Anadromous Steelhead in Lower Alameda Creek
- Consideration of Fish Passage at the Niles Gaging Station
- SFPUC Environmental Stewardship and Alameda Creek Fishery Restoration Projects
- Consideration of Steelhead at the Alameda Creek Diversion Dam
- Other Native Stream-Dependent Species
- SFPUC's Ongoing Management and Stewardship of the Alameda Watershed

Comment Summary

This section of this master response responds to all or part of the following comments:

L_ACFCWCD-02	L_ACFCWCD-13	SI_ACA1-11
L_ACFCWCD-03	L_ACFCWCD-15	

Summary of Issues Raised by Commenters

- An arbitrary distinction is drawn between steelhead and rainbow trout.

- Clarification is needed regarding the regulatory status of steelhead and rainbow trout in Alameda Creek above the BART weir.
- Issues regarding fish passage above the BART weir, including:
  - The consideration of steelhead currently passing upstream over the BART weir is inadequate.
  - The distinction between naturally migrating fish past the BART weir and fish transported past the weir is arbitrary.
  - The effects of reduced peak winter flows on fish passage over the BART weir and middle inflatable dam are not adequately addressed.
  - Mitigation for effects of reduced peak winter flows on fish passage over the BART weir and middle inflatable dam needs to be included.
- The discussion of Niles gaging station with respect to fish passage is inadequate.
- SFPUC involvement in fishery enhancement projects is inconsistent with the position that steelhead are not present upstream of the BART weir.

Biological Distinctions and Regulatory Status for Steelhead and Rainbow Trout

Comments received on the Draft PEIR requested further validation of the biological distinctions made between anadromous steelhead and resident rainbow trout within the Alameda Creek watershed in determining WSIP-related impacts on steelhead populations. The Draft PEIR addresses the regulatory status, life history, and distinctions between resident and migratory populations, as well as flows needed to support populations, in Section 5.4.5 (Vol. 3, Chapter 5, pp. 5.4.5-4 to 5.4.5-11).

The life-history discussion presented in Section 5.4.5 is summarized here to facilitate an understanding of how the biological distinction was drawn between steelhead and rainbow trout in the Draft PEIR. Steelhead and rainbow trout are both genetically identified as the species *Oncorhynchus mykiss* (*O. mykiss*), but are distinguished by their different regulatory status and life-history strategies, as summarized here. Both steelhead and rainbow trout have a flexible life history and adopt varying life-cycle strategies. All *O. mykiss* hatch in the gravel substrate of coldwater streams (Gunther et al., 2000). During spawning, the female steelhead and rainbow trout clears and cleans a depression in the gravel (redd) where eggs are deposited, fertilized, and incubate until hatching. After the eggs hatch, fry emerge from the gravel and disperse through the stream, typically occupying low-velocity areas along stream margins (Reiser and Bjornn, 1979). Juvenile steelhead and rainbow trout often move to deeper pools and higher velocity areas as they grow, and remain in freshwater for at least one year.

Following this rearing period of at least one year, juveniles (parr) may follow a variety of life-history patterns, which include residents (non-migratory) at one extreme and individuals that migrate to the open ocean (anadromous) at the other extreme. Intermediate life-history patterns include fish that migrate within the stream (potamodromous), fish that migrate only as far as estuarine habitat, and fish that migrate to near-shore ocean areas.

Juveniles that become migratory typically do so after one or two years of rearing, but sometimes longer. Physiological changes (smoltification) in these fish (smolts) ultimately allow them to make a transition from freshwater to seawater. Smolts migrate to the ocean, spend a variable amount of time there (typically one to two years), grow rapidly and return to spawn, generally in the stream where they hatched. This is an anadromous life history, typical of many salmon and trout as well as other fish species, and anadromous *O. mykiss* are commonly known as steelhead. Within a given stream, some *O. mykiss* do not migrate to the sea, and the proportion may vary considerably depending on local circumstances. These resident fish are often known as resident or stream rainbow trout. While resident rainbow trout share many of the same life-history characteristics and environmental requirements as anadromous steelhead, unlike steelhead—which migrate to the ocean for a portion of their life cycle—resident rainbow trout complete their entire life cycle within the freshwater environments of streams and lakes.

In the past, the Alameda Creek watershed supported anadromous steelhead (Gunther et al., 2000). Scientists have determined that resident rainbow trout and anadromous steelhead are genetically the same species that exhibits two different life-history strategies. Specifically, these different life-history strategies do not appear to be genetically distinct, and steelhead and rainbow trout have been observed interbreeding. Tissue samples have been collected from steelhead and rainbow trout in the Alameda Creek watershed and from other streams in the area for genetic analyses (Gunther et al., 2000). These analyses concluded with a high level of confidence that the Alameda Creek samples are not of hatchery origin and are genetically part of the Central California Coast (CCC) Distinct Population Segment (DPS) (formerly Evolutionarily Significant Unit, ESU) (Nielsen, 2003). Trout populations isolated above dams in the Alameda Creek watershed have been observed adopting an adfluvial life history, spending most of their lives in the reservoirs and migrating to tributary streams to spawn.

As described in the Draft PEIR (Vol. 3, Chapter 5, p. 5.4.5-4), while steelhead and resident rainbow trout are genetically identical, a distinction is made for steelhead based on the successful life-history strategy displayed. Although rainbow trout and steelhead are identified in the Draft PEIR as the same species, the two life-history strategies are not used interchangeably when discussing impacts on the listed special-status species of CCC steelhead. Steelhead are distinguished biologically as the anadromous life-history strategy. Anadromous steelhead have the ability to migrate to the sea and return to freshwater spawning areas in natal streams. Resident rainbow trout in upper Alameda Creek can migrate to coastal marine waters, but cannot return to spawning or rearing habitat upstream of the BART weir.

In January 2006, pursuant to the Federal Endangered Species Act (FESA), the NMFS listed as threatened the CCC steelhead DPS, including all naturally spawned anadromous steelhead populations below natural and manmade impassable barriers (71 Federal Register 834). The listing of the Alameda Creek CCC steelhead DPS as threatened applies only to the anadromous form of *O. mykiss* and is therefore limited to populations downstream of the BART weir. Specifically, the final listing determination stated, "Under our final approach of delineating steelhead-only DPSs of *O. mykiss*, the resident populations, including those in upper Alameda Creek and the Livermore-Amador Valley, are not considered part of the listed DPSs" (71 Federal

Register 841). Further discussion of the regulatory status of steelhead in Alameda Creek is presented in the Draft PEIR (Vol. 3, Chapter 5, p. 5.4.5-4).

As discussed in the Draft PEIR, a National Marine Fisheries Service (NMFS) ruling determined that steelhead and rainbow trout inhabiting a river or stream that allows the possibility of successful migration to and from coastal marine waters will, by definition, be classified as steelhead. Thus, the resident rainbow trout that occur in Alameda Creek upstream of the BART weir (a complete barrier to adult migration) are not designated as a listed species due to their inability to complete an entire life cycle involving adult upstream migration to the upper watershed with subsequent spawning. Therefore, a regulatory distinction currently exists that defines *O. mykiss* upstream of the BART weir as resident rainbow trout.

The NMFS has not designated the Alameda Creek watershed as critical habitat for steelhead, and has listed as threatened only those steelhead that currently exist below the lowest impassible barriers in the Alameda Creek watershed (i.e., the BART weir). Thus, the resident rainbow trout that occur in the creek above the BART weir are not designated as a listed species and are not proposed for listing. However, the NMFS has advised that the designation of critical habitat would be open to further evaluation if anadromous steelhead do obtain passage to upper Alameda Creek.

Anadromous Steelhead in Lower Alameda Creek

Many comments were received regarding fish passage in the lower portion of Alameda Creek and past the BART weir. Comments on this issue sought clarification on the extent to which the BART weir currently blocks upstream passage by anadromous CCC steelhead. Section 5.4.5 of the Draft PEIR (Vol. 3, Chapter 5, pp. 5.4.5-4 to 5.4.5-11) discusses steelhead populations in Alameda Creek, current barriers to fish passage, the regulatory status of steelhead in Alameda Creek, and the activities of the SFPUC, other agencies, and workgroups in passage improvement programs. Further discussion of this issue is provided in Section 14.9.3, below.

Alameda Creek historically hosted a steelhead run that spawned in the upper reaches of the watershed. That steelhead run was eliminated by the placement of several obstructions to migration within the Alameda Creek channel over the past century. These obstructions include the Alameda County Flood Control and Water Conservation District's (ACFCWCD) BART weir, located about 9.5 miles upstream from the creek's confluence with San Francisco Bay.

In February 2000, the Center for Ecosystem Management and Restoration published a report entitled *An Assessment of the Potential for Restoring a Viable Steelhead Trout Population in the Alameda Creek Watershed* (Gunther et al., 2000). The assessment found that suitable habitat exists in the watershed to support steelhead spawning and rearing, but that upstream adult migration was completely prevented by the presence of several barriers in the lower portion of the watershed. The assessment concluded that the BART weir presents a complete barrier to all migrating anadromous fish species under all flow conditions, with the possible exception of Pacific lamprey. Therefore, steelhead can currently migrate upstream within Alameda Creek only as far as the BART weir. The comment's assertion that the BART weir barrier is temporal (i.e.,

flow-dependent) is unsupported by either current literature (Gunther et al., 2000) or regulatory distinction.

Comments received on the Draft PEIR noted that individual steelhead fish have been transported upstream of the BART weir through citizen-group catch-and-release programs coordinated by the Alameda Creek Alliance. Concern was raised regarding impacts on these individual fish due to WSIP implementation. A discussion of steelhead in the Alameda Creek watershed is presented in Draft PEIR Section 5.4.5 (Vol. 3, Chapter 5), and a discussion of cumulative impacts on steelhead is presented in Section 14.9.4, below.

Steelhead that are artificially transported upstream of total passage barriers do not represent a naturally occurring, self-sustaining population, and, as such, impacts on these few individual fish are not evaluated in the Draft PEIR. These individuals are not considered part of the CCC steelhead DPS under FESA because these fish and their offspring, if successful in spawning, cannot return to the watershed upstream of the BART weir to complete a full life cycle. The Alameda Creek Alliance has been involved in transporting adult migrant fish past barriers in lower Alameda Creek. The Alameda Creek Alliance describes this transport operation on its website, which discusses the fact that the transport of a few individuals does not effectively move a sufficient number of fish upstream to create a viable spawning population (Alameda Creek Alliance, 2002).

Consideration of Fish Passage at the Niles Gaging Station

Comments raised concern that the Draft PEIR discussion of the U.S. Geological Survey (USGS) Niles gaging station (located upstream of the BART weir) was inadequate with respect to fish passage. Section 5.4.5 of the Draft PEIR (Vol. 3, Chapter 5, p. 5.4.5-9) discusses the Niles gaging station with respect to fish passage, as well as future habitat and passage improvement projects currently under study and planning. The Niles gaging station has been described as a potential impediment to fish passage (Gunther et al., 2000), although it remains passable during higher flow events. The downstream pool temperatures are characterized by stressful to highly unsuitable conditions in summer months, and improvements are required for both upstream and downstream passage (Hanson, 2008). The Northern California Council Federation of Fly Fishers has developed a preliminary study of fish passage by the Niles gage, and fish passage criteria and studies at the gaging station are ongoing. Because steelhead are unable to migrate upstream of the BART weir under existing conditions, impacts on steelhead passage at the Niles gaging station were not evaluated in the Draft PEIR. However, these impacts are considered in the cumulative impact analysis presented below in Section 14.9.4, which discusses future passage improvements and instream flow strategies as part of the SFPUC's involvement in steelhead population recovery within the Alameda Creek watershed.

SFPUC Environmental Stewardship and Alameda Creek Fishery Restoration Projects

As part of the continuing effort to address steelhead restoration in Alameda Creek, the SFPUC has entered into an agreement with 17 public agencies and organizations as part of the Alameda Creek Fisheries Restoration Workgroup (ACFRW) to provide funding and collaborate on flow

studies focused on steelhead restoration. To date, these studies have not developed instream flow recommendations, but an initial workplan—the *Alameda Creek Population Recovery Strategies and Instream Flow Assessment for Steelhead Trout*—has been developed to achieve this goal (McBain and Trush, 2007). Collaborative data collection is scheduled for the near future, and a joint process among the agencies has begun to recommend a range of flows to support steelhead restoration objectives. The referenced report details this effort to establish instream flow targets and outlines specific studies intended to result in a flow strategy for restoring and maintaining native fishes (McBain and Trush, 2007). Due to the many variables involved, these studies need to be completed before it is possible to develop a specific, scientifically based flow schedule for steelhead. Further detailed discussion on specific flow release volumes and schedules is provided in Section 14.9.4, below.

Comments raised concern that the Draft PEIR failed to mitigate or analyze impacts on fish passage within the context of proposed future projects designed to increase habitat quality and connectivity within Alameda Creek for steelhead. A detailed discussion of future cumulative scenario conditions and cumulative impacts associated with WSIP implementation is presented in Section 14.9.4. As previously described, various watershed and habitat studies have established that steelhead do not migrate above the BART weir (Gunther et al., 2000).

Regardless of the timing of the BART weir fish passage project and other planned habitat enhancement/restoration actions, the SFPUC will continue to participate in steelhead restoration efforts. Ongoing studies will recommend flows to support steelhead restoration (as detailed in Section 14.9.4), and the SFPUC will continue to work with the NMFS, CDFG, and other stakeholders on these studies. Section 14.9.4 provides a detailed discussion of the WSIP's potential contribution to cumulative impacts on future-occurring steelhead in Alameda Creek with the consideration of the revisions to the Calaveras Dam Replacement project (SV-2) and Draft PEIR mitigation measures summarized above in Section 14.9.1. The SFPUC plans to incorporate steelhead recovery strategies developed through the ACFRW process into its Alameda Watershed HCP or other regulatory mechanism, which will provide coverage under FESA for regional water system operations at the time steelhead return to the upper Alameda Creek watershed. The SFPUC will comply with FESA requirements for steelhead protection through the Alameda Watershed HCP, or other agreement/authorization acceptable to the permitting agencies, as described in Section 14.9.4.

Consideration of Steelhead at the Alameda Creek Diversion Dam

Comments on the Draft PEIR identified the desire to remove the ACDD as a barrier to fish passage in order to support restoration of the historical range of steelhead within Alameda Creek. The SFPUC has no plans to remove the ACDD, and its removal is not required to mitigate significant impacts of the WSIP. However, to address the potential for steelhead reestablishment in the upper Alameda Creek watershed, the SFPUC proposes to develop and implement an operational plan to provide minimum stream flows below the ACDD that will support steelhead spawning as part of the Calaveras Dam Replacement project (SFPUC, 2008). This operations plan will be developed in coordination with the ACFRW, CDFG, and NMFS. Other SFPUC actions proposed to address potential future-occurring steelhead in the upper watershed are

discussed in Section 14.9.1, above. Additionally, as stated in Mitigation Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek, and Mitigation Measure 5.4.5-3b, Alameda Diversion Dam Diversion Restrictions or Fish Screens (Vol. 4, Chapter 6, pp. 6-52 to 6-54), the SFPUC would complete site-specific studies to determine appropriate bypass flows to address impacts on the resident trout fishery in Alameda Creek below the diversion dam. As stated in Measure 5.4.5-3a, providing minimum flows below the dam would support resident trout spawning and egg incubation; it is also expected that this measure would be sufficient to sustain the resident trout population in this reach of the creek, which is limited due to natural drying of the stream channel in alluvial sections during the summer months (Sak, 2007). As stated above and further discussed in Section 14.9.4, the SFPUC is committed to the ongoing management and stewardship of the Alameda Creek watershed, including fishery enhancement projects and measures to provide flows for native stream-dependent species, as detailed in Section 14.9.1, above.

Other Native Stream-Dependent Species

Comments received from the CDFG noted that Mitigation Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek, may not provide adequate protective flows for steelhead and native stream-dependent species. In response to the comment recommending further study to determine whether sufficient water will be available for different life stages of fish and native stream-dependent species, the Draft PEIR mitigation measure incorporates site-specific studies and coordination with the ACFRW to determine the appropriate minimum stream flow. Section 14.9.4 presents a detailed analysis of current habitat conditions for different life stages of steelhead and rainbow trout, the potential impacts of WSIP implementation on these various life stages, and the status of studies on instream flow requirements to protect fishery resources. Please refer to Section 14.9.4, below, as well as **Response S_CDFG2-15** and **Response L_ACWD-22** (Vol. 6, Chapter 15, Sections 15.2 and 15.3, respectively) for more discussion of bypass flows in Alameda Creek.

In response to comments regarding the ACDD bypass flows and reevaluation of Mitigation Measure 5.4.5-3a, the measure has been expanded to address other species and life stages. The following three excerpts from the Draft PEIR are revised as follows:

Vol. 3, Chapter 5, p. 5.4.6-19, third full paragraph:

> Overall, implementation of the proposed WSIP water supply and system operations would result in *potentially significant* impacts on terrestrial biological resources due to a potential reduction in aquatic breeding habitat for key special-status species. Measure 5.4.1-2, Diversion Tunnel Operation, calls for operation of the diversion tunnel in a manner that ensures that flows not required to maintain storage in Calaveras Reservoir are passed down Alameda Creek at the diversion dam. Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek, calls for <u>developing and implementing an operational plan to provide</u> minimum <u>bypass</u> flows below the diversion dam <u>to support habitat for rainbow trout and other native stream-dependent species</u> from December through April. Implementation of these measures would ensure that minimum flows in Alameda Creek are allowed to pass by the diversion dam. Taken together, these measures would reduce adverse impacts on key special-status species to a less-than-significant level.

Vol. 4, Chapter 6, p. 6-52, first paragraph under Fisheries, first sentence:

> **Measure 5.4.5-3a:** The SFPUC shall develop and carry out as part of the implementation of the Calaveras Dam Replacement (SV-2) project, an operational plan to implement minimum ~~stream~~ bypass flows when precipitation generates runoff into the creek below the diversion dam to the Calaveras Creek confluence from December 1 through April 30 to support ~~resident trout~~ spawning and egg incubation for resident trout as well as breeding habitat for other native stream-dependent amphibians.

Vol. 4, Chapter 6, p. 6-53, first paragraph, last sentence:

> The operational plan will allow for adapting minimum flow amounts to support resident trout spawning and egg incubation and other native stream-dependent species based on the monitoring results and best available scientific information.

Section 14.9.4, below, provides a detailed discussion of planned steelhead restoration within the Alameda Creek watershed and assesses potential cumulative effects on steelhead that could result from WSIP implementation. As described in Section 14.9.4, successful implementation of planned and proposed fishery enhancement projects would result in the removal of many barriers to passage for anadromous steelhead within Alameda Creek. As described in Section 14.9.1 above, when steelhead passage is restored to the upper watershed, the SFPUC will work with the CDFG and NMFS to comply with the applicable FESA requirements for steelhead through the Alameda Watershed HCP or other regulatory mechanism. Currently, the SFPUC is developing the Alameda Watershed HCP in compliance with FESA, which will addresses operation (but not construction) of the Calaveras Dam Replacement project (SV-2), and steelhead is a covered species in the HCP. The HCP is a long-term mechanism in which the SFPUC and regulatory agencies are assessing the requirements for steelhead restoration and other native fish and aquatic species in the watershed affected by SFPUC water system operations.

SFPUC's Ongoing Management and Stewardship of the Alameda Watershed

Comments also requested clarification of the SFPUC's position regarding the presence of steelhead in the upper watershed, and the reasons for SFPUC involvement in fishery enhancement projects upstream of the BART weir if the current understanding is that steelhead are not present in the upper watershed. Sections 5.4.5 and 5.7.3 of the Draft PEIR (Vol. 3, Chapter 5) discuss the SFPUC's involvement in habitat improvement programs planned for the Alameda Creek watershed.

The SFPUC manages its Alameda watershed lands to benefit a wide range of species, habitat, and natural resources in addition to specific efforts to restore steelhead to Alameda Creek. The SFPUC's watershed management and stewardship policies are detailed in the *Alameda Watershed Management Plan* (SFPUC, 2001) and the Water Enterprise Environmental Stewardship Policy (SFPUC, 2006). The SFPUC has dedicated much time and funding toward numerous long-term efforts to improve steelhead habitat and passage within the watershed, such as the recent removal of the Sunol and Niles Dams; it is also a major participant in the ACFRW, which is focusing on the restoration of steelhead to Alameda Creek. The SFPUC's work with the ACFRW includes developing a long-term strategy that encompasses a range of watershed management goals.

Additionally, independent of involvement in the ACFRW's fishery enhancement projects, the SFPUC has funded studies to better understand the biological characteristics required for successful steelhead restoration. It is the policy of the SFPUC to operate the SFPUC water system in a manner that protects and restores native fish and wildlife downstream of SFPUC dams and water diversions, within SFPUC reservoirs, and on SFPUC watershed lands.

14.9.3 Impacts on Steelhead in Lower Alameda Creek below the BART Weir

Introduction

This section of the master response addresses comments concerning the analysis of the WSIP's potential effects on steelhead and flows in lower Alameda Creek downstream of the BART weir. This section is organized by the following subtopics:

- Lower Alameda Creek as a Migration Corridor and a Transition Zone for Steelhead Smolts
- Impacts on Stream Flow and Fisheries Downstream of the BART Weir

Comment Summary

This section of this master response responds to all or part of the following comments:

L_ACFCWCD-04	L_ACWD-09	L_ACWD-19
L_ACFCWCD-14	L_ACWD-12	L_Zone7-01
L_ACWD-07	L_ACWD-17	SI_ACA1-02

Summary of Issues Raised by Commenters

- The discussion of lower Alameda Creek as a transition zone for steelhead is inadequate.
- Inadequate discussion of project impacts on steelhead below the middle inflatable dam.
- Lower Alameda Creek flow diversions would affect fisheries and habitat in the flood control channel.
- The WSIP would reduce winter and spring flows by 50 percent in normal years and could adversely affect steelhead passage below the BART weir.
- Flows below the recapture facility should be addressed; flows should be allowed to pass downstream.

Response

Lower Alameda Creek as a Migration Corridor and a Transition Zone for Steelhead Smolts

Comments on the Draft PEIR raised concern that reduced flows below the BART weir resulting from the WSIP would affect the estuarine zone of Alameda Creek and reduce the potential for steelhead smolt development within this possible zone of transition to marine waters.

The flood control channel represents the 12-mile reach of Alameda Creek from the confluence with San Francisco Bay to the mouth of Niles Canyon. It is an artificially managed and modified environment with a heavily sedimented, sandy bottom and riprap sides. The low riparian cover and high summer water temperatures in this creek section (Hanson, 2002a, 2002b) are not suitable for summer rearing by coldwater fish species. Gunther et al. (2000) classify the geographic range of the flood control channel as non-viable habitat for steelhead spawning or rearing.

Tidal influence in the flood control reach of lower Alameda Creek falls short of Alameda County Water District's (ACWD) lowermost inflatable dam (Gunther et al., 2000); unless flows overtop or bypass the inflatable dam, the channel below the inflatable dams can become dry, further reducing the potential under current conditions for the flood control channel to provide viable smolt transition habitat. Under typical operating conditions, ACWD's inflatable dams are raised to facilitate the diversion of flows into off-channel recharge areas, except during peak storm events.

Currently, no summer rearing habitat exists in this reach of lower Alameda Creek that could be considered suitable for either steelhead or rainbow trout. The 12-mile reach of the flood control channel, extending upstream to Niles Canyon, is a simplified system without natural features (such as pool/riffle sequences) and, even after the implementation of future restoration projects, it would primarily offer only migratory habitat (see Section 14.9.4, below). Implementation of the WSIP, as outlined in the Draft PEIR, would not affect smolt development in this section of the creek, as no suitable habitat exists within this reach for smolt development due to the physical characteristics of the engineered flood control channel. Additionally, implementation of the WSIP would not significantly affect the potential for steelhead to continue using this stretch as a migratory corridor. The response presented below addresses the potential impacts on migrating salmonids due to changes in seasonal flow under the WSIP, including the continued use of this creek reach as a migratory corridor.

Impacts on Stream Flow and Fisheries Downstream of the BART Weir

Comments raised concern that increased diversions under the WSIP would adversely affect steelhead passage in the 9.5 miles of channel from San Francisco Bay to the BART weir, and that the Draft PEIR did not contain sufficient analysis of impacts on stream flow and fisheries in the lower section of Alameda Creek.

The Draft PEIR (Vol. 3, Chapter 5, pp. 5.4.1-16 to 5.4.1-43) describes the changes in stream flow and reservoir water levels that would result from the WSIP. Impact 5.4.1-4 (pp. 5.4.1-39 to 5.4.1-43) discusses the analyses conducted on stream flow changes that would occur under the WSIP, and the potential impact of WSIP implementation on flow along Alameda Creek below the confluence with San Antonio Creek. The Draft PEIR analysis concluded that average monthly flows in Alameda Creek below the confluence with San Antonio Creek would be lowered due to the WSIP in winter months of normal or wetter years. It was also determined that changes in flow would be substantially dampened by inflows from other tributaries in the Sunol Valley; therefore, no adverse hydrological effects would result, and no mitigation measures would be required. Additionally, in considering the WSIP-related effects on flow in Alameda Creek, along with

fishery flow releases (under the Calaveras Dam Replacement project, SV-2) being recaptured (under the Alameda Creek Fishery Enhancement project, SV-1), the Draft PEIR analysis found there would be no change in average monthly flows in most months of normal and wetter years, and no change in those flows in all months of drier years.

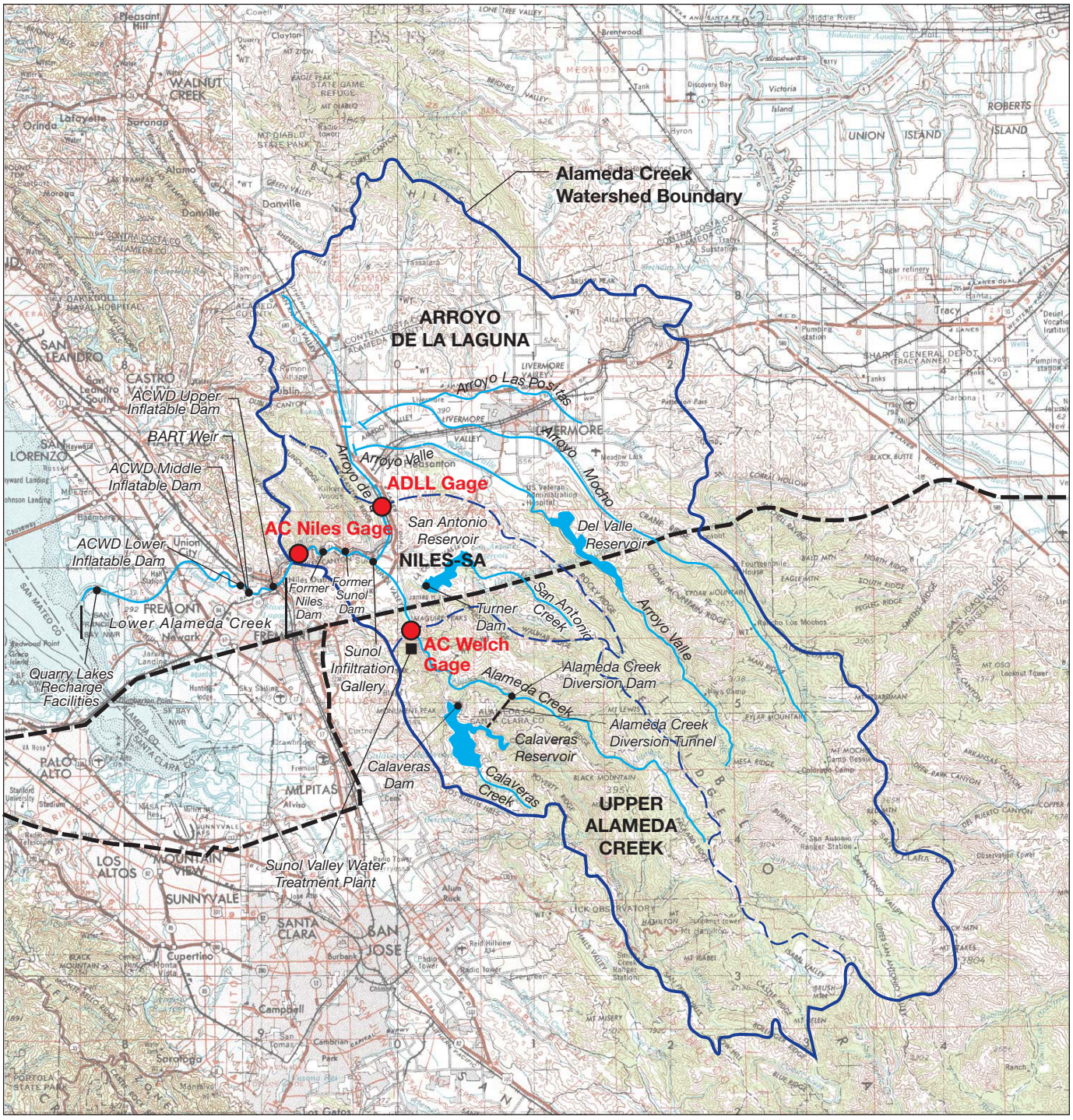
Section 5.4.5 of the Draft PEIR (Vol. 3, Chapter 5) describes fishery resources in Alameda Creek and the potential impacts that would result from the WSIP. Impact 5.4.5-6 (Vol. 3, Chapter 5, pp. 5.4.5-21 and 5.4.5-22) describes the WSIP's effects on fishery resources along Alameda Creek below the confluence with San Antonio Creek. The analysis concluded that potential impacts on fishery resources and habitat along Alameda Creek downstream of the confluence with San Antonio Creek would be less then significant, and no mitigation measures would be required.

In order to address comments regarding the WSIP's impacts on steelhead passage and fishery habitat in lower Alameda Creek downstream of the BART weir (to the confluence with San Francisco Bay), additional stream flow analysis was conducted (see Vol. 8, **Appendix N**); this analytical effort is summarized in the paragraphs that follow.

Downstream of the confluence of Alameda and San Antonio Creeks, Alameda Creek joins with the other major tributary in the Alameda Creek watershed, Arroyo de la Laguna. Below this confluence Alameda Creek enters Niles Canyon and flows for approximately 3.5 miles before exiting the canyon. Lower Alameda Creek, which begins downstream of the Niles Canyon reach, is a low-gradient creek characterized by flood control channels and several instream structures, including the BART weir and ACWD inflatable dams used for water diversion. The ACWD utilizes the lower creek for water supply via diversions and groundwater recharge. Lower Alameda Creek ultimately discharges to San Francisco Bay approximately 12 miles downstream of Niles Canyon.

Recent USGS flow records from three gaging stations on Alameda Creek (upstream of the San Antonio Creek confluence, near the downstream end of Niles Canyon, and from Arroyo de la Laguna) were reviewed to estimate the proportion of flow that upper Alameda Creek and Arroyo de la Laguna contribute to the lower reaches of Alameda Creek. The flow proportions were used to estimate the changes in flow that would occur in lower Alameda Creek as a result of the WSIP for hydrologic years 2000 to 2007.[2] **Figure 14.9-1** presents the locations of the three USGS gaging stations (labeled AC Welch, ADLL, and AC Niles) from which data were analyzed, and the contributing watersheds for each of the gages.

[2] This analysis takes into account both the "Calaveras Up" and "Calaveras Down" base-case HH/LSM results because historical gage data were used in the analysis, and the Division of Safety of Dams (DSOD) restriction on Calaveras Dam operations was implemented during the period of analysis (in 2002). Therefore, the analysis uses model data from the Calaveras Up condition (prior to the DSOD restriction) for hydrologic years 2000 to 2001, and model data from the Calaveras Down condition (after the DSOD restriction and the base-case used for the Draft PEIR impact analysis) for the remainder of the years.



SOURCE: ESA + Orion; USGS 1969

SFPUC Water System Improvement Program . 203287

Figure 14.9-1

Location of 3 USGS Gages and
Contributing Watersheds for Lower Alameda Creek

Data from the three USGS gages were reviewed on an average monthly flow basis for overlapping periods of record (hydrologic years 2000 to 2007). Diversions from upper Alameda Creek to Calaveras Reservoir were substantially curtailed starting in 2002 due to the operating restrictions imposed on Calaveras Reservoir by the California Department of Water Resources, Division of Safety of Dams (DSOD). **Figure 14.9-2** presents average monthly flows over the eight-year period for the three gages. Review of the flow data reveals that flow measured at the Arroyo de la Laguna gage (shown as a blue shaded area) generally contributes a higher percentage of the flow measured at the Niles gage (shown as a black line) compared to that measured at the Welch gage (shown as a green shaded area). The discrepancy between the summation of the Arroyo de la Laguna and Welch gage flows and flow at the Niles gage (the white space below the black line) is assumed to be inflow from the watershed between the two upper gages and the Niles gage (labeled "Niles–SA watershed" on Figure 14.9-1).

Included in the Niles–San Antonio Creek watershed are releases made from the State Water Project, flow from San Antonio Creek, and contributions/losses from the watershed that occur downstream of the two upper gages.

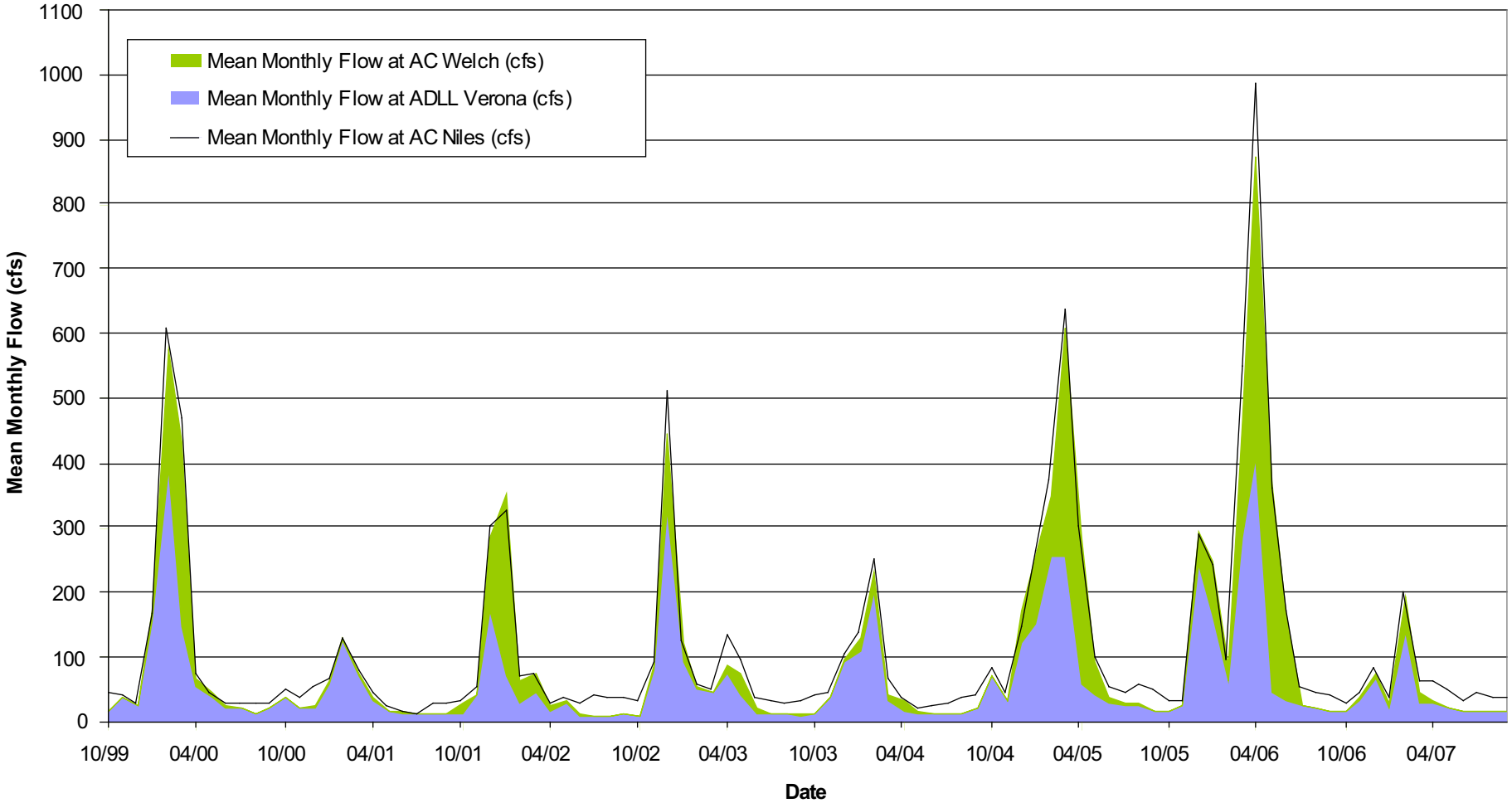
Releases or spills from San Antonio Reservoir rarely occur. Most flows in San Antonio Creek result from groundwater seepage or runoff from the watershed downstream of Turner Dam. The Niles–San Antonio Creek watershed contribution noted in summer months (as a gap between the green and blue areas and the black line) is assumed primarily to be releases from the State Water Project and contribution from groundwater in Niles Canyon. Also notable in the chart are the spikes in flow from upper Alameda Creek in the winter and spring of the hydrologic years 2005 and 2006. These spikes are a result of above-normal runoff in the watershed combined with the restricted Calaveras Reservoir storage and required releases from the reservoir to maintain the DSOD-restricted level.

The data presented in Figure 14.9-2 were analyzed to determine the percentage of flow contributed by each of the watersheds tributary to the Niles gage (identified in Figure 14.9-1). **Tables 14.9-1** and **14.9-2** present the relative contribution of the upstream watersheds to flow at the Niles gage over the past eight hydrologic years, from 2000 to 2007.

TABLE 14.9-1
AVERAGE MONTHLY PERCENTAGE OF WATERSHED CONTRIBUTIONS AT THE NILES GAGE HYDROLOGIC YEARS 2000–2007

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	WY Total
ADLL	58%	81%	71%	61%	70%	46%	42%	34%	40%	47%	41%	43%	55%
AC Welch	6%	3%	23%	40%	24%	44%	45%	59%	39%	3%	1%	1%	33%
Niles-SA	36%	16%	6%	-1%	5%	10%	13%	7%	20%	50%	58%	57%	13%

SOURCE: Hydroconsult Engineers Inc., 2008 (see Appendix N)



SOURCE: SFPUC Water System Improvement Program

Figure 14.9-2
Comparison of Mean Monthly Flow Contribution from ADLL and Upper Alameda Creek at Niles, WY 2000-2007

TABLE 14.9-2
SUMMARY OF FLOW CONTRIBUTIONS AT THE NILES GAGE
HYDROLOGIC YEARS 2000–2007

Watershed	Eight-Year Average Contribution	Eight-Year Range of Contribution
Arroyo de la Laguna	55%	43% – 71%
Upper Alameda Creek	33%	5% – 46%
Niles–San Antonio Creek	13%	8% – 27%

SOURCE: Hydroconsult Engineers Inc., 2008 (see Appendix N)

This analysis reveals that on average, approximately one-third of the flow at the Niles gage results from the upper Alameda Creek watershed. Since all SFPUC operations occur within the upper Alameda Creek watershed, implementation of the WSIP would only affect approximately one-third of the upstream flow that contributes to flow at the Niles gage. As such, flow changes in upper Alameda Creek as a result of the WSIP would be dampened in lower Alameda Creek by inflow from the other sub-watersheds. For instance, a flow of 100 cfs for Alameda Creek could hypothetically be reduced by 25 percent in a given month under the WSIP, resulting in a flow of 75 cfs for Alameda Creek. The same hypothetical flow at the Niles gage would be 300 cfs without the WSIP and 275 cfs with the WSIP, corresponding to an 8 percent reduction.

The results from the HH/LSM showing the percentage reductions in monthly flow for Alameda Creek below the San Antonio Creek confluence (see the Draft PEIR, Vol. 3, Chapter 5, Table 5.4.1-11, p. 5.4.1-42) were applied to monthly gage flow data from the Welch gage. Although the Welch gage and the HH/LSM analysis location of Alameda Creek below the San Antonio Creek confluence are not the same, this difference is not considered significant for this analysis. The San Antonio Creek confluence is approximately 2.7 miles downstream of the Welch gage, and the analysis presented in this section applies the percentage change in flow from the HH/LSM analysis, not actual flow data, to the Welch gage. Therefore, any difference in flows at the two locations would not affect this analysis, since the percentage reduction in flow was considered applicable to flow in Alameda Creek in the vicinity of the Welch gage.

Table 14.9-3 presents the flow changes estimated using the HH/LSM. The resulting changes in flow at the Welch and Niles gages are shown in **Tables 14.9-4** and **14.9-5** and **Figure 14.9-3**. Table 14.9-4 presents the results of applying the HH/LSM flow reductions to records from the Welch gage for the hydrologic years 2000–2007. Figure 14.9-3 and Table 14.9-5 detail the predicted changes in flow in Alameda Creek at the Niles gage over the eight-year period (2000–2007) with implementation of the WSIP. The solid blue area in Figure 14.9-3 represents average monthly flow at Niles, and the black line indicates calculated flow with implementation of the WSIP. The discrepancy between the two lines represents a change between gage records and calculated flow under the WSIP.

TABLE 14.9-3
HH/LSM CALCULATED FLOW REDUCTIONS IN ALAMEDA CREEK BELOW THE SAN ANTONIO CREEK CONFLUENCE

Percent Change, Revised Base (Calaveras Down) vs Revised WSIP (Proposed Program)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep
All	0%	0%	-28%	-32%	-21%	-15%	-4%	9%	0%	0%	0%	0%
Wet	0%	0%	-23%	-26%	-9%	-9%	-7%	16%	0%	0%	0%	0%
Above Normal	0%	0%	-38%	-43%	-35%	-21%	17%	1%	0%	0%	0%	0%
Normal	0%	0%	-34%	-47%	-56%	-45%	-12%	0%	0%	0%	0%	0%
Below Normal	0%	0%	0%	0%	-6%	0%	3%	0%	0%	0%	0%	0%
Dry	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Percent Change, Base (Calaveras Up) vs WSIP Proposed Program (Not Revised)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep
All	0%	0%	32%	19%	22%	2%	-3%	12%	0%	0%	0%	0%
Wet	0%	0%	49%	14%	13%	-3%	-7%	8%	0%	0%	0%	0%
Above Normal	0%	0%	26%	38%	67%	15%	18%	38%	0%	0%	0%	0%
Normal	0%	0%	5%	14%	17%	18%	16%	0%	0%	0%	0%	0%
Below Normal	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Dry	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Increase of greater than 1%
Decrease of greater than 1%
Decrease of greater than 5%

SOURCE: Hydroconsult Engineers Inc., 2008 (see Appendix N)

TABLE 14.9-4
COMPARISON OF RECORDED AND CALCULATED FLOWS IN ALAMEDA CREEK AT WELCH GAGE

Recorded Flow in Alameda Creek at Welch Gage (cfs, avg. monthly)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	Year Type
2000	0	1	2	17	183	287	13	8	3	2	1	1	AN
2001	1	1	1	3	7	8	3	2	1	0	0	0	BN
2002	17	1	112	282	37	28	8	4	2	1	0	0	BN
2003	0	5	117	26	5	3	11	34	5	1	0	0	N
2004	0	0	2	24	26	5	14	1	0	0	0	0	N
2005	0	1	53	106	95	351	227	53	7	3	1	0	AN
2006	0	1	51	84	27	177	466	325	133	2	1	0	AN
2007	1	2	10	5	56	16	4	2	1	0	0	0	D

Calculated Flow at Welch for Revised WSIP Proposed Program (cfs, avg. monthly)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	Year Type
2000	0	1	2	23	305	331	16	10	3	2	1	1	AN
2001	1	1	1	3	7	8	3	2	1	0	0	0	BN
2002	17	1	112	282	35	28	8	4	2	1	0	0	BN
2003	0	5	78	14	2	1	10	34	5	1	0	0	N
2004	0	0	1	12	11	3	12	1	0	0	0	0	N
2005	0	1	33	60	62	276	267	53	7	3	1	0	AN
2006	0	1	31	47	18	139	547	328	133	2	1	0	AN
2007	1	2	10	5	56	16	4	2	1	0	0	0	D

Difference Between Recorded and Calculated Flow for Revised WSIP Proposed Program at Welch (cfs, avg. monthly)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	Year Type
2000	0 [0%]	0 [0%]	0 [26%]	6 [38%]	122 [67%]	44 [15%]	2 [18%]	3 [38%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	AN
2001	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	BN
2002	0 [0%]	0 [0%]	0 [0%]	0 [0%]	-2 -[6%]	0 [0%]	0 [3%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	BN
2003	0 [0%]	0 [0%]	-40 -[34%]	-12 -[47%]	-3 -[56%]	-1 -[45%]	-1 -[12%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	N
2004	0 [0%]	0 [0%]	-1 -[34%]	-11 -[47%]	-14 -[56%]	-2 -[45%]	-2 -[12%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	N
2005	0 [0%]	0 [0%]	-20 -[38%]	-46 -[43%]	-33 -[35%]	-76 -[21%]	39 [17%]	1 [1%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	AN
2006	0 [0%]	0 [0%]	-19 -[38%]	-36 -[43%]	-9 -[35%]	-38 -[21%]	81 [17%]	4 [1%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	AN
2007	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	D

Increase of greater than 1%
Decrease of greater than 1%
Decrease of greater than 5%

NOTE: The portion of the table titled “Calculated Flow at Welch for Revised WSIP” represents the future condition with implementation of the WSIP. “Revised” WSIP refers to the 2008 updated modeling results, as discussed in Section 13.3 (Vol. 7).

SOURCE: Hydroconsult Engineers Inc., 2008 (see Appendix N)

TABLE 14.9-5
COMPARISON OF AVERAGE MONTHLY FLOW AT THE NILES GAGE, RECORDED FLOW VERSUS CALCULATED FLOW UNDER THE WSIP

Recorded Flow in Alameda Creek at Niles (cfs, avg. monthly)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	Year Type
2000	44	41	28	165	606	469	74	46	26	27	29	29	AN
2001	50	35	55	65	128	79	44	22	14	10	27	27	BN
2002	33	53	302	329	71	76	27	34	30	39	38	36	BN
2003	34	91	513	126	56	50	131	97	35	33	30	33	N
2004	39	45	104	138	251	65	36	21	23	27	35	41	N
2005	83	45	148	262	374	638	300	98	55	46	57	51	AN
2006	30	32	287	242	94	551	986	361	172	53	44	39	AN
2007	28	45	82	38	202	61	61	47	32	43	35	37	D

Calculated Flow at Niles for Revised WSIP Proposed Program (cfs, avg. monthly)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	Year Type
2000	44	41	28	171	728	513	76	49	26	27	29	29	AN
2001	50	35	55	65	128	79	44	22	14	10	27	27	BN
2002	33	53	302	329	68	76	27	34	30	39	38	36	BN
2003	34	91	474	114	53	48	130	97	35	33	30	33	N
2004	39	45	103	127	237	62	34	21	23	27	35	41	N
2005	83	45	127	216	341	562	340	99	55	46	57	51	AN
2006	30	32	267	205	85	513	1067	365	172	53	44	39	AN
2007	28	45	82	38	202	61	61	47	32	43	35	37	D

Difference Between Recorded and Calculated Flow for Revised WSIP Proposed Program at Niles (cfs, avg. monthly)

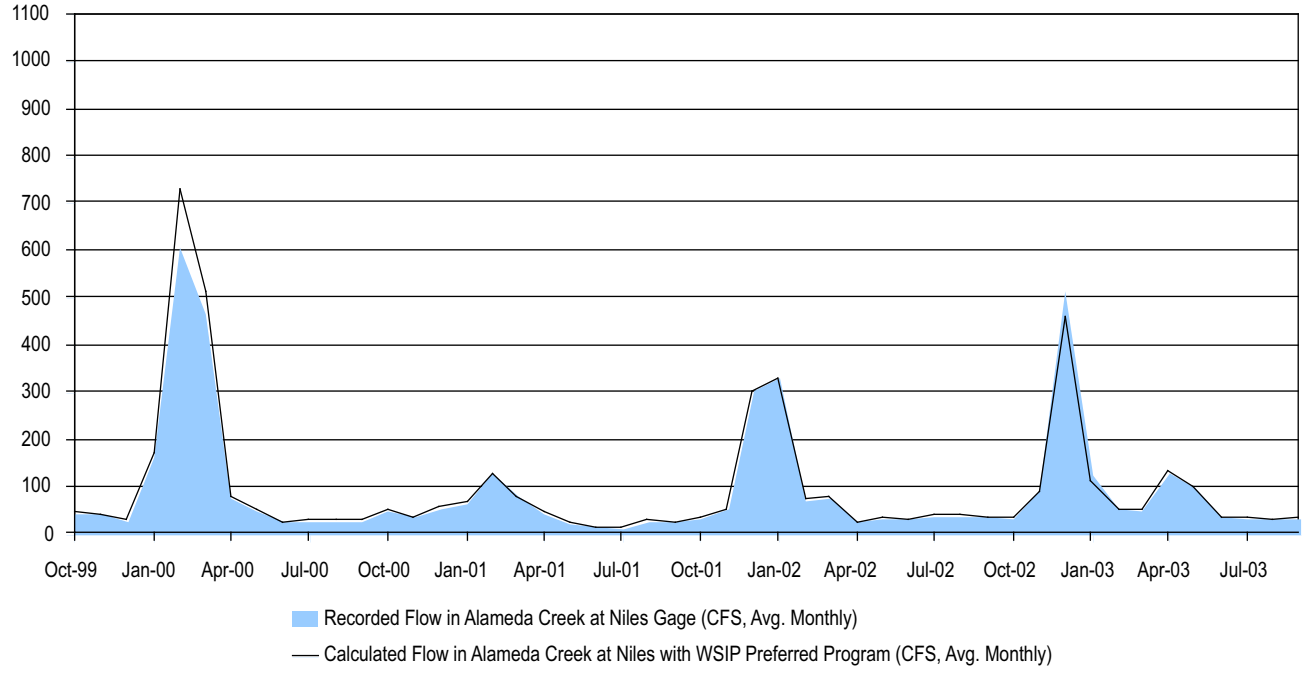
	OCT		NOV		DEC		JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		Year Type
2000	0	[0%]	0	[0%]	0	[1%]	6	[4%]	122	[20%]	44	[9%]	2	[3%]	3	[6%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	AN
2001	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	BN
2002	0	[0%]	0	[0%]	0	[0%]	0	[0%]	-2	-[3%]	0	[0%]	0	[1%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	BN
2003	0	[0%]	0	[0%]	-40	-[8%]	-12	-[10%]	-3	-[5%]	-1	-[2%]	-1	-[1%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	N
2004	0	[0%]	0	[0%]	-1	-[1%]	-11	-[8%]	-14	-[6%]	-2	-[4%]	-2	-[5%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	N
2005	0	[0%]	0	[0%]	-20	-[14%]	-46	-[18%]	-33	-[9%]	-76	-[12%]	39	[13%]	1	[1%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	AN
2006	0	[0%]	0	[0%]	-19	-[7%]	-36	-[15%]	-9	-[10%]	-38	-[7%]	81	[8%]	4	[1%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	AN
2007	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	D

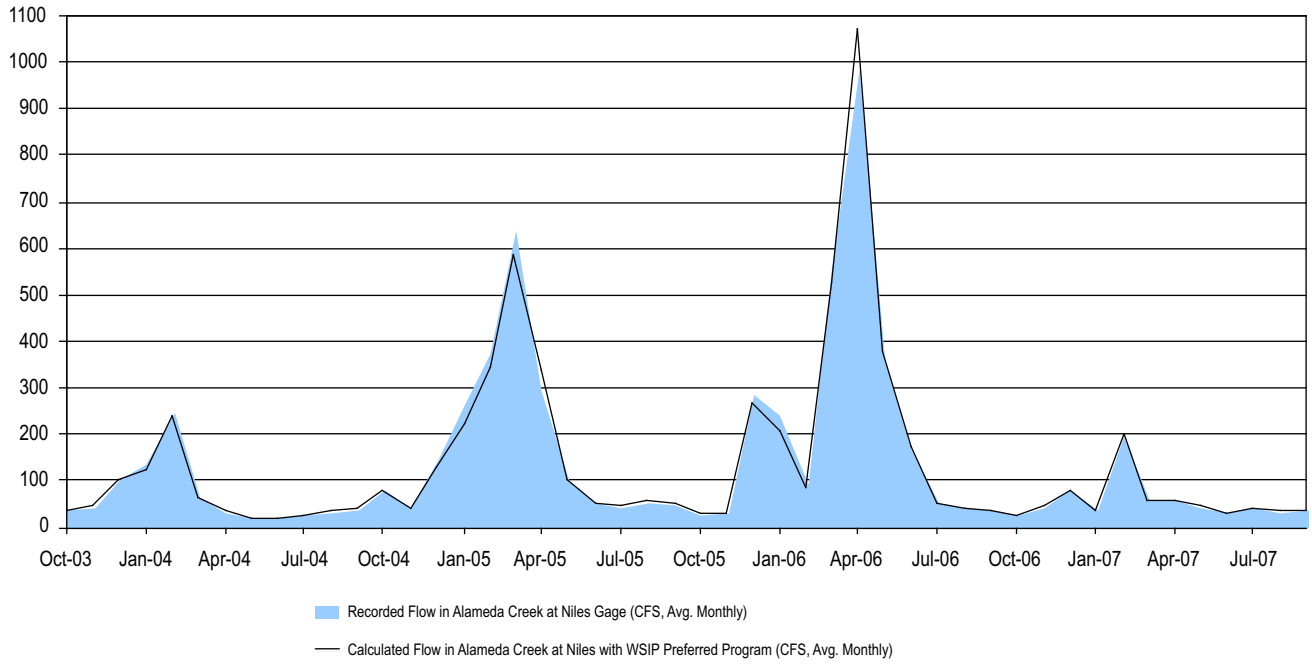
Increase of greater than 1%
Decrease of greater than 1%
Decrease of greater than 5%

NOTE: The portion of the table titled “Calculated Flow at Niles for Revised WSIP” represents the future condition with implementation of the WSIP. “Revised” WSIP refers to the 2008 updated modeling results, as discussed in Section 13.3 (Vol. 7).

SOURCE: Hydroconsult Engineers Inc., 2008 (see Appendix N)

The analysis shows that based on the historical hydrology from 2000 to 2007, reductions in flow in Alameda Creek at Niles Canyon would occasionally occur under the WSIP. Reductions of up to 18 percent in average monthly flow could occur in years similar to the past eight years of record. The maximum flow reduction would occur during January of an above-normal year, but a flow increase of 13 percent would occur in April of that same hydrologic year type. No changes in flow would occur in dry years, and minimal changes (up to 3 percent reductions) would occur in February of below-normal years. It should be noted that in 2000—an above-normal year—there would be an increase in flow of up to 20 percent under the WSIP; this year represents historical operating conditions prior to the DSOD operating restrictions placed on Calaveras Dam. The past eight years include four of the five hydrologic year types (only a wet year is absent). However, as shown in Table 14.9-5, the greatest flow changes under the WSIP would occur during normal and above-normal years, which are represented in the 2000–2007 data and are therefore included in this analysis.





Notes:

- WSIP conditions includes recapture of MOU flows released from Calaveras Dam.
- Years 2000 and 2001analysis includes a comparison of Base with Calaveras Up vs WSIP Proposed Program. DSOD restriction was implemented in
- Analysis for WSIP only, no other cumulative projects analyzed.

SOURCE: SFPUC Water System Improvement Program

Figure 14.9-3

Comparison of Average Monthly Flow at the Niles Gage, Recorded Flow versus WSIP Proposed Program

The impact conclusion for Impact 5.4.1-4 (Vol. 3, Chapter 5, p. 5.4.1-43) states: "Flow in Alameda Creek below the confluence of San Antonio Creek would be altered as a result of the WSIP in winter months of normal or wetter years; however, the change in flows would be substantially dampened by inflows from other tributaries in the Sunol Valley and would not result in adverse hydrologic effects." The analysis presented in this section corroborates and provides further supporting detail for this impact conclusion, and also estimates the dampening effect. The largest calculated decrease in flow in lower Alameda Creek would occur during January 2005, with a reduction in average monthly flow of 46 cfs, or 18 percent, of the average monthly flow recorded in January 2005. This corresponds to a reduction in upper Alameda Creek flow of 39 percent. Further review of the data reveals that flow reductions are predicted to occur in December through March of normal to wet years and in April of wet years, and to a small degree in February of below-normal years. In all other months, including winter months of below-normal years (with the exception of a slight decrease in February) and dry years, flow in upper Alameda Creek and at the Niles gage would either remain the same or would increase with implementation of the WSIP.

The calculated flows for lower Alameda Creek under the WSIP are within the range of current flows in this segment of the creek. Further, the flood control infrastructure and water supply facilities in lower Alameda Creek were constructed and operational well before the current DSOD restriction on Calaveras Reservoir required the SFPUC to reduce its diversions at the ACDD. The HH/LSM results indicate that, compared to the flow conditions in existence prior to the DSOD restriction on Calaveras Reservoir, flows in lower Alameda Creek under the WSIP would increase in winter months of normal to wet years (with the exception of slight decreases in March and April of wet years) and would remain the same in all other months of other year types. Therefore, implementation of the WSIP would not affect the operation of flood control infrastructure and water supply facilities in lower Alameda Creek.

The stream flow analysis for the lower 12-mile reach of Alameda Creek from downstream of Niles Canyon to the confluence with San Francisco Bay demonstrates that the WSIP would not affect steelhead passage, fisheries, or fish habitat during any month of a below-normal or drier year (see Table 14.9-5). The analysis also demonstrates that no WSIP-related impacts on steelhead passage, fisheries, or fish habitat would occur between April and November for normal or wetter years (Table 14.9-5). As the table shows, the maximum calculated reduction in flow would occur during the winter months of normal and wetter years (from 262 to 216 cfs), and these flows are within the range of recorded flows typical for this segment of Alameda Creek (from 28 to 638 cfs). The WSIP is therefore unlikely to affect steelhead passage, fisheries, or fish habitat in this reach. Draft PEIR Section 5.4.5.1 (Vol. 5, Chapter 5, pp. 5.4.5-9) discusses steelhead passage improvement projects for the flood control channel of Alameda Creek at the BART weir. Studies conducted on these potential improvement projects estimate that the minimum level of flow needed to ensure adult steelhead passage could range from 10 to 50 cfs for projects that involve total removal of the structure and restoration of a "roughened channel" as well as for projects that involve three ladder and screen options.

Therefore, the impact conclusion for Impact 5.4.5-6 (Draft PEIR, Vol. 3, Chapter 5, pp. 5.4.5-21 and 5.4.5-22) that "impacts on Alameda Creek below the confluence of San Antonio Creek would be less than significant, and no mitigation measures would be required" is supported by the additional analysis performed.

14.9.4 Steelhead – Future Fishery Scenario and Potential Cumulative Effects

Introduction

Several comments expressed concern that the Draft PEIR did not identify potential WSIP impacts under a future scenario in which steelhead have been restored to the reaches of Alameda Creek above the BART weir, as is expected to occur following the implementation of several proposed projects to remove current fish passage barriers. As discussed in the Draft PEIR (Vol. 3, Chapter 5, pp. 5.4.5-1 to 5.4.5-15) and in Section 14.9.2 of this master response, steelhead are precluded from naturally migrating to spawning habitat upstream of the BART weir under existing baseline conditions. In accordance with CEQA Guidelines Section 15125, the Draft PEIR assessed the WSIP's effects with respect to existing conditions in the program area, and therefore did not address potential effects on steelhead (or steelhead habitat) above the BART weir.

The Draft PEIR provides a full discussion of proposed plans to restore anadromous steelhead to Alameda Creek above the BART weir, including the many steps required, parties involved, and agreements in place to accomplish this goal (Vol. 3, Chapter 5, Section 5.4.5.1). The Draft PEIR discusses the planned restoration of steelhead above the BART weir and describes the SFPUC's active participation with other agencies to achieve steelhead restoration; as the PEIR states, once such restoration occurs, the SFPUC will comply with all applicable environmental regulations (FESA foremost among them) to ensure that its water system operations and watershed management practices incorporate conservation measures to protect steelhead. The SFPUC is engaged in consultation with the USFWS, NMFS, and CDFG to prepare a plan for FESA and California Endangered Species Act (CESA) compliance. This plan, called the Alameda Watershed HCP, will address the potential effects of SFPUC water system operations and watershed management activities on several listed species within the SFPUC's Alameda watershed lands, including steelhead. Thus, the SFPUC is actively engaged with the resource agencies in developing appropriate measures to protect this species once steelhead have been restored to this reach of the creek.

Although the presence of steelhead in Alameda Creek above the BART weir is not an "existing condition" as defined by CEQA, it is a possible future condition that could occur through the cumulative implementation of the many proposed projects and actions designed to restore steelhead in Alameda Creek. In response to the comments received on this issue, the Draft PEIR analysis of cumulative effects (Vol. 3, Chapter 5, pp. 5.7-52 to 5.7-67) has been revised to incorporate a discussion of potential WSIP impacts on future-occurring steelhead. This section of this master response provides an expanded discussion of the "future cumulative scenario" (which assumes that the steelhead fishery has been restored above the BART weir) and then discusses the

potential effects of the WSIP on potential future-occurring steelhead. Following this expanded discussion, specific text revisions to the Draft PEIR are identified.

The analysis of the WSIP's contribution to potential, cumulative effects (both positive and negative) on future-occurring steelhead is general because many uncertainties remain regarding how and when steelhead will be restored as well as the future environmental conditions that will be present in Alameda Creek at that time. Uncertainties regarding steelhead restoration include, but are not limited to the following: the way in which existing barriers to passage would be remedied in the future; the extent to which natural features act as barriers; and the extent to which the varying water resource operations of the water agencies in the overall Alameda Creek basin influence flows. Protective measures to address and minimize the WSIP's contribution to future cumulative effects on steelhead are included as part of the WSIP program description (incorporated as changes to the project descriptions of the Alameda Creek Fishery Enhancement, SV-1, and Calaveras Dam Replacement, SV-2, projects). As described in Section 14.9.1, above, such protective measures would include: SFPUC reservoir releases and bypass flows to support minimum instream flow requirements, operational modifications (reservoir diversion and release protocols), and monitoring/studying/surveying steelhead habitat below the ACDD. These measures demonstrate the SFPUC's commitment described in the Draft PEIR and the Comments and Responses documents—that the SFPUC would implement the necessary protective measures for steelhead once they are restored, in compliance with applicable environmental regulations including FESA and CESA.

This section of the master response is organized by the following subtopics:

- Future Cumulative Scenario for Steelhead
  - Introduction
  - Regulations, Plans, and Programs Related to Steelhead Recovery in the Watershed
  - Steelhead Life Stages and Habitat Requirements
  - Past and Present Projects Affecting Steelhead
  - Future Projects Influencing Future Habitat Conditions for Steelhead
- Cumulative Impact Assessment for Potential Future-Occurring Steelhead
  - Changes in Habitat Conditions from Future Cumulative Projects
  - Potential Future Cumulative Impacts on Steelhead
    - Migration
    - Spawning
    - Rearing
- PEIR Text Revisions to Include Cumulative Impact on Future-Occurring Steelhead

Comment Summary

This section of this master response responds to all or part of the following comments:

L_ACFCWCD-06	L_ACWD-20	SI_ACA1-12	SI_ACA2-01
L_ACFCWCD-09	SI_ACA1-02	SI_ACA1-13	SI_GWWF2-02
L_ACFCWCD-13	SI_ACA1-03	SI_ACA1-16	SI_NCFFSC-03
L_ACFCWCD-15	SI_ACA1-04	SI_ACA1-19	
L_ACWD-18	SI_ACA1-05	SI_ACA1-20	
L_ACWD-19	SI_ACA1-08	SI_ACA1-25	

Summary of Issues Raised by Commenters

- The effects of the WSIP combined with proposed fish passage improvement projects and steelhead restoration to the upper watershed are not adequately addressed.
- Additional diversions under the WSIP would result in the "take" of listed species through reduced passage and increased temperatures.
- The Draft PEIR contains insufficient information to support the contention that mitigation measures would reduce impacts to a less-than-significant level.
- Specific flow information is required for adequate mitigation of impacts on steelhead passage, spawning, and juvenile rearing.
- Issues related to releases required under two memoranda of understanding: the 1997 CDFG MOU and 2006 ACFRW MOU.
- Relationship of the Draft PEIR assessments to the Calaveras Dam Replacement project-level assessments is unclear.
- The impacts of Calaveras Dam on steelhead/trout in 2010–2012 are not speculative.

Response

Future Cumulative Scenario for Steelhead

Introduction

As described briefly above, it is possible that steelhead could be restored to the Alameda Creek watershed reaches upstream of the BART weir by 2030, the WSIP planning horizon. More specifically, steelhead could be restored during construction or operation of the Calaveras Dam project. In response to this scenario, the SFPUC has modified the project descriptions for components of the proposed program—the Alameda Creek Fishery Enhancement (SV-1) and Calaveras Dam Replacement (SV-2) projects—to recognize this potential for future steelhead restoration, as summarized in Section 14.9.1, above. The modifications to these projects include project revisions that would be implemented regardless of the success of planned and proposed projects to restore steelhead to the upper Alameda Creek watershed, as well as protective measures that would be implemented in the event that the NMFS and/or CDFG have determined steelhead to be present in Alameda Creek above the BART weir, construction of the Calaveras Dam Replacement project is complete, and the Alameda Watershed HCP has yet to be finalized. As summarized in Section 14.9.1, the protective measures have been incorporated into the

Calaveras Dam Replacement project component of the WSIP to address potential effects on steelhead in the event that planned and proposed projects to remove man-made barriers in Alameda Creek are successfully implemented and anadromous steelhead gain access to the upper Alameda Creek watershed. The WSIP's potential contribution to future cumulative effects on steelhead is evaluated here with respect to steelhead life-stage and habitat requirements in the various reaches of Alameda Creek.

The future cumulative scenario for the steelhead fishery in Alameda Creek assumes implementation of all necessary proposed projects and actions to remove the existing fish passage and migration barriers for steelhead, from the BART weir up to spawning and rearing habitats in the upper reaches of Alameda Creek. Under this future cumulative scenario, steelhead are assumed to be present in Alameda Creek above the BART weir. A more detailed discussion of this potential future scenario follows, including: a summary of the regulations, plans, and programs related to steelhead recovery in the Alameda watershed; a review of steelhead life stages and habitat requirements; and the expected future habitat conditions for steelhead following the removal of passage barriers.

This assessment of future conditions does not describe: the specifics of any barrier removal/bypass projects (since no specific adopted designs/plans are available); what flow requirements for reservoir releases, bypass flows at the ACDD, or flows through fish ladders might be adopted; or when (and if) the projects would be undertaken. Thus, this future cumulative scenario is based on a fair degree of speculation, but the information available at this time allows for a general framing of potential future conditions and discussions of the potential WSIP contribution to future cumulative effects.

Regulations, Plans, and Programs Related to Steelhead Recovery in the Watershed

Draft PEIR Section 5.4.5 (Vol. 3, Chapter 5, p. 5.4.5-4) includes a discussion of the regulatory status of steelhead in the Alameda Creek watershed, and Section 5.2 (Vol. 3, Chapter 5, pp. 5.2-1 to 5.2-26) provides an overview of plans and policies relevant to the management of the SFPUC's water supply and system operations, including regulations, policies, plans, and programs related to steelhead recovery in the watershed. Comments on the Draft PEIR expressed concern regarding the take of listed species (defined below under Federal Endangered Species Act) as a result of WSIP implementation. The following information on regulations, plans, and programs related to steelhead recovery augments the information presented in the Draft PEIR.

Federal Endangered Species Act. Pursuant to FESA, the USFWS and NMFS have authority over projects that may result in the take of a federally listed species. Under FESA, "take" means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." The USFWS has also interpreted the definition of "harm" to include significant habitat loss or modification. If a project could affect a federally listed species, either an incidental take permit under FESA Section 10(a) or a federal interagency consultation under FESA Section 7 is required. The USFWS has regulatory jurisdiction over freshwater and estuarine fishes as well as all terrestrial vegetation and wildlife, while the NMFS has jurisdiction over anadromous and marine species, including steelhead.

The NMFS has not designated the Alameda Creek watershed as critical habitat for steelhead, and has listed as threatened only those steelhead that currently exist below the lowest impassable barriers in the Alameda Creek watershed (i.e., the BART weir). Thus, the resident rainbow trout that occur in the creek above the BART weir are not designated as a listed species and are not proposed for listing. However, the NMFS has advised that the designation of critical habitat would be open to further evaluation if and when anadromous steelhead obtain passage to upper Alameda Creek (as discussed in Section 14.9.2, above). As noted, this cumulative impact assessment is based on the assumption that steelhead will regain access to the Alameda Creek watershed in the future.

Alameda Creek Fisheries Restoration Workgroup. The ACFRW is a multi-agency stakeholder group formed in 1999 to pursue the restoration of steelhead to Alameda Creek. The ACFRW is composed of numerous community and citizens' groups, local water management and flood control agencies, and state and federal resource agencies, including the SFPUC.

With funding from the ACFCWCD and the California Coastal Conservancy, the ACFRW published a report entitled *An Assessment of the Potential for Restoring a Viable Steelhead Trout Population in the Alameda Creek Watershed* (Gunther et al., 2000). The report found that suitable habitat exists in the watershed to support steelhead spawning and rearing, but that several barriers in the lower portion of the watershed completely prevent adult migration upstream. It concluded that making these barriers passable was essential to steelhead restoration in Alameda Creek, and made recommendations to address migration and other steelhead restoration issues in the watershed.

The ACFRW has identified the need to implement passage barrier modification projects, install positive-barrier fish screens at water diversion points, modify instream flows within the four reaches of Alameda Creek, and implement proposed riparian corridor improvements and possibly a steelhead supplementation program. The Draft PEIR discusses the ACFRW's Memorandum of Understanding (2006 ACFRW MOU) to perform steelhead flow studies, the various phases and elements of the studies, and the development of the Alameda Watershed HCP (Vol. 3, Chapter 5, pp. 5.4.5-10 and 5.4.5-11).

SFPUC Alameda Watershed Habitat Conservation Plan. The SFPUC, working with the CDFG, USFWS, and NMFS, is in the process of developing an HCP for its portion of the Alameda Creek watershed in compliance with FESA and CESA. Steelhead is a covered species in the HCP, which is scheduled for public review in 2009. The plan will require preparation of a joint environmental impact report/environmental impact statement (EIR/EIS) before the SFPUC can consider adoption and begin implementation of the HCP conservation strategies. The HCP will be the primary plan in which the SFPUC and regulatory agencies lay out the program and requirements for the restoration of steelhead and other fish species in the watershed affected by SFPUC operations.

SFPUC Water Enterprise Environmental Stewardship Policy. As described in the Draft PEIR (Vol. 3, Chapter 5, pp. 5.2-24 and 5.2-25), the Water Enterprise Environmental Stewardship Policy was adopted in June 2006 and established the long-term management direction for the City and County of San Francisco's lands and natural resources affected by operation of the SFPUC

regional water system within the Tuolumne River, Alameda Creek, and Peninsula watersheds. The policy includes the following points specifically relevant to the fishery issues in the Alameda Creek watershed:

- It is the policy of the SFPUC to operate the SFPUC water system in a manner that protects and restores native fish and wildlife downstream of SFPUC dams and water diversions, within SFPUC reservoirs, and on SFPUC watershed lands.

- Releases from SFPUC reservoirs will (consistent with the SFPUC mission, existing agreements, and applicable state and federal laws) mimic the variation of the seasonal hydrology (e.g., magnitude, timing, duration, and frequency) of their corresponding watersheds in order to sustain the aquatic and riparian ecosystems upon which these native fish and wildlife species depend (consistent with the SFPUC mission, existing agreements, and applicable state and federal laws).

The Environmental Stewardship Policy calls for specific integration of this policy into the WSIP and individual infrastructure projects.

Steelhead Life Stages and Habitat Requirements

A summary of steelhead life stages (e.g., migration, spawning, rearing) and habitat requirements is provided in the Draft PEIR (Vol. 3, Chapter 5, pp. 5.4.5-4 to 5.4.5-7). The following discussion augments the Draft PEIR discussion and focuses on different steelhead life-stage and habitat requirements in the Alameda Creek watershed. This information was derived from studies/ assessments of steelhead recovery in the Alameda Creek watershed, including the following:

- *Alameda Creek Population Recovery Strategies and Instream Flow Assessment for Steelhead Trout* (McBain and Trush, 2007)

- *An Assessment of the Potential for Restoring a Viable Steelhead Trout Population in the Alameda Creek Watershed* (Gunther et al., 2000)

As previously described, steelhead have a highly flexible and complex life history and may follow a variety of life-history patterns and strategies. Historical (pre-1900s) steelhead life-history strategies in the Alameda Creek watershed likely occurred within two broad categories: (1) fry were born in the upper tributaries and reared for one or two years, then migrated rapidly to San Francisco Bay, and (2) following emergence in the upper tributaries, the fry moved downstream and reared in the mainstem and/or Niles Canyon before entering the estuary and San Francisco Bay (McBain and Trush, 2007). The success of a given strategy likely varied from year to year and depended on several factors (e.g., precipitation, flow, temperature, food availability). Historically, headwater tributaries likely contributed large steelhead smolts to San Francisco Bay, especially during consecutive wet years, but many additional large smolts were likely produced by slower migrating juveniles that grew on their way downstream through the mainstem channels before smolting and entering the Alameda Creek estuary and then San Francisco Bay.

A critical period occurs during juvenile freshwater residency. Juvenile fish may remain in the watershed from less than a year to more than two years. Those residing in freshwater and/or an estuary for less than a full year from the time of egg deposition are called “0+ juveniles.”

Juveniles that spend one complete winter in freshwater and/or an estuary are termed "1+ juveniles," and those remaining for two complete winters in freshwater and/or an estuary are called "2+ juveniles." Prior to entering the Pacific Ocean, all juveniles physiologically transform into ocean salt-tolerant smolts. Smolts mature into adults and may remain in the Pacific Ocean from one to three years (or more) before returning to their natal streams to spawn. In California, most adult steelhead returning to spawn have spent at least one full winter rearing as juveniles (i.e., as 1+ juveniles) in their natal watershed (McBain and Trush, 2007).

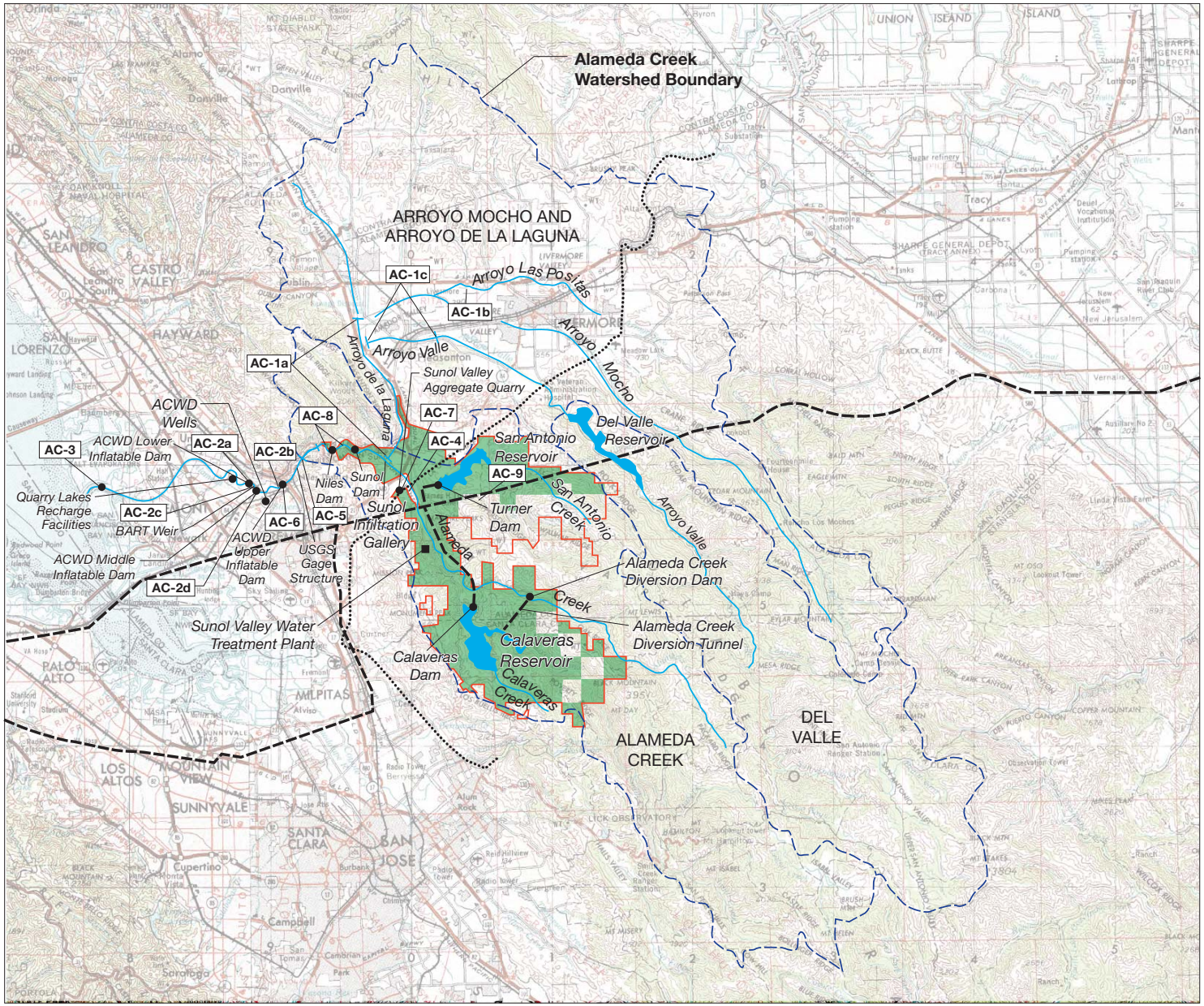
Often, each unique period of juvenile freshwater residency (i.e., staying less than a year, more than one full year, and slightly more than two full years in the watershed) is considered a separate life-history strategy. While these categories are helpful, they do not sufficiently differentiate patterns of watershed use. For example, a juvenile steelhead spending one winter in Alameda Creek (a 1+ juvenile) might reside high in the headwaters then migrate rapidly to San Francisco Bay, or it might move far downstream shortly following emergence to spend the entire winter in Niles Canyon (if suitable conditions exist) before migrating to San Francisco Bay in late spring. Both would enter San Francisco Bay as 1+ smolts, but their strategies for utilizing the watershed would have been fundamentally different (McBain and Trush, 2007).

A key factor in determining steelhead survival and recovery success is the growth of juveniles during freshwater residency and smolt transition. Fish size at smolting is important to steelhead survival, and big smolts are much more likely to return as spawning adults than small smolts (McBain and Trush, 2007). Growth rates during the juvenile rearing period are greatly influenced by both the availability (e.g., access and quantity) and quality (e.g., favorable water temperature and forage availability) of oversummer rearing habitat in the Alameda Creek watershed.

Past and Present Projects Affecting Steelhead

As presented in the Draft PEIR (Vol. 3, Chapter 5, pp. 5.4.5-7 to 5.4.5-10 and pp. 5.7-52 to 5.7-53), a number of existing facilities (i.e., past and present projects) under the jurisdiction of the SFPUC, the ACWD, Zone 7 Water Agency, and the ACFCWCD, among others, affect hydrological and fishery habitat conditions in the Alameda Creek watershed. Many of these structures and facilities have been in existence for well over 80 years and have resulted in substantial changes to the natural conditions that existed prior to the original construction of Calaveras Dam in 1913, when a steelhead run is presumed to have been present throughout the basin. Although built in the past, these facilities (as well as other influences) continue to operate and affect both current habitat conditions and future cumulative scenario conditions for potential future-occurring steelhead in the Alameda Creek watershed. Some of these are direct barriers to fish migration, while others pose various degrees of control/influence over habitat conditions. As shown in Draft PEIR **Figure 5.7-3** (as revised below), the major facilities and other factors affecting fish passage (separated by watershed and/or reach) outlined by Gunther et al. (2000) include:

- *Upper Alameda Creek*:
  - Calaveras Dam and Reservoir
  - Alameda Creek Diversion Dam and Tunnel



- Watershed Boundary
- Existing SFPUC System Corridor
- AP-1 Other SFPUC Project
- AC-1 Non-SFPUC Project
- CCSF Ownership (also project boundary for AP-1, AP-2, AP-3)
- HCP Study Area (also project boundary for AP-1a)
- DWR South Bay Aqueduct

See Draft PEIR Table 5.7-13 for names and descriptions of projects

Cumulative Project No.	Plan/Project Name
OTHER SFPUC PROJECTS (not shown on figure as watershed wide)	
AP-1	Alameda Watershed Management Plan (WMP)
AP-1a	Alameda Watershed Habitat Conservation Plan (sub-project of Alameda WMP)
AP-2	Watershed and Environmental Improvement Program (WSIP-related activity)
AP-3	Habitat Reserve Program (WSIP-related activity)
NON-SFPUC PROJECTS	
AC-1	Zone 7 Stream Management Master Plan (SMMP)
AC-1a	Arroyo de la Laguna Reach 10 Improvements (sub-project of Zone 7 SMMP)
AC-1b	Chain of Lakes (sub-project of Zone 7 SMMP)
AC-1c	Lower Arroyo del Valle Restoration and Enhancement (sub-project of Zone 7 SMMP)
AC-2	Alameda Creek Steelhead Restoration
AC-2a	Rubber Dam 2 Decommissioning and Foundation Modification Project (sub-project of Alameda Creek Steelhead Restoration)
AC-2b	Alameda Creek Pipeline No. 1 Fish Screen (sub-project of Alameda Creek Steelhead Restoration)
AC-2c	BART Weir (sub-project of Alameda Creek Steelhead Restoration Efforts)
AC-2d	Middle Inflatable Dam Modification
AC-3	Alameda Creek – Levee Reconfiguration
AC-4	PG&E Gas Line Crossing
AC-5	Stonybrook Creek Culvert Removal
AC-6	Upper Inflatable Dam Fish Passage Project
AC-7	Sunol Valley Aggregate Quarry – SMP 30
AC-8	Section 1135 Alameda Creek Flood Control Project Fish Passage Modifications
AC-9	Apperson Ridge Quarry

SOURCE: ESA + Orion

0 20 Miles

SFPUC Water System Improvement Program . 203287

Figure 5.7-3 (Revised)
Future Projects in the Alameda Creek Watershed Considered in the Cumulative Analysis

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  - Sunol Valley aggregate quarries and the associated relocation and channelization of Alameda Creek
  - PG&E gas line crossing
  - Turner Dam and San Antonio Reservoir
  - Sunol infiltration galleries

- *Niles Canyon*:
  - USGS gage structure

- *Arroyo de la Laguna watershed*:
  - Del Valle Reservoir/South Bay Aqueduct, including State Water Project releases
  - Livermore/Amador Valley/Quarry Lakes recharge facilities
  - Various channelized and culverted stream segments
  - Expansion of urban development of the Tri-Valley Area

- *Lower Alameda Creek*:
  - ACWD's upper, middle, and lower inflatable dams
  - BART weir
  - Alameda Creek levee reconfiguration

All of these facilities, combined with urbanization and other land use activities, have resulted in substantial alteration of habitat conditions for potential future-occurring steelhead in the watershed. In 2006, the SFPUC removed two historic structures—the Niles and Sunol Dams, both located on Alameda Creek below the Sunol quarries. While some influence on the creek channel due to these dams may remain, they have been removed entirely as barriers to fish migration.

Future Projects Influencing Future Habitat Conditions for Steelhead

The reasonably foreseeable future projects that could affect conditions for potential future-occurring steelhead in the Alameda Creek watershed are presented in Draft PEIR Section 5.7.3 and are summarized in Table 5.7-13 and Figure 5.7-3 (Vol. 3, Chapter 5, pp. 5.7-53 to 5.7-60). These projects include removing/modifying dams, weirs, culverts, and pipelines that block fish passage; installing positive-barrier fish screens at water diversions; constructing slurry cutoff walls in quarry pits to reduce losses to groundwater; and restoring and protecting habitat and instream flows. While these identified future projects are considered reasonably foreseeable for the purposes of this analysis, there remains uncertainty regarding their implementation due to unknowns such as funding or permitting issues. Of particular importance to this analysis are proposals to remove or bypass several fish migration barriers in the watershed. The future projects included in this analysis and their planning status are described in Draft PEIR Section 5.7.3. In response to comments, several revisions and updates have been made to the future projects that would influence habitat conditions for steelhead in the Alameda Creek watershed. These revisions to future projects are presented here and were used in establishing the future baseline condition for assessing the effects of the WSIP on future-occurring steelhead upstream of the BART weir.

A comment received on the Draft PEIR regarding future fish passage improvement projects indicated that, subsequent to publication of the Draft PEIR, the ACFCWCD and ACWD entered into an agreement (on July 31, 2007) to design a fish passage facility over the BART weir and the middle inflatable dam in the Alameda County Flood Control Channel. In response to this comment, the Draft PEIR (Vol. 3, Chapter 5, p. 5.4.5-9, first bullet) is amended as follows:

- Alameda County Flood Control and Water Conservation District's BART Weir – several studies have been conducted regarding potential designs to provide passage at this location. The most recent effort is a report (Wood Rogers, 2006) that outlines options ranging from total removal of the structure ("roughened channel") to three ladder and screen alternatives. The range of low flows estimated to allow suitable passage for adult steelhead among these four options is 10–50 cfs. However, other barriers (e.g., ACWD middle and upper rubber dams, PG&E Drop Structure – see below) within Alameda Creek may be impassable at these low flows. ~~There is currently no schedule or budget for this project, and environmental review has yet to begin.~~ On July 31, 2007, the Alameda County Flood Control and Water Conservation District and the Alameda County Water District entered into an agreement to design a fish passage facility over the BART weir and the middle inflatable dam in the Alameda County Flood Control Channel to improve steelhead passage within the Alameda Creek watershed.

Cumulative Impact Assessment for Potential Future-Occurring Steelhead

The following analysis evaluates the WSIP's potential contribution to effects on future-occurring steelhead in combination with past, present, and probable future projects, including other SFPUC and non-SFPUC projects or activities under the jurisdiction of various federal, state, and local agencies that have the potential to affect steelhead recovery in the watershed. The project description changes summarized above include protective measures for future-occurring steelhead in Alameda Creek above the BART weir that are proposed as part of the Calaveras Dam Replacement project, as well as Mitigation Measures 5.4.1-2 and 5.4.5-3a identified in the Draft PEIR. These protective measures and mitigation measures are summarized in Section 14.9.1, above.

Changes in Habitat Conditions from Future Cumulative Projects

A characterization of habitat conditions for steelhead under existing conditions and the projected future cumulative scenario, based on an analysis of past, present, and probable future projects, is provided below. Alameda Creek has historically been divided into three distinct reaches: lower Alameda Creek, Niles Canyon, and upper Alameda Creek. This section provides a description of habitat conditions within each of these three reaches.

Table 14.9-6 presents a summary of existing conditions along Alameda Creek with the current fish passage barriers in place and with Calaveras Reservoir and the ACDD operating under DSOD-restricted conditions, and summarizes the stream and habitat conditions for three different steelhead life stages under two scenarios:

1. A future scenario *without* implementation of the WSIP (i.e., specifically the Calaveras Dam Replacement and Alameda Creek Fishery Enhancement [recapture facility] projects). This scenario assumes that all planned and proposed projects to improve fish passage in the

TABLE 14.9-6
SUMMARY OF ALAMEDA CREEK STEELHEAD HABITAT USE AND CONDITION
UNDER FUTURE CUMULATIVE WITHOUT WSIP AND FUTURE CUMULATIVE WITH WSIP SCENARIOS

Alameda Creek Reach (moving upstream)	Existing Condition	Assumed Future Condition without WSIP[a]				Assumed Future Condition with WSIP and Measures to Address Potential Impacts[b]			
	Stream Condition (Steelhead do not have access to Alameda Creek above the BART weir under the Existing Condition)	Stream Condition	Life Stage Habitat Use and Condition[b]			Stream Condition	Life Stage Habitat Use and Condition[c]		
			Migration	Spawning	Rearing		Migration	Spawning	Rearing
Lower Alameda Creek (Flood Control Channel) – from San Francisco Bay to mouth of Niles Canyon	• Concrete-lined flood control channel • BART weir acts as complete barrier to migration; ACWD dams are also major migration obstacles • High summer temperatures • Substrate has high silt component • Intermittent flow in summer • High winter flows with limited diversion in normal/wet and wet years	• Fish passage restored upstream of BART weir and ACWD inflatable dams • No change to habitat conditions in this reach • Possible increased surface flow from upstream improvements at Sunol quarries	PRESENT	ABSENT	ABSENT/ LIMITED	• Fish passage restored upstream of BART weir and ACWD inflatable dams • No change to habitat conditions in this reach • Calaveras Dam Replacement project / WSIP would increase diversions to Calaveras Reservoir, implement releases from ACDD or Calaveras Dam consistent with the 1997 MOU, and recapture releases also consistent with the 1997 MOU. It would result in reduced stream flow in lower Alameda Creek in winter months of normal/wet and wet years (up to 18%); minimal change during below-normal and dry years.	PRESENT	ABSENT	ABSENT/ LIMITED
Niles Canyon – from mouth of Niles Canyon to confluence with Arroyo de la Laguna	• Confined channel with steep canyon walls • Well-developed riparian zone • Low-gradient perennial stream • Large deep pools, connected by run and riffle habitat • High summer temperatures • Serves as conveyance for water supply from South Bay Aqueduct • USGS gage acts as obstacle to migration under moderate to low flow conditions	• Fish passage restored at USGS gage for all flow conditions • Possible increased surface flow from upstream improvements at Sunol quarries • Improved rearing habitat through cool-water thermal buffering	PRESENT	PRESENT/ LIMITED	LIMITED	• Fish passage restored at USGS gage for all flow conditions • Calaveras Dam Replacement project / WSIP would increase diversions to Calaveras Reservoir, implement releases from ACDD or Calaveras Dam consistent with the 1997 MOU, and recapture releases also consistent with the 1997 MOU. It would result in reduced stream flow in lower Alameda Creek in winter months of normal/wet and wet years (up to 18%); minimal change during below-normal and dry years. • Improved rearing habitat through cool-water thermal buffering	PRESENT	PRESENT/ LIMITED	LIMITED
Upper Alameda Creek (General) – from confluence with Arroyo de la Laguna and upstream	• Fish passage limited by Turner Dam, Little Yosemite, Alameda Creek Diversion Dam, Calaveras Dam • Spawning and rearing habitat influenced by SFPUC dam operations and releases	• Downstream passage improvements increase potential for migration to upper reaches • Fish passage limited by Turner Dam, Little Yosemite, Alameda Creek Diversion Dam, Calaveras Dam • Spawning and rearing habitat influenced by SFPUC dam operations and releases	(see reach-by-reach below)	(see reach-by-reach below)	(see reach-by-reach below)	• Downstream passage improvements increase potential for migration to upper reaches • Calaveras Dam Replacement project / WSIP would increase diversions to Calaveras Reservoir and implement fish releases consistent with 1997 MOU. WSIP would include downstream recapture of those releases at downstream end of Reach A-1. • Fish passage limited by Turner Dam, Little Yosemite, Alameda Creek Diversion Dam, Calaveras Dam • Spawning and rearing habitat influenced by SFPUC dam operations and releases	(see reach-by-reach below)	(see reach-by-reach below)	(see reach-by-reach below)
A-1 – from confluence with Arroyo de la Laguna to lower Sunol Valley (near Sunol WTP)	• Wide, low-gradient, alluvial valley • Intermittent flows • Natural channel relocated due to gravel mining operations • "Losing" reach – up to 36% seepage of surface water from Alameda Creek to gravel mining pits, infiltration galleries, etc. • Warmwater fish habitat • Trout likely not present in reach • PG&E pipeline crossing acts as obstacle to migration • Migration impeded at several locations (critical riffles) at low flows	• Downstream passage barriers removed and fish passage restored • Historical channel realigned • Improved stream flow conditions due to reduced surface and groundwater losses with construction of slurry cutoff walls (but would remain a naturally "losing" reach) • Fish passage provided at the PG&E pipeline crossing • Critical riffles present within the segment of Alameda Creek adjacent to the Sunol quarry (SMP 30) would be enhanced through restoration of the stream channel associated with Sunol quarry permit renewal	PRESENT	LIMITED	ABSENT/ LIMITED	• Downstream passage barriers removed and fish passage restored • Historical channel realigned • Improved stream flow and habitat conditions due to reduced surface and groundwater losses with construction of slurry cutoff walls (but would remain "losing" reach) and stream habitat restoration • Intermittent stream flow • Warmwater fish habitat • Calaveras Dam Replacement project / WSIP would increase diversions to Calaveras Reservoir and implement fish releases consistent with 1997 MOU. WSIP would include downstream recapture of those releases at downstream end of Reach A-1. This would result in substantially reduced normal/wet and wet year winter stream flows in this reach (up to 45%), which would adversely affect migration.	PRESENT	LIMITED/ PRESENT	ABSENT/ LIMITED

TABLE 14.9-6 (continued)
SUMMARY OF ALAMEDA CREEK STEELHEAD HABITAT USE AND CONDITION
UNDER FUTURE CUMULATIVE WITHOUT WSIP AND FUTURE CUMULATIVE WITH WSIP SCENARIOS

Alameda Creek Reach (moving upstream)	Existing Condition	Assumed Future Condition without WSIP[a]				Assumed Future Condition with WSIP and Measures to Address Potential Impacts[b]			
	Stream Condition (Steelhead do not have access to Alameda Creek above the BART weir under the Existing Condition)		Life Stage Habitat Use and Condition[b]				Life Stage Habitat Use and Condition[c]		
		Stream Condition	Migration	Spawning	Rearing	Stream Condition	Migration	Spawning	Rearing
A-1 (cont.)		• Intermittent stream flow • Warmwater fish habitat				• Calaveras Dam Replacement project / WSIP would provide for releases to augment flows to support fisheries consistent with the 1997 MOU, and releases would improve habitat conditions upstream of recapture			
A-2 – from lower Sunol Valley to confluence with Calaveras Creek	• Confined stream channel • Well-developed riparian zone • Pool, run, and riffle habitat present • Intermittent stream flow in dry years • High summer temperatures favor warmwater fish • Flows influenced by Calaveras Dam and Alameda Creek Diversion Dam operations under DSOD-restricted conditions • Rearing habitat influenced by operation of Calaveras Dam and Alameda Creek Diversion Dam	• No projects planned in this reach • Downstream passage barriers removed and fish passage restored	PRESENT	PRESENT	ABSENT/ LIMITED	• Downstream passage barriers removed and fish passage restored • Calaveras Dam Replacement project / WSIP implementation would: – Restore historical flow diversions at diversion dam to Calaveras Reservoir and storage in Calaveras Reservoir – Reduce high winter stream flows in normal/wet and wet years (up to 45%); remaining relatively moderate to high flows would enable migration – Provide for releases to augment flows at upstream end of this reach to support fisheries consistent with 1997 MOU – WSIP would include downstream recapture of 1997 MOU releases at downstream end of Reach A-1 – Improve habitat conditions upstream of recapture • Summer coldwater habitat conditions improved in Alameda Creek from the Calaveras Creek confluence to approximately 2 miles downstream	PRESENT	PRESENT (improved due to 1997 MOU releases)	PRESENT (improved due to 1997 MOU releases)
A-3 – from confluence with Calaveras Creek to point upstream of Little Yosemite	• Steep, confined stream channel • Warmwater and coldwater fish habitat present • Steep bedrock/falls/gradient limit fish passage • Passage impeded by steep bedrock falls at Little Yosemite • Diversion dam operations affect winter and spring stream flow, which has substantially increased since DSOD restriction on Calaveras Reservoir	• No projects planned in this reach • Downstream passage barriers removed • Passage impeded by steep bedrock falls at Little Yosemite	LIMITED, only during specific flows (natural barriers)	PRESENT	PRESENT	• No projects planned in this reach • Downstream passage barriers removed • Passage impeded by steep bedrock falls at Little Yosemite • Calaveras Dam Replacement project / WSIP implementation would restore historical flow diversions to Calaveras Reservoir and would reduce magnitude and frequency of flows • PEIR mitigation for bypass flows at diversion dam would provide minimum flows for resident trout	LIMITED, only during specific flows (natural barriers)	PRESENT	PRESENT
A-4 – from Little Yosemite to Alameda Creek Diversion Dam	• Steep gradient channel sections impede passage • Fragmented habitat under low flow conditions • Dry stream sections in summer • Alameda Creek Diversion Dam and Tunnel operations heavily influence flows and habitat conditions	• No projects planned in this reach • Downstream passage barriers removed	LIMITED, only during specific flows (natural barriers)	PRESENT	LIMITED	• No projects planned in this reach • No change to future scenario habitat conditions other than downstream passage barriers removed and WSIP • Calaveras Dam Replacement project / WSIP implementation would restore historical flow diversions to Calaveras Reservoir but mitigation for bypass flows at diversion dam would provide minimum flows for resident trout	LIMITED, only during specific flows (natural barriers)	PRESENT with mitigation for trout minimum flows (PEIR Measure 5.4.5-3a)	LIMITED
A-5 – from Alameda Creek Diversion Dam to Camp Ohlone	• Steep gradient sections impede passage • Fragmented habitat • Dry stream sections in summer • Steelhead access excluded by Alameda Creek Diversion Dam	• No projects planned in this reach • Downstream passage barriers removed • Migration, spawning, and rearing habitat conditions would remain unchanged	N/A (barrier at ACDD would remain)	N/A (barrier at ACDD would remain)	N/A (barrier at ACDD would remain)	• No projects planned in this reach • Migration, spawning, and rearing habitat conditions would remain unchanged • Calaveras Dam Replacement project / WSIP implementation would not affect this reach • Steelhead access still precluded by ACDD	N/A (barrier at ACDD would remain)	N/A (barrier at ACDD would remain)	N/A (barrier at ACDD would remain)

TABLE 14.9-6 (continued)
SUMMARY OF ALAMEDA CREEK STEELHEAD HABITAT USE AND CONDITION
UNDER FUTURE CUMULATIVE WITHOUT WSIP AND FUTURE CUMULATIVE WITH WSIP SCENARIOS

Alameda Creek Reach (moving upstream)	Existing Condition	Assumed Future Condition without WSIP[a]				Assumed Future Condition with WSIP and Measures to Address Potential Impacts[b]			
	Stream Condition (Steelhead do not have access to Alameda Creek above the BART weir under the Existing Condition)	Stream Condition	Life Stage Habitat Use and Condition[b]			Stream Condition	Life Stage Habitat Use and Condition[c]		
			Migration	Spawning	Rearing		Migration	Spawning	Rearing
C-1 – Calaveras Creek from confluence with Alameda Creek to Calaveras Dam	• Deep pool, run, and riffle habitat present • Stream flow heavily influenced by Calaveras Dam operations • Water temperature influenced by temperatures of reservoir releases • Habitat values marginal for steelhead due to steep topography, isolated pools, altered stream hydrology • Rainbow trout not present	• No projects planned in this reach • No change to future scenario habitat conditions other than WSIP / Calaveras Dam Replacement project	LIMITED (barrier at dam)	LIMITED	LIMITED/ ABSENT	• Calaveras Dam Replacement project / WSIP implementation would restore operations of Calaveras Dam and include fish releases to achieve flow conditions at confluence consistent with 1997 MOU	LIMITED (barrier at replacement dam)	LIMITED	PRESENT
C-2, AH-1 – Calaveras Creek and Arroyo Hondo upstream of Calaveras Reservoir	• Calaveras Creek lacks hydrologic connection with Calaveras Reservoir at lowermost segment of creek • Calaveras Reservoir provides habitat for trout and warmwater fishes • Arroyo Hondo has good habitat/connectivity for 1.8 miles upstream of the reservoir • Steelhead access precluded by Calaveras Dam	• No projects planned in this reach	N/A (barrier at Calaveras Dam would remain)	N/A (barrier at Calaveras Dam would remain)	N/A (barrier at Calaveras Dam would remain)	• Calaveras Dam Replacement project / WSIP would restore historical operating levels and improve coldwater pool in Calaveras Reservoir • Improved connectivity of Arroyo Hondo and Calaveras Creek with Calaveras Reservoir • Steelhead access still precluded by dam	N/A (barrier at replacement dam)	N/A (barrier at replacement dam)	N/A (barrier at replacement dam)

NOTES: See Figure 14.9-4 for the location of reaches.

[a] Future cumulative condition assumes that planned and proposed projects to improve fish passage in the Alameda Creek watershed would be successfully implemented such that anadromous steelhead have access to the upper Alameda Creek watershed, but flow conditions would be the same as under existing conditions (Alameda Creek Diversion Dam and Calaveras Reservoir operations with DSOD restrictions).

[b] Future cumulative condition assumes that planned and proposed projects to improve fish passage in the Alameda Creek watershed would be successfully implemented such that anadromous steelhead have access to the upper Alameda Creek watershed. In addition, it assumes that the proposed WSIP water supply and system operations modifications would be implemented, including construction and operation of the Calaveras Dam Replacement and Alameda Creek Fishery Enhancement projects. Further, it assumes that identified direct impacts of the WSIP would be mitigated and assumes implementation of Draft PEIR Mitigation Measures 5.4.1-2 (Diversion Tunnel Operation) and 5.4.5-3a (Minimum Flows for Resident Trout on Alameda Creek) and 5.4.5-3b (Alameda Creek Diversion Dam Restrictions or Fish Screens).

[c] ABSENT denotes habitat not present in reach to support life stage. LIMITED denotes habitat present to support life stage during periods of the year, but limited by seasonal low flows and/or high summer temperatures; marginally suitable. PRESENT denotes habitat present to support life stage. N/A = Not Applicable, i.e., not affected by Calaveras Dam Replacement project or WSIP because existing barriers (Calaveras Dam and Alameda Creek Diversion Dam) would remain.

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Alameda Creek watershed have been successfully implemented and anadromous steelhead have access to the upper Alameda Creek watershed, and that stream flow conditions attributable to SFPUC water system operations would be the same as under the existing condition.

2. A future scenario *with* implementation of the WSIP, including the Calaveras Dam Replacement and Alameda Creek Fishery Enhancement projects and associated protective measures. This scenario assumes the same conditions as Scenario 1, except it includes full implementation of the WSIP, which would modify stream flow conditions. Under Scenario 2, full implementation of the WSIP would include increasing diversions at the ACDD to restore historical storage levels in Calaveras Reservoir, providing bypass flows at the ACDD as well as releases from Calaveras Reservoir to augment stream flow to support fisheries consistent with the 1997 CDFG MOU, and, if recaptured, recapturing those releases at a downstream location consistent with the 1997 CDFG MOU.

Table 14.9-6 describes the stream and habitat conditions along the various reaches of Alameda Creek that could be affected by the WSIP, including the Calaveras Dam project, beginning at the downstream end of the watershed in lower Alameda Creek and Niles Canyon, and moving upstream to individual reaches in upper Alameda Creek. **Figure 14.9-4** shows the location of the reaches described in Table 14.9-6.

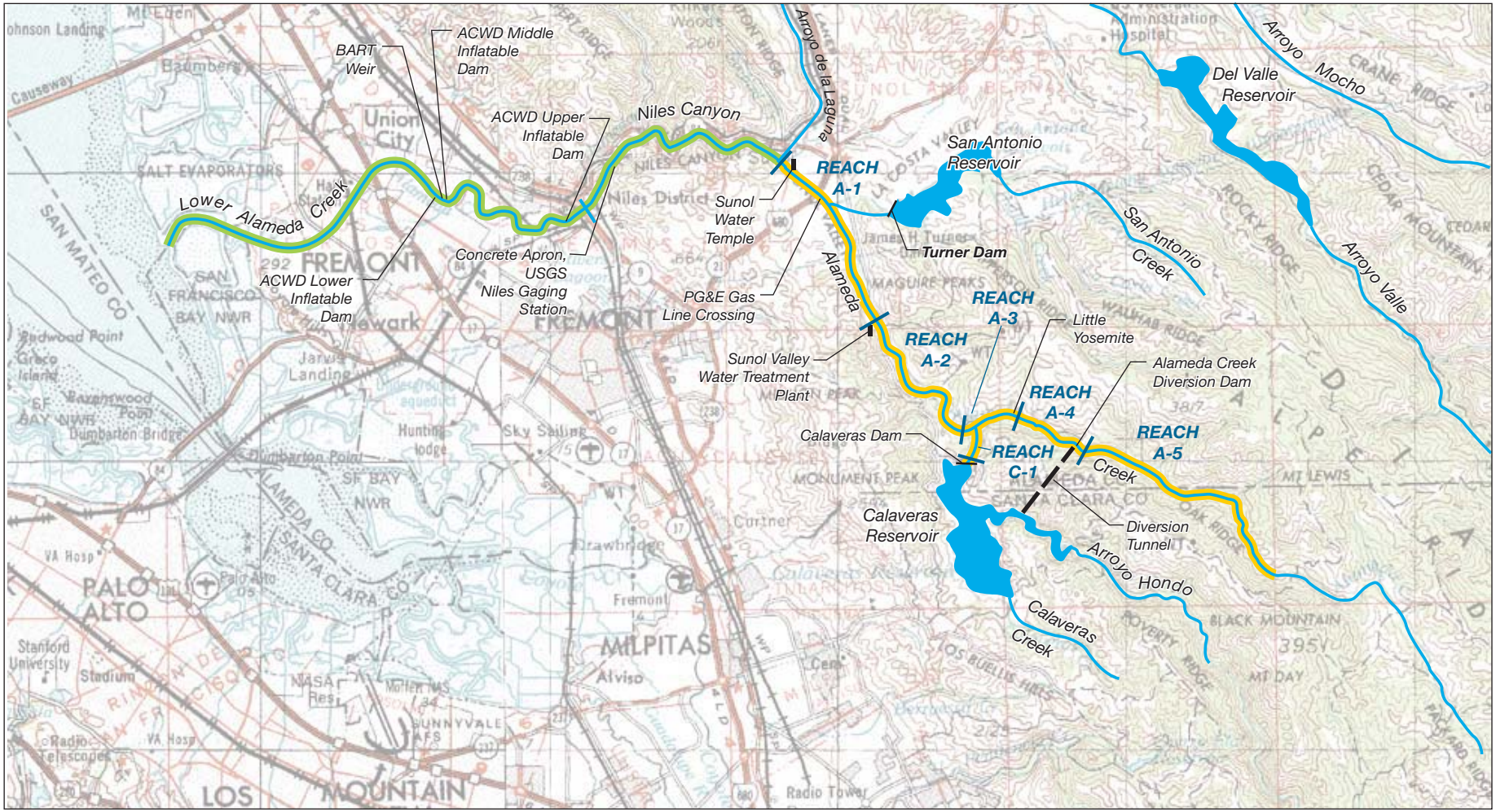
It should be noted that the WSIP's effect on habitat conditions for steelhead in the reaches downstream of Arroyo de la Laguna (i.e., lower Alameda Creek and Niles Canyon) are linked to a number of uncertainties regarding:

- The way in which existing barriers to passage would be remedied in the future (the design of passage facilities and the timing and amount of flow that would be required to achieve suitable passage conditions at those locations) as well as the effectiveness of the proposed slurry cutoff wall on the perimeter of the quarry on the right bank (looking downstream) of Alameda Creek above the San Antonio Creek confluence to reduce seepage losses from Alameda Creek in the Sunol Valley

- The extent to which natural features act as barriers (e.g., wide/braided channel locations, falls, sediment wedges) under various flow regimes and associated water temperature conditions

- The extent to which varying water resource operations of all water agencies in the overall Alameda Creek basin influence flows needed to establish and sustain appropriate flow and temperature conditions for steelhead and the subsequent effects of the WSIP on these downstream conditions (the contributions of flow from Arroyo del Valle and Arroyo de la Laguna complicate the hydrology further and add to uncertainties)

Understanding and resolving the approach to steelhead habitat restoration in the watershed, including addressing uncertainties regarding habitat requirements in Niles Canyon and lower Alameda Creek, requires a comprehensive, coordinated, basinwide effort and is currently being addressed through the ACFRW, of which the SFPUC is a participant.



SOURCE: ESA + Orion; USGS 1969

SFPUC Water System Improvement Program . 203287

Figure 14.9-4
Existing and Future Habitat Conditions for Steelhead on Alameda Creek

Potential Future Cumulative Impacts on Steelhead

The following discussion provides a reach-by-reach analysis of the WSIP's impacts on steelhead in Alameda Creek based on the changes in steelhead life-stage functions: migration (adult and juvenile), spawning, and rearing. The analysis incorporates the project revisions, protective measures, and mitigation measures described in Section 14.9.1, above. The protective measures added to the Calaveras Dam Replacement project description (SFPUC, 2008) include specific operational protocols, seasonal bypass flows at the ACDD and Calaveras Dam, and performance criteria to meet the habitat requirements of steelhead (if present) and other native aquatic species (fish and sensitive amphibians) in upper Alameda Creek in the event that the NMFS and/or CDFG determine that steelhead are present in Alameda Creek above the BART weir, construction of the Calaveras Dam project is complete, and the Alameda Watershed HCP is yet to be finalized. The protective measures also include an interim bypass flow release schedule that would consist of the implementation of flows consistent with the 1997 CDFG MOU, with the additional requirement that these flows be achieved through bypass flows at the ACDD at all times when flows are available, rather than through releases at Calaveras Dam. This interim flow schedule would meet the requirements of the 1997 CDFG MOU point of compliance below the confluence of Alameda and Calaveras Creeks as well as provide additional benefit in the reach between the ACDD and Calaveras Creek. The SFPUC would implement this interim measure until such time that the resource agencies (USFWS, NMFS, and CDFG) develop alternative requirements (i.e., operational protocols, seasonal bypass flows, and performance criteria) through the Alameda Watershed HCP process or other regulatory mechanism to ensure the habitat requirements of steelhead and other native aquatic species are provided at a level that is equal to or better than that provided by this interim measure. Following the development of these protocols, the SFPUC would implement these actions either through the Alameda Watershed HCP or other mechanism developed in consultation with the USFWS, NMFS, and CDFG.

The project revisions and protective measures for steelhead proposed as part of the Calaveras Dam Replacement project (SFPUC, 2008), along with the mitigation measures detailed in the Draft PEIR, have been analyzed by ESA+Orion and EDAW-Turnstone JV (2008) to determine the WSIP's contribution to cumulative effects (both positive and negative) on potential future-occurring steelhead, as discussed below. Implementation of the project revisions, protective measures, and mitigation measures (summarized in the Section 14.9.1, above) would reduce adverse effects of the WSIP on steelhead life stages and habitat in Alameda Creek to a less-than-significant level.

Migration

Upper Alameda Creek (Reaches A-1 through A-5). Implementation of the WSIP would influence stream flow and water temperature in Alameda Creek during steelhead migration periods. Under the WSIP, proposed operation of the ACDD would increase diversions from upper Alameda Creek to Calaveras Reservoir as well as implement protective measures to address steelhead migration downstream of the recapture facility. The protective measures incorporated into the WSIP as part of the Calaveras Dam Replacement and Alameda Fishery Enhancement projects include: (1) in the long term, operational protocols, seasonal bypass flows at the ACDD and Calaveras Dam, and performance criteria to ensure the habitat requirements of steelhead (if

present) as implemented through the Alameda Watershed HCP or other regulatory mechanism ensuring compliance with FESA and CESA, and (2) in the short-term until issues associated with the long-term measures are resolved, seasonal flow bypasses at the ACDD and/or Calaveras Dam consistent with the 1997 CDFG MOU but without recapture or with recapture at a point at the downstream end of Reach A-1 below critical riffle locations or lower in the creek. Under this cumulative analysis, it is assumed that Mitigation Measure 5.4.5-3a would be implemented in conjunction with the protective measures

As a result, flows in Alameda Creek downstream of the diversion dam would be substantially reduced from those under existing conditions. Flows passing the diversion dam would include flows above 650 cfs (capacity of the diversion), downstream tributary inflow, and bypass flows when upstream flows are available (from December 1 to April 30) implemented as part of the protective measures and Measure 5.4.5-3a. Natural summer low-flow limitations would not be affected by the bypass flow protective measures, since the bypass flows only address the period from December 1 to April 30, and there is typically no diversion during the summer months.

Because the bypass flows outlined in the 1997 CDFG MOU and Mitigation Measure 5.4.5-3a were developed to meet life-stage habitat suitability requirements for resident rainbow trout, conditions may only be marginally suitable for steelhead migration. As shown in Table 14.9-6, steelhead passage under the existing condition is impeded by natural rock barriers in the steep sections of Alameda Creek within Little Yosemite (Reach A-3, upstream from the Calaveras Creek confluence) under most flow conditions, based on recently completed studies (URS/SWRI, unpublished data). Thus, the effect of the proposed increased diversions on steelhead migration in the reach from the base of the diversion dam to the downstream end of Little Yosemite would only occur during times when flow conditions would have otherwise been adequate for steelhead migration, or if that natural barrier (i.e., falls at Little Yosemite) were to be removed. Removal of the natural Little Yosemite rock barrier is not proposed at this time.

Under the WSIP, flows in the segment of the creek downstream from the confluence of Alameda and Calaveras Creeks would be managed in accordance with the 1997 CDFG MOU through naturally occurring flows, releases from Calaveras Dam, and/or bypass flows at the diversion dam. The resulting stream flows would contribute to potentially suitable migratory conditions at certain times of the year within the reach of Alameda Creek that extends from the Calaveras Creek confluence with Alameda Creek downstream to the water recapture facility. When the bypass flows are released from the diversion dam to meet the terms of the MOU as part of the protective measures incorporated in the Calaveras Dam Replacement project, then the beneficial effects of these flows would also be achieved in Reaches A-3 and A-4, upstream from the Calaveras Creek confluence to the diversion dam.

In the Sunol Valley (Reaches A-1 and A-2), some wide channel areas may limit steelhead passage at lower flows (also known as areas of critical riffles) under existing conditions. In general concept, higher flows would enable upstream migrating adults and downstream migrating adult and juvenile steelhead to pass these areas and the remaining “natural” migration obstacles (following removal of the human-made barriers) in the Sunol Valley and farther downstream.

Stream flow and fish migration assessments conducted in Reach A-1, the stream reach with primary critical riffles adjacent to the Sunol quarry (SMP 30) (ENTRIX, 2006; URS/SWRI, unpublished data), have determined that a total of seven critical riffles are present that could potentially limit fish passage. The assessments determined that a wide range of low to moderate flows would be required to enable fish passage at the individual critical riffle locations. These flow requirements, in order of magnitude, are: 74, 17, 6, 5, 4, 2, and 1 cfs. The flow assessment results indicate that fish passage could be enabled through the provision of minimum flows equal to the highest flow requirement (i.e., 74 cfs) or through physical modification of the creek channel at the critical riffle locations to improve the specific conditions (e.g., wide channel, shallow depths, high velocities, steep gradient, etc.) that impede fish passage, and which, in general, would reduce the flow requirements for suitable fish passage.

While WSIP implementation would result in increased diversions in upper Alameda Creek at the diversion dam, the implementation of releases and/or bypass flows at Calaveras Dam and the ACDD, consistent with the 1997 CDFG MOU (per protective measures incorporated into the Calaveras Dam Replacement project) and Mitigation Measure 5.4.5-3a, would augment migration flows and assure project impacts on fishery habitat as far downstream as the proposed recapture facility are reduced to a less-than-significant level. As part of the project revisions incorporated into the Alameda Fishery Enhancement project, the SFPUC would either not implement recapture until the long-term regulatory mechanism for steelhead protection is resolved, or would locate the recapture facility at a point approximately at the downstream end of Reach A-1 below the areas of critical riffles. Thus, implementation of the 1997 MOU flows would enhance migratory conditions in this area.

Under the assumed future conditions with construction of a slurry cutoff wall and stream habitat restoration at the Sunol quarry pit (i.e., SMP 30 in Reach A-1),[3] downstream losses in stream flow from percolation into these pits in the Sunol area would be reduced; physical conditions at critical riffles is assumed to be improved; and there would be a resulting beneficial effect on steelhead migration in this area. While the remaining stream flow losses due to infiltration and the actual stream flow increase resulting from a future cutoff wall at the Sunol quarry are unknown at this time, it is assumed that increases in stream flows would be achieved and stream habitat restoration would improve physical conditions at critical riffles. Previous assessments of the critical riffles (ENTRIX, 2006; URS/SWRI, unpublished data) determined that passage is enabled at five of the seven critical riffles at relatively low flows (i.e., 1 to 6 cfs). Based on these results, it

[3] The SFPUC's Sunol Valley Sand and Aggregate Quarry Operations (SMP 30) includes projects to be undertaken by the quarry operator to correct losses of water into quarry pits and to enhance riparian vegetation. There is limited fish passage and degraded habitat value in this reach due to past mining-related realignment of the creek channel (noted above), which results in mining pit capture of a significant amount of Alameda Creek flows at the head of the realigned creek. The SFPUC proposes to coordinate planning for an Alameda Creek channel restoration project at this location as part of its negotiation with the selected operator of its Sunol quarry and to include aspects of the restoration project as part of the lease conditions. The SFPUC desires the operator to construct a slurry cutoff wall to reduce inflow to the pit as well as provide restoration of riparian habitat on the right bank of Alameda Creek and the left bank of San Antonio Creek (looking downstream). A plan for these actions has not yet been developed. The selected entity will be required to provide funds towards these efforts. CEQA/NEPA environmental review has yet to begin, but will include planning information for fish passage at the PG&E pipeline drop structure.

is assumed that physical conditions (e.g., channel width and form, gradient) would be improved at the critical riffles that require the highest flows (i.e., 74 and 17 cfs) and these improvements would enable fish passage at low flows, similar to the other critical riffle locations (1 to 6 cfs). These actions combined with minimum flow releases/bypasses consistent with the 1997 CDFG MOU (range of flows between 5 and 20 cfs during migration periods) would achieve suitable steelhead migration conditions in the Sunol Valley downstream to the recapture facility.

In summary, under the future conditions with the WSIP, the total combined stream flow from both regulated and unregulated sources, coupled with the assumed stream flow and habitat improvements at the Sunol Quarry, would sustain some winter flows in Alameda Creek that could facilitate fish migration. Location of the recapture facility downstream of critical riffles (Reach A-1) would assure suitable steelhead migration conditions. With the proposed program modifications described above, the WSIP would have a *less-than-significant* impact on steelhead migration in upper Alameda Creek (ESA+Orion and EDAW-Turnstone JV, 2008).

Lower Alameda Creek and Niles Canyon. At present, steelhead have access only to the segment of lower Alameda Creek below the BART weir because the BART weir acts as a complete barrier to steelhead migration under all flow conditions. In combination with other projects that could provide steelhead access through lower Alameda Creek and Niles Canyon to upper Alameda Creek in the future (including the provision of a fish bypass at the BART weir), the WSIP could result in a cumulative effect on steelhead migration.

Additional stream flow analysis was conducted subsequent to publication of the Draft PEIR (summarized above in Section 14.9.3 and included in Vol. 8, **Appendix N**) in order to address comments regarding the WSIP's impacts on steelhead passage and fishery habitat in lower Alameda Creek and Niles Canyon. This analysis determined that, based on the historical hydrology from 2000 to 2007, flows in Alameda Creek in Niles Canyon and downstream, on average, would occasionally be reduced under the WSIP. Reductions of up to 18 percent in average monthly flow could occur in winter months of years similar to the past eight years of record. The maximum flow reduction would occur during January of an above-normal year; however, the average calculated flow during this period remains relatively high (171 to 216 cfs). A flow increase of up to 13 percent would occur in April of that same hydrologic year type. The average monthly reduction that would occur from December through March of these year types is approximately 20 cfs, with a remaining calculated average flow of 313 cfs (range of 28 to 562 cfs). No changes in flow would occur in below-normal and dry years, when naturally low flow conditions would potentially result in the most substantial passage impediments.

Because the WSIP's effect on flows would only occur during above-normal hydrologic year types when flow conditions are predicted to remain relatively high (ESA+Orion and EDAW-Turnstone JV, 2008), operation of the WSIP is expected to have a negligible cumulative effect on future (anticipated) habitat conditions for steelhead migration. Therefore, this impact would be *less than significant*.

Spawning

Upper Alameda Creek (Reaches A-1 through A-5). Studies recently completed by Hagar and Payne (ETJV, 2008) identified suitable habitat for steelhead spawning in the reach of Alameda Creek immediately downstream of the Calaveras Creek confluence (Reach A-2) and between the Calaveras Creek confluence and the ACDD (Reaches A-3 and A-4). Implementation of the Calaveras Dam Replacement project (SV-2) component of the WSIP would alter stream flow in Alameda Creek during steelhead spawning periods. At present, steelhead do not have access to upper Alameda Creek. However, in combination with other projects that would provide steelhead access to upper Alameda Creek in the future, operation of the Calaveras Dam project could affect steelhead spawning.

Upstream of the Calaveras Creek confluence, Alameda Creek flows are predominantly influenced by operation of the diversion dam and tunnel. At present, Alameda Creek between the diversion dam and the confluence with Calaveras Creek provides habitat for spawning resident rainbow trout as well as other native species. As discussed above, passage conditions are extremely limited under most flow conditions at Little Yosemite and likely impede steelhead access to the majority of this reach, and therefore the effects of the Calaveras Dam project on steelhead spawning may only practically be realized in Alameda Creek downstream of Little Yosemite. Implementation of the WSIP would substantially reduce flows in Alameda Creek compared to existing conditions; however, implementation of PEIR Mitigation Measure 5.4.5-3a would address spawning and egg incubation habitat needs for resident rainbow trout as well as breeding habitat for other native stream-dependent amphibian species present in the creek and would require the SFPUC to monitor fish and sensitive amphibian populations and aquatic habitats. With the addition of the protective measures incorporated into the Calaveras Dam Replacement project, the implementation of the 1997 CDFG MOU flow releases from the ACDD when flow is available in upper Alameda Creek would reduce the WSIP's effect on steelhead spawning in this reach.

While steelhead generally require increased flow (compared to rainbow trout) to meet spawning habitat suitability requirements (e.g., water depth and flow velocity conditions), the bypass flows developed for rainbow trout spawning have been modeled so they would also be adequate for anadromous steelhead spawning. Preliminary studies by Hagar and Payne (ETJV, 2008) to assess flow requirements for steelhead spawning indicate that flows in Alameda Creek between the diversion dam and the Calaveras Creek confluence in the range of 18 to 60 cfs provide the *most* suitable[4] quantity and quality of steelhead spawning habitat. For Alameda Creek downstream of the Calaveras Creek confluence, the studies indicate that flows in the range of 21 to 80 cfs provide the *most* suitable quantity and quality of steelhead spawning habitat. Bypass flows to support spawning in Alameda Creek would be most effective if implemented from approximately January through March, and based on different hydrologic year types and aligned with the timing of precipitation in the upper watershed. It is noted that the 1997 CDFG MOU flows range up to 20 cfs and thus are at or near the lower ranges noted above for the most suitable habitat quantity and quality for steelhead.

[4] 80 percent or greater of maximum usable area based on the relationship between stream flow and spawning habitat requirements (i.e., water depth, flow velocity, and substrate type and size).

Under the WSIP, water releases from Calaveras Dam and/or bypasses from the ACDD consistent with the 1997 CDFG MOU would contribute to enhancing steelhead spawning habitat conditions at certain times (18 to 20 cfs from January to March) within the reach of Alameda Creek that extends from the Calaveras Creek confluence downstream through Reach A-2 (extent of suitable spawning habitat). The MOU was developed to address habitat needs for rainbow trout only, but would also be expected, based on the Hagar and Payne study (ETJV, 2008, Appendix A), to provide spawning habitat functions for steelhead (ESA+Orion and EDAW-Turnstone JV, 2008). Incorporation of the protective measures (steelhead bypass flows) into the WSIP program description, as summarized above, would reduce these impacts to a *less-than-significant* level.

As a separate issue related to spawning, the increased diversion of higher flows (up to about 650 cfs at the diversion dam as part of the Calaveras Dam Replacement project) could provide a benefit in above-normal and wet years by reducing the likelihood that steelhead eggs incubating in redds downstream of Little Yosemite would be vulnerable to scour and erosion. As such, in some years the increased diversions occurring with the WSIP would be expected to contribute to improved reproductive success of any steelhead spawning within the reach, provided that a suitable base level of flow (through bypass flow mitigation) would be available for spawning and egg incubation (ETJV, 2008).

Lower Alameda Creek and Niles Canyon. Steelhead spawning habitat in lower Alameda Creek is either absent or very limited, and there are no proposed spawning habitat restoration projects in this reach of Alameda Creek. Therefore, the WSIP would not affect steelhead spawning in lower Alameda Creek.

Potential spawning habitat is present in Niles Canyon; however, the future production of individuals spawned in this reach would be restricted by several factors related to subsequent rearing requirements and existing and future habitat limitations (see discussion below). As described above under the heading Migration, stream flow modeling indicated that the WSIP could result in reductions of up to 18 percent in average monthly flow in winter months of above-normal/wet years. The maximum flow reduction would occur during January of an above-normal year; however, the average calculated flow during this period remains relatively high (171 to 216 cfs). A flow increase of up to 13 percent would occur in April of that same hydrologic year type. The average monthly reduction that would occur from December through March of these year types is approximately 20 cfs, with a remaining calculated average flow of 313 cfs (range of 28 to 562 cfs). No changes in flow would occur in below-normal and dry years, when naturally low flow conditions would potentially result in the most limited habitat conditions for spawning.

Because the WSIP's effect on potential steelhead spawning habitat would only occur during above-normal hydrologic year types (when remaining flow conditions are predicted to still be relatively high), the WSIP is expected to have a negligible effect on future (anticipated) habitat conditions for steelhead spawning (ESA+Orion and EDAW-Turnstone JV, 2008). Therefore, this impact would be *less than significant*.

Rearing

Upper Alameda Creek (Reaches A-1 through A-5). At present, steelhead do not have access to upper Alameda Creek. However, in combination with planned projects that would provide steelhead access to upper Alameda Creek in the future, operation of the proposed program could affect steelhead rearing. Implementation of the WSIP could influence stream flow and water temperatures in Alameda Creek during steelhead rearing periods.

Although no published studies have been conducted that specifically address flow needs for rearing steelhead in reaches of Alameda Creek downstream of Calaveras Dam or the diversion dam, the 1997 CDFG MOU was developed to provide an increase in the amount of coldwater habitat in lower Alameda Creek for the benefit of resident trout. This is especially important in the summer and fall periods, at which times the MOU releases would provide sufficiently cool water to support fish survival through the hot, dry summer period. Resident trout and juvenile steelhead have essentially the same requirements for rearing habitat (e.g., flow, water temperature, physical habitat components). Therefore, under the WSIP, releases from Calaveras Dam and/or bypasses from the diversion dam that meet flow and temperature objectives consistent with the 1997 CDFG MOU would be expected to provide habitat conditions suitable for rearing steelhead in Alameda Creek from the confluence with Calaveras Creek downstream, and, with bypasses made from the diversion dam under the Calaveras Dam Replacement project, upstream in Alameda Creek as well. Releases consistent with the MOU are proposed as part of the WSIP, including summer releases that do not occur under existing conditions. Thus, the WSIP would have a *beneficial* effect on potential steelhead summer rearing habitat in the approximate two-mile segment of Alameda Creek between the Calaveras Creek confluence and the boundary of the Sunol Regional Park (i.e., the creek segment where sufficiently cool water temperatures could be maintained before warming [CDFG, 1997]) (see Figure 14.9-4).

There is the potential for adverse effects on steelhead rearing habitat during the rainy season (i.e., approximately November through March) in the reach of Alameda Creek between the diversion dam and the Calaveras Creek confluence (Reaches A-3 and A-4). However, proposed bypass releases from the ACDD under Measure Mitigation 5.4.5-3a would reduce the WSIP's contribution to this effect. During the dry season when there is minimal naturally occurring flow in Alameda Creek (i.e., April through November), minimal diversions would be made under the WSIP, similar to the existing condition. Furthermore, Draft PEIR Mitigation Measure 5.4.1-2 (Vol. 4, Chapter 6, pp. 6-51 and 6-52) would formalize a commitment for the SFPUC operators to close the gates to the diversion tunnel once reservoir storage levels are met to provide the maximum possible days of winter and spring flows in Alameda Creek below the diversion dam.

Downstream of the bridge at the Sunol Valley Water Treatment Plant (Reach A-1), habitat conditions in the Sunol Valley do not appear to be suitable for steelhead rearing. Annual fish monitoring from 1998 to present (conducted by the SFPUC and summarized in ETJV, 2008) resulted in no rainbow trout being sampled or observed at locations immediately above this reach. With construction of a slurry cutoff wall at the Sunol quarry pit (SMP 30), downstream losses in stream flow resulting from the percolation of groundwater may be substantially reduced, resulting in a beneficial effect. However, remaining losses in stream flow and the capture efficiency of a

future cutoff wall at the Sunol quarry (SMP 30) are unknown. Therefore, while the future viability of reestablished steelhead rearing habitat in the Sunol Valley is still uncertain, releases/bypasses included under the WSIP as part of the 1997 CDFG MOU requirements or as part of the PEIR mitigation requirements for resident trout could result in the limited seasonal enhancement of rearing habitat conditions for steelhead (i.e., late spring and late fall, when water temperatures remain sufficiently cool) compared to the existing condition (ESA+Orion and EDAW-Turnstone JV, 2008). Therefore, the WSIP is unlikely to have an adverse effect on steelhead rearing habitat in Reach A-1. In summary, implementation of the WSIP, including project description changes that provide protective measures, in conjunction with the mitigation measures, would result in a *less-than-significant impact* on steelhead rearing.

Lower Alameda Creek and Niles Canyon. There are several key uncertainties regarding the availability and quality of rearing habitat in lower Alameda Creek and Niles Canyon (McBain and Trush, 2007). The Niles Canyon reach may have historically provided important rearing habitat for juvenile steelhead. Currently, rearing habitat in this reach for steelhead is limited by altered flows and warm water temperatures (ETJV, 2008; McBain and Trush, 2007; Hanson, 2002b). As previously noted, the proposed slurry cutoff wall at the Sunol quarry pits could improve the contributions to stream flow and underflow of shallow groundwater into Niles Canyon.

As described above under the heading Migration, additional stream flow analysis indicated that the WSIP could result in reductions of up to 18 percent in average monthly flow in winter months of above-normal/wet years. The maximum flow reduction would occur during January of an above-normal year; however, the average calculated flow during this period remains relatively high (171 to 216 cfs). A flow increase of up to 13 percent would occur in April of that same hydrologic year type. The average monthly reduction that would occur from December through March of these year types is approximately 20 cfs, with a remaining calculated average flow of 313 cfs (range of 28 to 562 cfs). No changes in flow would occur in below-normal and dry years, when naturally low flow conditions would potentially result in the most limited habitat conditions for rearing.

Because habitat functions for rearing have been greatly diminished in lower Alameda Creek and the WSIP's predicted effect on rearing habitat would only occur during above-normal year types (when remaining flow conditions are predicted to still be relatively high), the WSIP is expected to have a negligible effect on future (anticipated) habitat conditions for steelhead rearing (ESA+Orion and EDAW-Turnstone JV, 2008). Therefore, this impact would be *less than significant.*

PEIR Text Revisions to Include Cumulative Impact on Future-Occurring Steelhead

Based on the analysis of the WSIP's contribution to future cumulative effects on potential future-occurring steelhead presented above, the assessment presented in the Draft PEIR of the WSIP's cumulative impacts in the Alameda Creek watershed has been revised. The Draft PEIR text is revised as follows (Vol. 3, Chapter 5, p. 5.4.5-11, fifth full paragraph):

Potential Steelhead Restoration

For the purposes of full disclosure, the PEIR provides this discussion of steelhead in lower Alameda Creek, and the potential for steelhead to be restored to the upper reaches of Alameda Creek (above the BART weir). However, because this steelhead access does not currently exist and there is no current steelhead migration above the BART weir, ~~there would be no~~ the potential impact on steelhead migration, spawning, or juvenile rearing upstream of the BART weir as a result of WSIP implementation is not analyzed in this section, which addresses WSIP impacts relative to existing conditions, but instead is analyzed as a future, cumulative impact in Section 5.7.3. ~~Further, as described in the preceding discussion, since a number of steps are required before steelhead migration further upstream can occur, it is speculative to assess the specific impacts that system operation under the WSIP might have on the potential future restoration of steelhead. Thus, no impact analysis or conclusion is developed in this PEIR. If and when steelhead are restored, the SFPUC will be required to conform its system operations to comply with the applicable Endangered Species Act requirements.~~

In addition, the Draft PEIR text is revised as follows (Vol. 3, Chapter 5, p. 5.7-65, second paragraph):

Cumulative Effects and WSIP Contribution

Table 5.7-15 summarizes the effects of past and present projects, the impacts of the WSIP, the effects of probable future projects, and the combined impacts of the WSIP plus probable future projects on the Alameda Creek watershed. Past and present projects have substantially altered the hydrology, geomorphology, surface water quality, groundwater, fisheries, and terrestrial biology of this portion of the Alameda Creek watershed compared to pre-Euro-American settlement conditions. Visual and recreational resources have been moderately altered. The existing condition, which serves as the baseline for the analysis of the WSIP, reflects the substantial environmental changes that have occurred as a result of the past projects. Because past and present actions have drastically altered ~~this portion of~~ the Alameda Creek watershed, some of the environmental resources are more sensitive to small adverse changes than they would be if the ~~reach~~ watershed had remained relatively unaltered from pre-Euro-American settlement conditions.

In addition, the Draft PEIR text is revised as follows (Vol. 3, Chapter 5, p. 5.7-66, third paragraph):

Implementation of the WSIP would substantially reduce flows in the reach of Alameda Creek from the diversion dam to below its confluence with Calaveras Creek compared to existing conditions (Impact 5.4.1-2). This impact was determined to be significant and unavoidable, even with implementation of Measure 5.4.1-2 (Diversion Tunnel Operation) and bypass flows included as part of the protective measures in the Calaveras Dam Replacement project (SV-2). However, no other past, present, or future projects were identified that would further reduce the stream flow in this reach of Alameda Creek, and some of the projects listed in Table 5.7-13 could enhance the flow. Thus, there would be no adverse cumulative impact on hydrology associated with past, present, and future projects, and the WSIP's contribution to the cumulative impact on hydrology is not applicable.

Due to agreements and ongoing actions regarding the implementation of fish passage improvement projects in lower Alameda Creek (as described in Section 5.4.5 of the Draft

PEIR), it is possible that steelhead will be restored to the Alameda Creek watershed reaches upstream of the BART weir by 2030. More specifically, steelhead may be restored during construction or operation of the Calaveras Dam Replacement project (SV-2) under the WSIP. In response to this scenario, the SFPUC has modified the WSIP program description—mainly that of the Alameda Creek Fishery Enhancement (SV-1) and Calaveras Dam Replacement (SV-2) projects—to incorporate protective measures for steelhead in the event that man-made barriers in Alameda Creek have been successfully removed and that steelhead migration, spawning, and rearing have been restored in Alameda Creek above the BART weir. The protective measures incorporated into the operations of the Calaveras Dam Replacement project would address future-occurring steelhead and would provide for a range of minimum bypass flows and releases at the Alameda Creek Diversion Dam and Calaveras Dam to support steelhead migration, spawning, and rearing. The program as revised, and with implementation of mitigation measures identified in the Draft PEIR, which together include minimum bypass flows to support the various life stages and habitat requirements for steelhead, would have a less-than-significant contribution to cumulative impacts on fishery resources in the Alameda Creek watershed. Please refer to Chapter 14, Section 14.9, of the Final PEIR for further discussion.

14.9.5 Other Fish Species and Aquatic Habitat in Alameda Creek

Introduction

This section of the master response addresses comments concerning the impact analysis and mitigation for the WSIP's potential effects on fishery resources in Alameda Creek upstream of the BART weir. This section of the master response is organized by the following subtopics:

- Analysis of Chinook Salmon, Coho Salmon, and Pacific Lamprey
- Warmwater Fish Species and their Habitats in Alameda Creek

Comment Summary

This section of this master response responds to all or part of the following comments:

L_ACFCWCD-14	SI_ACA1-08	SI_ACA1-19
L_ACWD-19	SI_ACA1-09	SI_ACA1-20
SI_ACA1-05	SI_ACA1-10	SI_GWWF2-02

Summary of Issues Raised by Commenters

- Need to acknowledge the historical range of Chinook salmon, coho salmon, and Pacific lamprey.
- Need to perform analyses to determine mitigation for impacts of flow diversions on Chinook salmon and Pacific lamprey.
- The mitigation measures target rainbow trout and may not mitigate impacts on steelhead, Pacific lamprey, and Chinook salmon.

- Inadequate discussion of warmwater and coldwater fish species and their habitats in the lower Alameda Creek reach.
- Lower Alameda Creek flow diversions would affect fisheries and habitat in the flood control channel.

Chinook Salmon, Coho Salmon, and Pacific Lamprey

Chinook Salmon

Chinook salmon are addressed in the Draft PEIR as part of the environmental setting for Alameda Creek fisheries (Vol. 3, Chapter 5, pp. 5.4.5-11 and 5.4.5-12). While small runs of Chinook salmon may have historically occurred within Alameda Creek, in recent years only a small number of individual Chinook salmon adults have been recovered in the flood control channel downstream of the BART weir. As presented in the Draft PEIR, it is believed that hatchery-produced salmon have strayed into streams that did not traditionally (and do not currently) support them (Gunther et al., 2000).

Although Chinook salmon are occasionally observed and documented below the BART weir, these few individuals are not currently able to migrate upstream of this barrier. If the migration barriers were absent, as discussed above in Section 14.9.3, seasonal high temperatures and low stream flow conditions during both the adult and juvenile migration and rearing periods would likely limit successful Chinook salmon production in most years.

As described above, the discussion of existing conditions presented in the Draft PEIR does not include Chinook salmon as a species of concern in the program area upstream of the BART weir. Impacts on Chinook salmon due to reduced flows below the BART weir have not been determined to be significant based on hydrological modeling of flow changes in the lower portion of Alameda Creek. Further discussion of WSIP-related flow impacts in the flood control channel is provided above in Section 14.9.3, under the heading Impacts on Stream Flow and Fisheries Downstream of the BART Weir. It should be noted, however, that Chinook salmon will be included in the SFPUC's Alameda Watershed HCP.

Coho Salmon

The geographic range for the CCC coho salmon DPS extends from Punta Gorda in northern California south to and including the San Lorenzo River in central California (NMFS, 2006). Evidence presented by Leidy (2007) shows the Alameda Creek watershed historically supported a run of coho salmon. Although there is evidence to support the historical presence of coho salmon in tributaries and coastal streams in and around San Francisco Bay, current findings on the geographic distribution of coho salmon conclude the species is absent from San Francisco Bay and its tributaries and is limited locally to a small number of tributaries in Marin County (NMFS, 2005).

A report by the NMFS (2005) on the status of federally listed DPS of west coast salmon and steelhead summarized a range of surveys and reports on the occurrence of coho salmon in tributaries and coastal streams in and around San Francisco Bay. In assessing historical data and

discussing decreasing population numbers for coho salmon in this region, the report identified extremely low contemporary abundance compared to historical abundance, widespread local extinctions, clear downward trends in abundance, extensive habitat degradation, and associated decreases in the carrying capacity of Alameda Creek. The NMFS (2005) presented findings that salmon stocks in small coastal streams north of San Francisco were at moderate risk of extinction, and those in coastal streams south of San Francisco Bay were at high risk of extinction. The report indicated that coho salmon were not present in San Francisco Bay and its tributaries. The results of presence-absence analyses for the CCC coho salmon ESU as a whole estimated that coho salmon were present in only 42 percent of streams historically known to contain coho salmon (NMFS, 2005). Data presented as part of these analyses (CDFG findings, as presented in NMFS, 2005) estimated occupancy was highest in Mendocino County (62 percent), followed by Marin County (40 percent), Sonoma County (4 percent), and San Francisco Bay tributaries (0 percent).

In summary, there is no documentation indicating the presence of coho salmon within Alameda Creek. Therefore, the Draft PEIR does not include an analysis of impacts on coho salmon as a species of concern in the program area.

Pacific Lamprey

Pacific lamprey is addressed in the Draft PEIR as part of the environmental setting for Alameda Creek fisheries (Vol. 3, Chapter 5, p. 5.4.5-12). Additionally, Leidy (2007) presents records for the upper Alameda Creek watershed suggesting that lamprey are able to ascend some formidable migration barriers to reach spawning habitat in the upper Sunol Valley, including the BART weir and the PG&E gas line crossing, as well as more transitory obstacles such as the ACWD inflatable dams in the Alameda Creek flood control channel downstream of Niles Canyon.

Moyle (2002) suggests the possibility that some upstream populations of Pacific lamprey may contain individuals that remain resident, rather than migrating to sea (much like rainbow trout), and it is therefore possible that the sampled population in the program area is resident. There are no known observations of either Pacific lamprey or river lamprey spawning in Alameda Creek, and no recorded observations of lamprey attached to other fish or of scars on fish from lamprey attacks. If adult Pacific lamprey can ascend barriers in the lower creek and reach Sunol Park, it is unclear how often they are successful at doing so.

The Draft PEIR identified sensitive habitat and listed species in the program area. The PEIR description of existing conditions does not include anadromous Pacific lamprey as a species of concern in the program area due to the lack of conclusive data indicating that this form of Pacific lamprey occurs within the upper Alameda Creek watershed. Impacts on Pacific lamprey due to reduced flows below the BART weir (where individual lamprey have recently been netted in the flood control channel section) have not been determined to be significant based on hydrological modeling of flow changes in the lower portion of Alameda Creek. Further discussion of WSIP-related flow impacts in the flood control channel is provided above in Section 14.9.3 under the heading “Impacts on Stream Flow and Fisheries Downstream of the BART Weir.” It should be noted, however, that Pacific lamprey will be included in the SFPUC’s Alameda Watershed HCP.

Warmwater Fish Species and their Habitats in Alameda Creek

Comments on the Draft PEIR requested consideration of warmwater fish habitat in the lower portion of Alameda Creek. A discussion of species present within Alameda Creek, including warmwater species, is presented in Section 5.4.5 of the Draft PEIR (Vol. 3, Chapter 5, p. 5.4.5-12) and summarized in Table 5.4.5-1 (Vol. 3, Chapter 5, pp. 5.4.5-13 to 5.4.5-15).

The CDFG has outlined recreational fishing resources in the San Francisco Bay Area and classifies Alameda Creek as habitat for federally listed steelhead as well as for many native non-game warmwater fish and native and introduced game fish species (CDFG, 2008). According to Skinner (1962), while Alameda Creek may not be a typical warmwater stream, it does support a number of warmwater fish species, including largemouth bass, small-mouth black bass, crappie, catfish, panfish, and roughfish.

The impacts of the WSIP on all fishery resources, including the warmwater species discussed in Table 5.4.5-1, are presented in the Draft PEIR (Vol. 3, Chapter 5, pp. 5.4.5-16 to 5.4.5-22). These impacts were determined to be either beneficial or less than significant in all cases (except for Impact 5.4.5-3, which would be potentially significant, but could be mitigated to a less-than-significant level with implementation of Mitigation Measures 5.4.5-3a and 5.4.5-3b).

14.9.6 Climate Change and Cumulative Effects on Future Fish Passage and Fish Habitat

Introduction

This section of the master response addresses comments concerning the WSIP's potential effects on fish passage and fishery resources in the Alameda Creek watershed when the effects of climate change are taken into consideration.

Comment Summary

This section of this master response responds to all or part of the following comments:

L_ACFCWCD-05

Summary of Issues Raised by Commenters

- The combined effects of the WSIP and climate change on flows and fish passage over the BART weir and middle inflatable dam are not adequately addressed.

Response

Comments received on the Draft EIR included concern regarding climate change effects on flows as they relate to fish passage over the BART weir. A number of habitat studies identify the BART weir as a total barrier to anadromous fish passage (Gunther et al., 2000). As described above in Section 14.9.4, passage improvement projects in Alameda Creek must be successfully completed

for fish passage to be possible at the BART weir, and other barriers to passage will need to be removed as well for steelhead to become restored to the upper watershed. For this reason, impacts related to fish passage at the BART weir within the context of climate change were not analyzed in the Draft PEIR. Potential cumulative impacts on fish passage are discussed in Section 14.9.4, which describes the impacts of the WSIP on potential future-occurring anadromous fish under the future cumulative scenario, which assumes the implementation of passage improvement projects and minimum flow releases for the protection of listed species. Impacts on anadromous salmonid migration and fishery habitat in lower Alameda Creek below the recapture facility due to implementation of the WSIP are presented above in Section 14.9.3.

Additional concern was raised that climate change could affect flows in the upper watershed and thus affect future fish passage and habitat connectivity. Potential impacts of climate change on the regional water system, precipitation patterns, and local hydrology are discussed in **Section 14.11, Master Response on Climate Change** (Vol. 7, Chapter 14, Section 14.11.4); this master response provides a qualitative assessment of WSIP impacts in the Alameda Creek watershed with consideration of climate change effects, and therefore addresses effects of climate change on Alameda Creek flows.

Potential impacts on habitat and habitat connectivity from climate-change-induced temperature effects are discussed here. The results of temperature monitoring in Alameda Creek conducted as part of habitat survey work (Hanson, 2002a, 2002b; McBain and Trush, 2007) demonstrate that current habitat conditions in Alameda Creek are on the threshold for steelhead suitability. Temperatures in mid-April already exceeded the smoltification success threshold, and by mid-June had exceeded the assumed juvenile growth threshold in Niles Canyon and farther downstream. Summer water temperatures within the lower reaches of the tributaries and mainstem Alameda Creek were characterized as stressful and/or unsuitable for juvenile steelhead rearing under the environmental conditions monitored during 2001 and 2002 (Hanson, 2002a, 2002b).

Under future climate change scenarios, increased summer temperatures could cause Alameda Creek to exceed the range for viable steelhead summer rearing habitat, particularly in the middle and lower reaches of the creek. Cooler waters are also more likely to favor high juvenile growth rates. Instream flow releases can generate physical juvenile rearing habitat, but abundant habitat that is too warm is not viable for steelhead. However, greater stream flow generally produces cooler water temperatures, especially instream flows released from the hypolimnion[5] of reservoirs (McBain and Trush, 2007). Instream flow releases will be an important management tool for extending favorable water temperatures into spring and summer. In addition, as discussed above in Section 14.9.4, under the future cumulative scenario, the proposed improvements at the Sunol quarry pits could improve the contributions to stream flow and underflow of shallow groundwater into Niles Canyon, improving rearing habitat through cool-water thermal buffering.

[5] The bottom portion of a thermally stratified lake or reservoir; water in the hypolimnion is generally cool and has a low oxygen concentration.

Under proposed WSIP operations, peak winter flows of up to 650 cfs would be diverted from Alameda Creek to Calaveras Reservoir through the diversion tunnel. These proposed diversions would not adversely affect summer temperatures or rearing habitat, as no diversions occur during the summer (dry) months. The project revisions described in Section 14.9.1, above, provide detailed discussion of the various strategies for instream flow releases, designed as protective measures for fishery and native stream-dependent biological resources in Alameda Creek. The protective measures include ongoing monitoring and adaptive management of bypass flows such that the SFPUC would modify and adjust flows as needed to address steelhead habitat and life-stage requirements. The ongoing monitoring and adaptation would include operational and flow modifications to address possible climate change effects.

14.10 Master Response on Modified WSIP Alternative

14.10.1 Introduction

Overview

This master response addresses the issues commenters raised on the Modified WSIP Alternative, which was identified in the Draft PEIR as the environmentally superior alternative. Several commenters requested that the Final PEIR further describe and analyze the Draft PEIR's Modified WSIP Alternative. Commenters expressed support for the Modified WSIP Alternative because it would result in fewer impacts on natural resources than the proposed program. This master response is organized by the following subtopics:

14.10.2 Modified WSIP Alternative – Additional Details
14.10.3 Additional Water Conservation/Recycling and the Modified WSIP Alternative
14.10.4 Modified WSIP Alternative – Additional Information on Environmental Impacts

It was apparent from the comments that the Modified WSIP Alternative concept needed clarification. This alternative was devised to avoid the significant adverse impacts on fisheries and terrestrial biological resources in the reach of the Tuolumne River below La Grange Dam that were identified to occur with the WSIP. It incorporates some, but not all, of the mitigation measures that were designed to lessen or eliminate the significant impacts of the WSIP (see Draft PEIR, Vol. 4, Chapter 6). If the Modified WSIP Alternative were to be implemented, mitigation measures would still be needed to avoid significant adverse impacts, as described below in Section 14.10.4.

Commenters

Commenters that addressed this topic include:

Federal Agencies

- None

State Agencies

- California Department of Fish and Game – S_CDFG2
- California State Assembly – S_CSA

Local and Regional Agencies

- Alameda County Water District – L_ACWD
- Bay Area Water Supply and Conservation Agency – L_BAWSCA1, L_BAWSCA2, L_BAWSCA6
- City of Daly City – L_DalyCty
- City of Hillsborough – L_Hillsb
- City of Millbrae – L_Millbr
- City of Palo Alto – L_PaloAlto
- City of Sunnyvale – L_Snnyvl
- Stanford University (BAWSCA member) – L_Stanford

- Tuolumne Utilities District – L_TUD1
- Tuolumne County Board of Supervisors – L_Tuol1
- Alameda County Flood Control and Water Conservation District, Zone 7 – L_Zone7

Groups

- Citizens Advisory Committee to PUC – SI_CAC2
- California Native Plant Society, East Bay Chapter – SI_CNPS-EB1
- Environmental Defense – SI_EnvDef
- Pacific Institute – SI_PacInst
- Restore Hetch Hetchy – SI_RHH1
- San Francisco Planning and Urban Research Association – SI_SPUR
- State Water Contractors – SI_SWC
- Tuolumne River Trust – SI_TRT3

Citizens

- Okuzumi, Margaret – C_Okuzu

PEIR Section Reference

The Draft PEIR addresses this topic area in the following locations: Vol. 1, Summary, Section S.7, pp. S-75, S-77, and S-78; and Vol. 4, Chapter 9, Section 9.2.8, pp. 9-78 to 9-84.

14.10.2 Modified WSIP Alternative – Additional Details

Comment Summary

This section of this master response responds to all or part of the following comments:

S_CDFG2-06	L_BAWSCA6-03	L_Zone7-02
S_CDFG2-07	L_DalyCty-22	SI_EnvDef-03
S_CSA-02	L_Hillsb-04	SI_EnvDef-17
S_CSA-04	L_Millbr-03	SI_PacInst-22
L_BAWSCA1-46	L_PaloAlto-05	SI_PacInst-83
L_BAWSCA1-47	L_Snnyvl-10	SI_SPUR-03
L_BAWSCA1-49	L_Stanford-01	
L_BAWSCA6-02	L_TUD1-04	

Summary of Issues Raised by Commenters

- The PEIR should provide a more detailed description of the Modified WSIP Alternative.

Response

As described in the Draft PEIR (Vol. 4, Chapter 9, pp. 9-78 to 9-82), the Modified WSIP Alternative incorporates changes into the proposed WSIP primarily to modify the proposed water supply and system operations so as to minimize environmental effects on resources in the

Tuolumne River, Alameda Creek, San Mateo Creek, and Pilarcitos Creek watersheds. This alternative incorporates many (but not all) of the mitigation measures identified in the Draft PEIR to reduce potentially significant or significant impacts. It consists of the same facility improvement projects and water supply sources as the WSIP, but would also include additional conservation, water recycling, and local groundwater development and certain system operation modifications that would reduce environmental impacts. The Modified WSIP Alternative would meet 2030 customer purchase requests and achieve all of the WSIP goals and level of service objectives, and its performance would be essentially identical to that of the WSIP based on the drought-year shortages and the amount of rationing that would be required during the design drought (see Table 14.10-3, below).

The Modified WSIP Alternative is similar to the proposed WSIP and would consist of the following elements:

- Water supply sources during all years (nondrought and drought periods):
  - Local supplies from the Peninsula and Alameda Creek watersheds (similar to the WSIP)
  - Tuolumne River (similar to existing conditions)
  - Transfer of water conserved in the TID and MID service areas and/or in the service area of another water agency (not part of the WSIP)
  - Recycled water/groundwater/increased conservation in San Francisco (same as the WSIP)
  - Increased recycled water/conservation/local groundwater in the regional wholesale customer service area (not part of the WSIP)

- Supplemental dry-year water supply sources:
  - Westside Groundwater Basin conjunctive use (same as the WSIP)
  - Dry-year water transfer of conserved water from TID and MID (similar to the WSIP, but with transfer made from conserved water)

- System operations under the Modified WSIP Alternative would be the same as with the WSIP, except for the following additional measures designed to minimize environmental effects:
  - Alameda Creek bypass flows between the Alameda Creek Diversion Dam and the confluence with Calaveras Creek to provide minimum flows for resident trout
  - Modified operations of Pilarcitos facilities to reduce effects on water quality, biological resources, and fisheries
  - Modified operations of Crystal Springs Reservoir to reduce effects on biological resources

Table 14.10-1 presents a comparison of the Modified WSIP Alternative and the proposed program, and updates information on the Modified WSIP Alternative shown in Table 9.5 of the Draft PEIR (Vol. 4, Chapter 9, p. 9-11). As shown in the table, the Modified WSIP Alternative would have essentially the same water supply sources as the proposed program, with the notable

TABLE 14.10-1
(SIMILAR TO DRAFT PEIR TABLE 9.4)
COMPARISON OF PROPOSED PROGRAM AND MODIFIED WSIP ALTERNATIVE

Program Element	Existing Condition	Proposed Program	Modified WSIP Alternative
Planning Year	2005	2030	2030
Target Delivery Level (annual average)	265 mgd	300 mgd	300 mgd
Water Supply Sources (during nondrought and drought periods)	▪ Local watersheds (with Calaveras and Lower Crystal Springs Reservoirs operating at reduced levels based on Division of Safety of Dams restrictions) ▪ Tuolumne River	▪ Local watersheds (with Calaveras and Lower Crystal Springs Reservoirs restored) ▪ Tuolumne River, with increased average annual diversions ▪ Recycled water/groundwater/additional conservation in San Francisco, 10 mgd	▪ Local watersheds (with Calaveras and Lower Crystal Springs Reservoirs restored, but with reduced maximum operating levels for Crystal Springs Reservoir) ▪ Tuolumne River, with increased average annual diversions between Hetch Hetchy and Don Pedro Reservoirs but with no increase in diversions below La Grange Dam ▪ Recycled water/groundwater/additional conservation in San Francisco, 10 mgd ▪ Regional recycled water/groundwater/additional conservation in wholesale service area, 10 mgd ▪ Transfer of conserved water in the TID and MID service area and/or in the service area of another water agency
Supplemental Dry-Year Water Supply Sources (for implementation during drought periods only)	None	▪ Additional Tuolumne River diversions from Turlock and Modesto Irrigation District (TID and MID) transfers of 25 mgd (average over design drought) ▪ Westside Basin conjunctive use, 6 mgd (average over design drought)	▪ Transfer of conserved water from TID and MID (17.5 mgd average over design drought) ▪ Westside Basin conjunctive use, (6 mgd average over design drought)
Maximum Drought Rationing Policy	No defined limit, but assumed incidental rationing of up to 25%	20%	20%
System Firm Yield	219 mgd	256 mgd	248 mgd
WSIP PEIR Facility Improvement Projects	None	All projects	All projects
Other Facility Improvements	None	None	▪ Low-head pumping station and permanent aeration system at Pilarcitos Reservoir ▪ Facilities associated with water conservation project(s) in TID, MID, and/or other water agency service area ▪ Facilities associated with additional water conservation, recycling, and groundwater projects in the wholesale service area
Delivery, Operations, and Maintenance	As described in Chapter 2, Section 2.3 (Vol. 1)	Improved to meet WSIP goals and objectives (as described in Vol. 1, Chapter 3, Section 3.8)	Similar to proposed program but with: bypass flows for resident trout at Alameda Creek Diversion Dam; revised operations at Pilarcitos Reservoir; reduced maximum operating levels in Crystal Springs Reservoir; habitat monitoring and compensation at Pilarcitos Reservoir; and establishing flow criteria, monitoring, and augmenting flows below Stone Dam

TABLE 14.10-1 (Continued)
COMPARISON OF PROPOSED PROGRAM AND MODIFIED WSIP ALTERNATIVE

Program Element	Existing Condition	Proposed Program	Modified WSIP Alternative
Permits, Approvals, and other Decisions/Actions	As described in Chapter 2, Sections 2.4 and 2.5 (Vol. 1)	▪ San Francisco Planning Commission certifies Final PEIR ▪ SFPUC adopts CEQA findings/mitigation monitoring and reporting program and approves and adopts the WSIP ▪ Water transfer agreements with TID and MID ▪ Operating agreements with Daly City, San Bruno, and California Water Service Company for Westside Basin conjunctive-use program ▪ Water sales agreements with retail and wholesale customers (see Vol. 1, Chapter 3, Section 3.13)	Same as proposed program except: ▪ Transfer agreements with TID and MID and/or other water agency for conserved water ▪ Agreements for participation in regional recycled water/ conservation/local groundwater projects that could offset SFPUC supply
Mitigation Measures needed to reduce significant and potentially significant impacts	N/A	▪ All programmatic mitigation measures identified for impacts associated with facility improvement projects (Measures 4.3-2 to 4.17-8) ▪ All mitigation measures identified for water supply and system operations impacts (Measures 5.3.6-4 to 5.6-5)	▪ All programmatic mitigation measures for facility improvement projects (Measures 4.3-2 to 4.17-8) ▪ All mitigation measures identified for water supply and system operations impacts (Measures 5.3.6-4 to 5.6-5), except for the following, which would be incorporated into this alternative: - Measure 5.3.6-4a, Avoidance of Flow Changes by Reducing Demand for Don Pedro Reservoir Water - Measure 5.3.6-4b, Fishery Habitat Enhancement - Measure 5.3.7-6, Lower Tuolumne River Riparian Habitat Enhancement - Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek - Measure 5.4.5-3b, Alameda Diversion Dam Diversion Restrictions or Fish Screens - Measure 5.5.3-2a, Low-Head Pumping Station at Pilarcitos Reservoir - Measure 5.5.3-2b, Aeration System at Pilarcitos Reservoir - Measure 5.5.3-2c, Habitat Monitoring and Compensation at Pilarcitos Reservoir - Measure 5.5.5-5, Establish Flow Criteria, Monitor and Augment Flow below Stone Dam

difference that the alternative would implement increased levels of conservation and water recycling. Section 14.10.3, below, presents a detailed description of the water conservation and recycling proposed under the Modified WSIP Alternative to supplement water supply sources, including agricultural conservation in the San Joaquin Valley and increased conservation/water recycling/local groundwater projects in the wholesale service area. The additional water conservation and recycling efforts incorporated into the Modified WSIP Alternative would enable the SFPUC to reduce diversions from the Tuolumne River compared to the levels proposed under the WSIP while still achieving all of the WSIP's level of service objectives, including serving customer purchase requests to 2030. As indicated in the table, the Modified WSIP Alternative would incorporate some, but not all, of the mitigation measures identified for the WSIP in the Draft PEIR. This alternative is designed to reduce the water-supply-related impacts of the WSIP, but would still require implementation of many of the same mitigation measures as the proposed program to reduce other identified impacts to a less-than-significant level. As described below in Section 14.10.4, the Modified WSIP Alternative was determined to be the environmentally superior alternative.

The Draft PEIR (Vol. 1, Chapter 3) provides detailed descriptions of the proposed facility improvement projects (pp. 3-48 to 3-72) that would be implemented under both the WSIP and the Modified WSIP Alternative. However, since publication of the Draft PEIR in June 2007, the SFPUC has conducted additional studies that would result in slight modifications to the facility improvement projects and system operations under the Modified WSIP Alternative. These changes would affect Alameda Creek bypass flows, Pilarcitos facilities operations, and Crystal Springs Reservoir operations, as described below.

Facility Improvement Project Updates and Alameda Creek Fishery Releases

As described in Section 13.2, Program Description Changes Affecting System Operations (Vol. 7, Chapter 13), as well as in **Section 14.9, Master Response on Alameda Creek Fishery Issues** (Vol. 7, Chapter 14), the SFPUC modified the project descriptions of the Alameda Creek Fishery Enhancement (SV-1) and Calaveras Dam Replacement (SV-2) projects after publication of the Draft PEIR. These modifications would reduce the environmental impacts on fishery, recreational, and visual resources in the Alameda Creek watershed and would also affect regional system operations. The modifications to the Calaveras Dam project include construction of a new bypass structure at the Alameda Creek Diversion Dam and implementation of releases from this structure to meet the requirements of the 1997 California Department of Fish and Game Memorandum of Understanding when flow is available in Alameda Creek. This proposed measure to implement flow releases at the Alameda Creek Diversion Dam would reduce the effects of the WSIP on resident trout between the diversion dam and the confluence with Calaveras Creek and on recreational and visual resources in the Sunol Regional Wilderness. It would also serve as an interim measure to reduce potential impacts on future-occurring steelhead in Alameda Creek to a less-than-significant level, until such time that the Alameda Watershed Habitat Conservation Plan is completed.

Under both the WSIP and the Modified WSIP Alternative, the SFPUC would incorporate these modifications and implement them as part of the Calaveras Dam Replacement project (SV-2).

The Modified WSIP Alternative would also incorporate the specific requirements included in Mitigation Measure 5.4.5-3a (see Vol. 7, Chapter 16, Section 16.2, Measure 5.4.5-3a, as revised), which call for the SFPUC to conduct the necessary site-specific studies to determine the minimum flow requirements needed to support resident trout spawning and egg incubation, and to implement an operations plan that provides for adaptation of the minimum flows based on the monitoring results and best available scientific information.

Modified Pilarcitos Facilities Operations and Related Measures

As described in the Draft PEIR (Vol. 4, Chapter 9, p. 9-79), the Modified WSIP Alternative incorporates Mitigation Measure 5.5.3-2, Revised Operations Plan for Pilarcitos Watershed Facilities, to avoid impacts on multiple Pilarcitos watershed resources, including water quality, terrestrial biological resources, and fisheries. However, as described in Section 13.3 (Vol. 7, Chapter 13), the SFPUC conducted further analysis and modeling of Pilarcitos facilities subsequent to Draft PEIR publication and determined that this proposed mitigation measure would be technically challenging and that other more practical solutions are available. As a result, multiple substitute mitigation measures have been developed to replace Measure 5.5.3-2 that would reduce the impacts of the WSIP on all resources in the Pilarcitos Creek watershed to a less-than-significant level. The replacement measures are described in Section 13.3 (Vol. 7, Chapter 13) and are presented as revised text in Section 16.2 (Vol. 7, Chapter 16). The replacement/substitute measures for the Pilarcitos watershed consist of the following: Measure 5.5.3-2a, Low-Head Pumping Station at Pilarcitos Reservoir; Measure 5.5.3-2b, Aeration System at Pilarcitos Reservoir; Measure 5.5.3-2c, Habitat Monitoring and Compensation; and Measure 5.5.5-5, Establish Flow Criteria, Monitor and Augment Flow.

Therefore, the Modified WSIP Alternative as currently proposed incorporates these replacement mitigation measures. Under the Modified WSIP Alternative, the SFPUC would:

- Install a permanent low-head pumping station at Pilarcitos Reservoir, which would enable the SFPUC to augment flow in Pilarcitos Creek with water from the reservoir when the WSIP would cause releases from Pilarcitos Reservoir to Pilarcitos Creek to be reduced to reservoir inflow earlier in the summer than would occur under the existing condition—about 25 percent of years in the hydrologic record (see Measure 5.5.3-2a)

- Install a permanent aeration system at Pilarcitos Reservoir, which the SFPUC would operate as necessary to avoid anoxic conditions and maintain good water quality conditions at the reservoir (see Measure 5.5.3-2b)

- Develop and implement an adaptive management plan for managing and maintaining freshwater marsh and other wetlands around the periphery of Pilarcitos Reservoir, and compensate for the reduced productivity and diversity of San Francisco garter snake and California red-legged frog wetland habitat that could occur as a result of the greater variability, extent, and duration of drawdowns at Pilarcitos Reservoir associated with operation of the proposed low-head pumping station (see Measure 5.5.3-2c)

- Develop and implement a monitoring and operations plan for Stone Dam to ensure WSIP-related flow reductions downstream of Stone Dam do not impair steelhead passage and spawning during the winter months of normal and wetter hydrologic years and, if

needed, release bypass flows from Stone Dam when flow is available to meet the minimum stream flow for steelhead passage in Pilarcitos Creek in the reach between Stone Dam and Albert Canyon (see Measure 5.5.5-5)

Modified Crystal Springs Reservoir Operations

Since publication of the Draft PEIR, the SFPUC has completed studies on Crystal Springs Reservoir as part of the development of the Lower Crystal Springs Dam Improvements project (PN-4). These studies included topographic LiDAR surveys, detailed review of historical water surface elevations and operating procedures, mapping of existing habitat, and analysis of future conditions under the WSIP and the Modified WSIP Alternative using the Hetch Hetchy/Local Simulation Model (HH/LSM) (SFPUC, 2008; Entrix, 2008). The studies identified the maximum operating water surface elevation and corresponding maximum storage capacity in Crystal Springs Reservoir under various conditions, as shown in **Table 14.10-2**, below:

TABLE 14.10-2
CRYSTAL SPRINGS RESERVOIR WATER SURFACE ELEVATION AND STORAGE CAPACITY

Condition	Maximum Water Surface Elevation (feet, NGVD)	Maximum Storage Capacity (billion gallons)
Existing Condition, with DSOD restrictions imposed since 1982	283.8	18.5
WSIP, proposed program analyzed in the Draft PEIR	291.8	22.2
Modified WSIP Alternative	287.8	20.3

NGVD = National Geodetic Vertical Datum of 1929; DSOD = California Department of Water Resources, Division of Safety of Dams.

SOURCE: SFPUC, 2008.

In determining the maximum operating water surface elevation and corresponding storage capacity under the Modified WSIP Alternative, the SFPUC considered numerous factors that would reduce impacts on biological resources, including existing vegetation, the potential for areas to revegetate with other vegetation/habitat if operating water elevations are raised, and the estimated frequency and duration of various inundation conditions, among others. This revised definition of operating parameters for Crystal Springs Reservoir under the Modified WSIP Alternative would set a maximum water surface elevation for most of the year, below the maximum capacity of the future reservoir, to reduce impacts on various habitats and related biological resources while still allowing the SFPUC to achieve the WSIP level of service objectives. It assumes that proposed system operations would not affect the daily rates of change in water surface elevation (which are based on storms and customer demand) or minimum elevations during drought periods (which are based on supply limitations). The major change in operating assumptions under the WSIP and the Modified WSIP Alternative compared to the existing condition is that Crystal Springs Reservoir would be fuller longer, subject to the maximum water surface elevation and corresponding storage level specified above.

The above assumptions constitute a refinement and improvement of the proposed Crystal Springs Reservoir operations under the Modified WSIP Alternative described in the Draft PEIR, which suggested that the SFPUC could regulate seasonal fluctuations within the maximum reservoir capacity rather than restricting the maximum storage level (Vol. 4, Chapter 9, p. 9-9). The refined operating assumptions for the Modified WSIP Alternative would reduce the magnitude of impacts on biological resources compared to the WSIP, but would not eliminate the impacts, which would remain potentially significant under the Modified WSIP Alternative. Therefore, implementation of the following mitigation measures would still be required to reduce impacts to a less-than-significant level: Measure 5.5.6-1a, Adaptive Management of Freshwater Marsh and Wetlands; Measure 5.5.6-1b, Compensation for Impacts on Terrestrial Biological Resources; and Measure 5.5.6-1c, Compensation for Serpentine Seep-Related Special-Status Plants (Vol. 4, Chapter 6, pp. 6-57 and 6-58). However, these impacts and mitigation measures will be reevaluated in detail at a project level and refined as part of the environmental review of the Lower Crystal Springs Dam Improvements project (PN-4).

14.10.3 Additional Water Conservation/Recycling and the Modified WSIP Alternative

Comment Summary

This section of this master response responds to all or part of the following comments:

S_CDFG2-06	L_Hillsb-04	SI_EnvDef-16
S_CDFG2-07	L_Millbr-03	SI_EnvDef-17
S_CSA-02	L_PaloAlto-05	SI_PacInst-22
S_CSA-04	L_Snnyvl-10	SI_PacInst-83
L_ACWD-03	L_Stanford-01	SI_RHH1-03
L_BAWSCA1-46	L_TUD1-04	SI_SPUR-03
L_BAWSCA1-47	L_Tuol1-01	SI_SWC-02
L_BAWSCA1-49	L_Zone7-02	SI_TRT3-04
L_BAWSCA2-04	SI_CAC2-03	SI_TRT10-02
L_BAWSCA6-02	SI_CNPS-EB1-15	C_Okuzu-03
L_BAWSCA6-03	SI_EnvDef-07	
L_DalyCty-22	SI_EnvDef-10	

Summary of Issues Raised by Commenters

- The PEIR should provide a more detailed description of how the proposed conserved water transfer from the Turlock Irrigation District (TID) and the Modesto Irrigation District (MID) (i.e., reduction in demand for water from Don Pedro Reservoir) is to be achieved.

- The PEIR should explore the feasibility of increasing agricultural conservation beyond that proposed to develop the conserved water dry-year water transfer element of the WSIP, with the goal of no net decrease in flows released to the lower Tuolumne River or even an increase; this could result in *more* water (a net increase) remaining in Don Pedro Reservoir (and released to the lower Tuolumne) than is currently the case, even after taking the proposed increased diversions for the SFPUC regional system into account. Possible mechanisms to increase

agricultural water conservation to be explored include: Bay Area water agencies provide economic incentives and/or financial support to encourage and fund agricultural conservation.

- The PEIR should provide more detail on future water recycling efforts by the wholesale customers.

- The preferred alternative identified in the Draft PEIR (the proposed program) does not maximize water conservation and recycling in lieu of additional water diversions from the Tuolumne River.

- The SFPUC and Bay Area Water Supply and Conservation Agency (BAWSCA) should work together to establish more effective regional conservation and recycling programs.

Response

Proposed Transfer of Conserved Water Included in Modified WSIP Alternative

Under the WSIP, the SFPUC would increase the amount of water it would divert from the Tuolumne River at Hetch Hetchy Reservoir. The increased diversion of water at Hetch Hetchy Reservoir needed to serve increased purchase requests by 2030 would be partially facilitated by a proposed dry-year water transfer from TID and MID to the SFPUC. The dry-year water transfer is included in the WSIP in order to avoid water rationing of more than 20 percent systemwide during a prolonged drought. For more information on the proposed dry-year water transfer, see **Section 14.3, Master Response on Proposed Dry-Year Water Transfer** (Vol. 7, Chapter 14).

Because more water would be diverted at Hetch Hetchy Reservoir with the WSIP (including the dry-year transfer), less water would flow down the river between O'Shaughnessy Dam and Don Pedro Reservoir, and inflow to Don Pedro Reservoir would be reduced. Decreased inflow would reduce storage in Don Pedro Reservoir compared to the existing condition. Because storage in Don Pedro Reservoir with the WSIP would be reduced, more of the late spring/early summer snowmelt runoff would be needed to refill the reservoir. As a result, less water would be released to the Tuolumne River below La Grange Dam than is released under the existing condition. Releases would still be in compliance with the Federal Energy Regulatory Commission's minimum required releases, but the HH/LSM results indicate that minimum releases would be made in 734 months of the 984-month hydrologic record with the WSIP compared to 717 months under the existing condition. The reduction in late spring/early summer releases attributable to the WSIP would have significant adverse impacts on fisheries and terrestrial biological resources in the reach of the river below La Grange Dam, as described in the Draft PEIR (Vol. 3, Chapter 5, Sections 5.3.6 and 5.3.7).

Draft PEIR Mitigation Measure 5.3.6-4a describes a "conserved water transfer" (Vol. 4, Chapter 6, p. 6-48) to reduce the impacts of the WSIP on fisheries and terrestrial biological resources in the Tuolumne River below La Grange Dam to a less-than-significant level. Measure 5.3.6-4a would involve a water transfer from TID/MID and/or another water agency to the SFPUC, in a manner similar to the dry-year water transfer that is already part of the WSIP. The water for Measure 5.3.6-4a would be developed through conservation in the service areas of TID, MID, and/or another water agency. In this context, conservation could include water savings

achieved through altered irrigation methods or planting of less water-intensive crops; improved delivery efficiency; an interagency transfer of conserved water; or use of an alternative supply such as groundwater. Measure 5.3.6-4a was incorporated into the Modified WSIP Alternative, as described in Chapter 9 of the Draft PEIR (Vol. 4, pp. 9-78 to 9-81), but with the condition that the water for the mitigation measure would be developed through conservation only. Unlike Measure 5.3.6-4a, this alternative would not include as an option the use of alternative water sources.

As described in the Draft PEIR (Vol. 1, Chapter 3, pp. 3-36 to 3-39), and expanded upon in **Section 14.3, Master Response on Proposed Dry-Year Water Transfer** (Vol. 7, Chapter 14), the dry-year transfer would be made between TID/MID and the SFPUC. The conserved water transfer included in Measure 5.3.6-4a and the Modified WSIP Alternative differs from the dry-year transfer in that it could be made between TID/MID and the SFPUC or between another water agency and the SFPUC. From a practical standpoint, only a water agency in reasonable proximity to the TID and MID service areas could serve as the source of the conserved water transfer to the SFPUC. The Modified WSIP Alternative, incorporating Measure 5.3.6-4a with water developed through conservation only, would result in less-than-significant adverse impacts on fisheries and terrestrial biological resources in the Tuolumne River below La Grange Dam because it would have little effect on storage in Don Pedro Reservoir compared to the existing condition. Storage in Don Pedro Reservoir with the Modified WSIP Alternative would be similar to storage under the existing condition, and, consequently, releases to the river from La Grange Dam with the Modified WSIP Alternative would be similar to those under the existing condition. Under the Modified WSIP Alternative, the WSIP-caused reduction in inflow to Don Pedro Reservoir would be offset by a reduction in Don Pedro Reservoir outflow, thus maintaining storage in the reservoir at close to the existing condition. Outflow from the reservoir (i.e., water diverted to the Modesto and Turlock Canals) would be reduced through conservation in the TID and MID service areas, or in the service areas of neighboring irrigation districts. The conserved water would be transferred to the SFPUC.

If the source of the conserved water transfer were to be TID and MID, those agencies would conserve water in their service areas and transfer the conserved water directly to the SFPUC. If the source of the conserved water transfer were to be an agency other than TID and MID, the transfer would still involve TID and MID and would occur as follows. The transferring agency would reduce water use in its service area by implementing conservation measures and would transfer the conserved water to TID and MID. TID and MID would use the conserved water in their service areas, thereby reducing the need to divert water from the Tuolumne River. The reduction in diversions of Tuolumne River water by TID and MID, and the consequent reduction in outflow from Don Pedro Reservoir, would offset the reduction in inflow to the reservoir produced by the SFPUC's increased diversions from the Tuolumne River at Hetch Hetchy Reservoir. As noted in the Draft PEIR, the details of the proposed water transfers have not been developed, and no agreements have been made with MID/TID or another water agency with respect to the transfers. The proposed water transfers could themselves have environmental impacts and may need additional environmental review, as described in the Draft PEIR (Vol. 4, Chapter 6, p. 6-63) and Section 14.10.4 of this master response, once the details of such transfers are known.

A commenter on the Draft PEIR, BAWSCA, supports the conserved water transfer concept but notes that decisions regarding crop choice and irrigation water pricing are the responsibility of the irrigation districts and their members. Furthermore, BAWSCA states that it does not support the fallowing of land as a means of water conservation. The San Francisco Planning Department acknowledges the views expressed by BAWSCA. The SFPUC intends to work with TID, MID, and/or other water agencies to develop a transfer of conserved water that is acceptable to all parties to the transfer. Any conserved water transfer agreement is likely to involve the implementation of water conservation measures selected and implemented by the transferring agency and paid for by the SFPUC and the wholesale customers. BAWSCA has expressed its willingness to contribute to the cost of agricultural water conservation measures that reduce environmental impacts on the Tuolumne River.

Many experts believe that water could be used more efficiently in California's cities and agricultural areas, and that it would be if appropriate financial incentives were provided. (See the comment letter from BAWSCA dated February 21, 2008 and the attached materials authored by Professor Brent Haddad, Director of the Center for Integrated Water Research at the University of California, and Peter Gleick, President of the Pacific Institute [Vol. 8, **Appendix M**].) Even without financial incentives, farmers in California are slowly but consistently moving toward more efficient irrigation methods. For example, data from surveys conducted by the California Department of Water Resources indicate that the percentage of land in California irrigated by the more efficient methods—sprinkler and drip/micro irrigation—increased from about 20 percent in the early 1970s to 50 percent in 2000.

The adoption of more efficient irrigation methods could be accelerated through the provision of appropriate financial incentives. Currently, TID and MID divert an average of 867,000 acre-feet of water annually from the Tuolumne River at La Grange Dam. If the SFPUC and TID/MID agreed to a conserved water transfer, TID and MID would only have to increase their water use efficiency slightly to offset the effects of the Modified WSIP Alternative. With appropriate financial incentives, it is assumed that additional agricultural water conservation and improvements in water use efficiency on this scale in the service areas of TID, MID, and/or other water agencies would be feasible.

It should be noted that the Modified WSIP Alternative would lessen but not entirely eliminate the impacts of the WSIP on flow, fisheries, and terrestrial biological resources in the Tuolumne River below La Grange Dam. With the conserved water transfer, average annual releases to the river below La Grange Dam would increase slightly with the Modified WSIP Alternative compared to the existing condition, which would be marginally beneficial for fisheries and terrestrial biological resources. With the Modified WSIP Alternative, there would still be occasional delays in the late spring/early summer releases from La Grange Dam (those releases in excess of minimum requirements), but the magnitude and frequency of the delays would be much less than with the WSIP. The delays would not be completely eliminated under the Modified WSIP Alternative because the timing of changes in Don Pedro Reservoir inflow attributable to increased water demand could not be perfectly matched with the timing of changes in reservoir outflow attributable to the conserved water transfer. Nevertheless, the impacts of the occasional delays in spring releases on fisheries and terrestrial biological resources that would occur under the

Modified WSIP Alternative would be reduced to a less-than-significant level with implementation of the conserved water transfer.

The conserved water transfer that is a part of the Modified WSIP Alternative could have an indirect effect on surface and groundwater resources in the lower Tuolumne River watershed and neighboring watersheds, as noted in the Draft PEIR (Vol. 4, Chapter 6, p. 6-64). Conservation measures and measures to improve the efficiency of agricultural water use could reduce groundwater recharge and the volume of irrigation tailwater discharges to surface streams. The environmental effects of the measures would depend on their nature and location, but would be expected to be relatively minor because any reductions in groundwater recharge or tailwater discharge would be small compared to total groundwater storage capacity or river flow.

Water Conservation in Agricultural Areas Beyond that Included in the Modified WSIP Alternative

BAWSCA and some of its member agencies have proposed the implementation of additional agricultural water conservation beyond that included in the Modified WSIP Alternative. According to these proposals, the water saved would accumulate in Don Pedro Reservoir and could be used to increase flows in the Tuolumne River below La Grange Dam or could be conveyed to water users in the Bay Area via a water exchange agreement with TID and MID. The SFPUC regards any project intended to increase agricultural water conservation beyond the level needed to reduce the impacts of the WSIP to a less-than-significant level to be separate from the WSIP. If the Modified WSIP Alternative is selected as the preferred course of action, the SFPUC would work with TID, MID, or another water agency to develop the transfer of conserved water that is included in the Modified WSIP Alternative. BAWSCA could choose to pursue a separate agricultural water conservation project to augment this transfer, but if the SFPUC were to participate in the project, it would be considered a distinct action from the WSIP or any alternative/variant of the WSIP.

Increased Conservation, Water Recycling, and Local Groundwater Use by Wholesale Customers Included in the Modified WSIP Alternative

The WSIP would increase the average annual diversion of water from the Tuolumne River by 24 million gallons per day (mgd) compared to the existing condition, based on updated HH/LSM results (see **Table 14.10-3**). The Modified WSIP Alternative includes features that would both increase and decrease average annual diversions of water from the Tuolumne River compared to the WSIP, but would result in a net reduced level of Tuolumne River diversions compared to the proposed program. The components of the Modified WSIP Alternative that would increase average annual diversions include the measures to lessen the impacts of the WSIP on natural resources in the Alameda Creek and Peninsula watersheds. They include the release of water from the diversion dam on Alameda Creek to support resident trout, modified operations in the Pilarcitos Creek watershed, and restrictions on the use of storage in Crystal Springs Reservoir. Implementation of these measures would reduce the amount of water available to the regional system from the Alameda Creek and Peninsula watersheds by an annual average of 1 mgd. In order to meet its level of service goals under the Modified WSIP Alternative, the SFPUC would have to increase diversions from the Tuolumne River by an annual average of about 1 mgd compared to the WSIP to compensate for the loss of water from the local watersheds.

TABLE 14.10-3
(SIMILAR TO DRAFT PEIR TABLE 9.5)
AVERAGE ANNUAL TUOLUMNE RIVER DIVERSIONS AND DROUGHT-YEAR SHORTAGES FOR THE MODIFIED WSIP ALTERNATIVE[a]

Scenario	Estimated Tuolumne River Diversions Over the 82-Year Period of Hydrologic Record[b]		Drought-Year Shortages Based on 82-Year Period of Hydrologic Record				Drought-Year Shortages During Design Drought (8.5 years)		
	Average Annual Increase by the SFPUC (mgd)	Average Annual Diversions by the SFPUC (mgd)	Years of Shortages (10% Shortage)	Years of Shortages (20% Shortage)	Years of Shortages >20% Shortage)	No. of Years Drought-Year Supplies Triggered	Years of Shortages (10% Shortage)	Years of Shortages (20% Shortage)	Years of Shortages (25% to 30% Shortage)
Existing Conditions	N/A	221	6 out of 82 (1 in 14 years)	8 out of 82 (1 in 10 years)	None	N/A	1	5	1.5
Proposed Program (WSIP)	24	245	6 out of 82 (1 in 14 years)	2 out of 82 (1 in 41 years)	None	24	3	3.5	None
Modified WSIP Alternative, between Hetch Hetchy and Don Pedro Reservoirs	15	236	6 out of 82 (1 in 14 years)	2 out of 82 (1 in 41 years)	None	23	3	3.5	None
Modified WSIP Alternative, below La Grange Dam	0	221[c]	6 out of 82 (1 in 14 years)	2 out of 82 (1 in 41 years)	None	23	3	3.5	None

[a] Results from the 2008 HH/LSM analysis using updated and refined model input assumptions. The numbers are not directly comparable to those in Draft PEIR Table 9.5, which are based on the 2007 HH/LSM analysis.
[b] Diversion levels represent the average annual amount modeled over the 82-year historical hydrology, but do not represent year-to-year variation in diversions. Thus, even with a zero average annual increase in diversions, there would still be year-to-year variations in diversions compared to the existing condition, due primarily to modified system operations for maintenance and implementation of the conjunctive-use program.
[c] This represents the net effect of SFPUC diversions below La Grange Dam with conserved water transfers implemented.

The components of the Modified WSIP Alternative that would decrease average annual diversions include increased local water conservation, recycling, and groundwater use within the wholesale customer service area of 5 to 10 mgd compared to the WSIP (see Draft PEIR, Vol. 4, Chapter 9, p. 9-80). Studies completed by BAWSCA and the SFPUC indicate that opportunities exist to develop more water conservation, recycling, and groundwater projects within the wholesale customers' service areas than were reflected in the purchase request estimates for the WSIP (Vol. 4, Chapter 9, pp. 9-47 to 9-59). These projects alone would not meet the full projected wholesale customer need for additional water delivery in 2030, but they could meet more of the demand than was assumed in the Draft PEIR.

Increasing local conservation, water recycling, and groundwater use within the wholesale customer service area by 5 to 10 mgd under the Modified WSIP Alternative would decrease the SFPUC's diversion of water from the Tuolumne River by an annual average of 5 to 10 mgd compared to the WSIP. As noted above, the mitigation measures in the Alameda and Peninsula watersheds that are part of the Modified WSIP Alternative would increase the SFPUC's diversion of water from the Tuolumne River by an annual average of 1 mgd compared to the WSIP. Thus, the reduction in diversions associated with additional local conservation, water recycling, and groundwater use would more than offset the increase in diversions attributable to the mitigation measures in the Alameda and Peninsula watersheds.

Modeling performed for the Modified WSIP Alternative—assuming an additional 10 mgd of regional water conservation, recycling, and groundwater use—indicates that the SFPUC's diversion of water from the Tuolumne River at Hetch Hetchy Reservoir would be reduced by an annual average of 9 mgd compared to the WSIP. As shown in Table 14.10-3, the SFPUC's annual average diversion of water from the Tuolumne River at Hetch Hetchy Reservoir under the existing condition is 221 mgd. Annual diversions would average 245 mgd with the WSIP and 236 mgd with the Modified WSIP Alternative. Flow in the Tuolumne River below O'Shaughnessy Dam would be reduced under the Modified WSIP Alternative, but to a lesser extent than under the WSIP.

As described above, the Modified WSIP Alternative includes a transfer of conserved water, which on balance would offset the effects of the SFPUC's increased diversion of water from the Tuolumne River at Hetch Hetchy Reservoir in the reach of the river below La Grange Dam. With the Modified WSIP Alternative, annual average releases from La Grange Dam would be greater than under the WSIP and similar to those made under the existing condition. The environmental effects of the Modified WSIP Alternative on fisheries and terrestrial biological resources in the reach of the river below La Grange Dam would be much less than those of the WSIP.

BAWSCA supports additional conservation, water recycling, and groundwater use within the wholesale customer service area as part of the Modified WSIP Alternative (see Comment L_BAWSCA1-51, Vol. 6, Chapter 12, Section 12.3). In March 2008, the BAWSCA Board of Directors authorized a study of additional water conservation, recycling, and groundwater use opportunities within its service area, and in July 2008, BAWSCA released a Request for Proposals for preparation of a water conservation/recycling implementation plan. Building on the work presented in the *Investigation of Regional Water Supply Option No. 4 Technical*

Memorandum (SFPUC, 2007, Appendix D), this current effort is expected to provide more detailed information about specific near-term projects that BAWSCA and its member agencies can pursue to develop additional local supplies and/or offset demand with conservation and/or water recycling.

14.10.4 Modified WSIP Alternative – Additional Information on Environmental Impacts

Comment Summary

This section of this master response responds to all or part of the following comments:

S_CDFG2-06	L_BAWSCA6-02	L_Stanford-01
S_CDFG2-07	L_BAWSCA6-03	L_TUD1-04
S_CSA-02	L_DalyCty-22	L_Zone7-02
S_CSA-04	L_Hillsb-04	SI_EnvDef-17
L_BAWSCA1-46	L_Millbr-03	SI_PacInst-22
L_BAWSCA1-47	L_PaloAlto-05	SI_PacInst-83
L_BAWSCA1-49	L_Snnyvl-10	SI_SPUR-03

Summary of Issues Raised by Commenters

- The PEIR should further analyze the Modified WSIP Alternative.
- The PEIR should more fully explore the environmentally superior alternative.

Response

The Draft PEIR includes a qualitative/comparative assessment of the environmental impacts of the Modified WSIP Alternative compared to those of the WSIP (Vol. 4, Chapter 9, pp. 9-82 to 9-84). Since publication of the Draft PEIR, the SFPUC has conducted a review of the Modified WSIP Alternative and has refined the assumptions for measures included in it, as described above in Sections 14.10.2 and 14.10.3. This section provides further discussion and analysis of the environmental impacts of the Modified WSIP Alternative, including the results of additional HH/LSM modeling. The impacts of this alternative on resources in the Tuolumne River, Alameda Creek, and Peninsula watersheds are summarized in **Tables 14.10-4**, **14.10-5,** and **14.10-6**; the tables include only those impacts that were determined to be significant or potentially significant under the WSIP, and present a comparison of those impacts between the WSIP and the Modified WSIP Alternative. The impacts of the Modified WSIP Alternative are discussed below under three categories: facility impacts, supply and system operations impacts, and growth-inducement impacts.

Facility Impacts

The environmental impacts of the facility improvement projects proposed under the Modified WSIP Alternative would be the same as those of the WSIP, as described in the Draft PEIR (Vol. 2, Chapter 4), and the same mitigation measures identified for the WSIP's impacts would also apply

TABLE 14.10-4
SUMMARY OF SIGNIFICANT WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP AND MODIFIED WSIP ALTERNATIVE
TUOLUMNE RIVER WATERSHED

Impact	Impact Description	Proposed Program	Modified WSIP Alternative
Section 5.3.6, Fisheries			
Impact 5.3.6-4: Effects on fishery resources along the Tuolumne River below La Grange Dam.			
	In wet or above-normal years when Don Pedro Reservoir is being filled, changes in the timing and duration of releases from the reservoir would decrease average monthly flows along the lower Tuolumne River beneath La Grange Dam. The greatest average flow reductions would occur during June and could result in elevated water temperatures. Changes in stream flow and water temperature would result in a reduction in the linear extent of suitable habitat for rearing Chinook salmon and oversummering steelhead/rainbow trout, potentially causing adverse affects on these fish populations in the lower Tuolumne River.	PSM	Similar to but much less than proposed program (LS) due to conserved water transfer
Section 5.3.7, Terrestrial Biological Resources			
Impact 5.3.7-2: Impacts on meadow/alluvial features along the Tuolumne River below O'Shaughnessy Dam.			
▪ Sensitive habitats	Delayed snowmelt releases, reductions in flow, and the resulting reduction in groundwater recharge would result in an incremental reduction in the extent and diversity of wetland and riparian habitats, including sensitive wetland and riparian habitats in the Poopenaut Valley.	PSM	Similar to but slightly less than proposed program (PSM)
▪ Key special-status species	A reduction in wetland and riparian habitat would reduce suitable breeding habitat for key special-status species potentially occurring along this reach (e.g., foothill yellow-legged frog, California red-legged frog, and willow flycatcher), the populations of which are already critically reduced in the Sierra Nevada.	PSM	Similar to but slightly less than proposed program (PSM)
▪ Other species of concern	A reduction in the extent and diversity of wetland and riparian habitats would reduce habitat quality and extent for animal and plant species of concern.	PSM	Similar to but slightly less than proposed program (PSM)
▪ Common habitats and species	All habitats affected by the WSIP are considered sensitive. The WSIP could affect a large number of common animal species that depend on sensitive meadows and larger riparian areas for food and cover.	PSM	Similar to but slightly less than proposed program (PSM)
Impact 5.3.7-6: Impacts on biological resources along the Tuolumne River below La Grange Dam.			
▪ Sensitive habitats	Delayed spring releases and reductions in average and total flow (particularly during and following an extended drought) below La Grange Dam would reduce or eliminate suitable conditions for the recruitment of some riparian species along the river.	PSM	Similar to but much less than proposed program (LS) due to conserved water transfer

TABLE 14.10-4 (Continued)
SUMMARY OF SIGNIFICANT WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP AND MODIFIED WSIP ALTERNATIVE
TUOLUMNE RIVER WATERSHED

Impact	Impact Description	Proposed Program	Modified WSIP Alternative
Section 5.3.7, Terrestrial Biological Resources (cont.)			
▪ Key special-status species	Because of the known presence of key special-status species and the very limited amount of remaining suitable habitat along this reach of the Tuolumne River, this incremental impact would be potentially significant.	PSM	Similar to but much less than proposed program (LS) due to conserved water transfer
▪ Other species of concern	Species of concern that would be adversely affected by changes in the extent and quality of suitable riparian habitat include western pond turtle, several bat species, and a wide variety of riparian- and marsh-associated bird species.	PSM	Similar to but much less than proposed program (LS) due to conserved water transfer
▪ Common habitats and species	The populations of common species that depend on riparian habitat could be adversely affected by the alteration of habitat.	PSM	Similar to but much less than proposed program (LS) due to conserved water transfer

LS = Less than Significant, no mitigation required
SM or PSM = Significant or Potentially Significant, can be Mitigated to less than significant
SU or PSU = Significant Unavoidable or Potentially Significant Unavoidable, cannot be mitigated to less than significant

TABLE 14.10-5
SUMMARY OF SIGNIFICANT WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP AND MODIFIED WSIP ALTERNATIVE
ALAMEDA CREEK WATERSHED

Impact	Impact Description	WSIP	Modified WSIP Alternative
Section 5.4.1, Stream Flow and Reservoir Water Levels			
Impact 5.4.1-2: Effects on flow along Alameda Creek below the diversion dam.			
	In all year types, system operations under the WSIP would increase diversions from Alameda Creek to Calaveras Reservoir between the months of December and May, nearly eliminating low and moderate (1 to 650 cubic feet per second) flows in Alameda Creek downstream of the diversion dam and substantially reducing many higher (greater than 650 cubic feet per second) flows that have occurred since 2002. The resultant reduction in stream flows and alteration of the stream hydrograph is considered an adverse effect.	SU	Similar to proposed program (SU)
Section 5.4.5, Fisheries			
Impact 5.4.5-3: Effects on fishery resources.			
	Following implementation of the Calaveras Dam Replacement project (SV-2), operation of Calaveras Reservoir and the Alameda Creek Diversion Dam would be restored to pre-2002 conditions. A substantial increase in diversions from Alameda Creek to Calaveras Reservoir would reduce flows in this stretch of the creek, despite proposed bypass flows at the diversion dam. Diversion of most or all flows during late winter and spring months would reduce the ability of resident rainbow trout to spawn and for eggs to incubate; additional monitoring would be needed to determine the effectiveness of proposed bypass flows. In addition, the increased diversion of flows to the reservoir would divert fish from Alameda Creek to the reservoir, prevent fish passage to downstream reaches of the creek, and increase the potential for fish entrainment since there are currently no screens on the diversion.	PSM	Much less than proposed program (LS) due to bypass flows for resident trout from Alameda Creek Diversion Dam
Section 5.4.6, Terrestrial Biological Resources			
Impact 5.4.6-1: Impacts on riparian habitat and related biological resources in Calaveras Reservoir.			
▪ Sensitive habitats	Increased reservoir storage elevations would result in inundation and permanent loss of seasonal wetlands, seeps, perennial freshwater marsh, and riparian habitat that have established since 2002.	PSM	Same as proposed program (PSM)
▪ Key special-status species	Since 2002, foothill yellow-legged frogs have occupied approximately 10,000 linear feet of stream channel along Arroyo Hondo between the maximum reservoir elevation mandated by the Division of Safety of Dams and the spillway elevation. Higher maintained reservoir levels would reduce the length of this high-quality habitat along the creek and adversely affect existing populations of foothill yellow-legged frog.	PSM	Same as proposed program (PSM)
Impact 5.4.6-2: Effects on riparian habitat and related biological resources along Alameda Creek from below the diversion dam to the confluence with Calaveras Creek.			
▪ Key special-status species	A reduction in the frequency, duration, and magnitude of flows below the diversion dam would reduce the total available aquatic breeding habitat and food sources for California red-legged frog and foothill yellow-legged frog populations that currently occupy this reach of Alameda Creek.	PSM	Much less than proposed program (LS) due to bypass flows for resident trout from Alameda Creek Diversion Dam

TABLE 14.10-5 (Continued)
SUMMARY OF SIGNIFICANT WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP AND MODIFIED WSIP ALTERNATIVE
ALAMEDA CREEK WATERSHED

Impact	Impact Description	WSIP	Modified WSIP Alternative
Section 5.4.6, Terrestrial Biological Resources (cont.)			
Impact 5.4.6-3: Effects on riparian habitat and related biological resources along Calaveras Creek from Calaveras Reservoir to the confluence with Alameda Creek.			
▪ Key special-status species	Future outlet works at Calaveras Dam would have the capacity to make higher volume releases than under existing conditions. Depending on the timing and volume of operational releases, they could adversely affect the reproductive success of special-status amphibian species along this reach (e.g., California red-legged frog and foothill yellow-legged frog).	PSM	Similar to proposed program (PSM)
Impact 5.4.6-4: Effects on riparian habitat and related biological resources along Alameda Creek from Calaveras Creek to San Antonio Creek.			
▪ Key special-status species	Depending on annual rainfall and localized site conditions along this creek segment, changes in winter and summer flows along this reach could result in both beneficial and adverse impacts on habitat for California red-legged frog and foothill yellow-legged frog populations.	PSM	Similar to proposed program (PSM)
Section 5.4.7, Recreational and Visual Resources			
Impact 5.4.7-1: Effects on recreation.			
	Operations under the WSIP would substantially reduce flows along Alameda Creek in the Sunol Regional Wilderness during winter and early spring months and adversely affect the recreational experience for hikers. *(Note: The Draft PEIR determined this impact to be PSM, but due to the change in the project description of the Calaveras Dam Replacement project (SV-2), this impact determination is revised to LS.)*	LS	Same as proposed program (LS)
Impact 5.4.7-2: Visual effects.			
	WSIP-induced reductions in stream flows along Alameda Creek would substantially change the quality of visual resources in the Sunol Regional Wilderness. *(Note: The Draft PEIR determined this impact to be PSM, but due to the change in the project description of the Calaveras Dam Replacement project (SV-2), this impact determination is revised to LS.)*	LS	Same as proposed program (LS)

LS = Less than Significant, no mitigation required
SM or PSM = Significant or Potentially Significant, can be Mitigated to less than significant
SU or PSU = Significant Unavoidable or Potentially Significant Unavoidable, cannot be mitigated to less than significant

TABLE 14.10-6
SUMMARY OF SIGNIFICANT WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP AND MODIFIED WSIP ALTERNATIVE
PENINSULA WATERSHED

Impact	Impact Description	WSIP	Modified WSIP Alternative
Section 5.5.3, Surface Water Quality			
Impact 5.5.3-2: Water quality in Pilarcitos Reservoir and along Pilarcitos Creek.			
	Proposed operations would generally be within the same range as existing conditions, although replacement Measure 5.5.3-2a would cause Pilarcitos Reservoir to be drawn down earlier in the summer compared to existing conditions. Water temperature could increase and dissolved oxygen could be reduced. *(Note: The Draft PEIR determined this impact to be PSM, and with the refined impact analysis for the Pilarcitos Creek watershed, implementation of a replacement mitigation measure would result in this impact determination remaining PSM.)*	PSM	Effects offset by aeration system (LS)
	During dry years, summertime releases from Pilarcitos Reservoir to Pilarcitos Creek would be reduced to reservoir inflow at an earlier date than they are under the existing condition. This would increase the temperature of instream flows between Pilarcitos Creek and Stone Dam and reduce the creek's ability to support designated cold freshwater habitat along this reach.	PSM	Similar to existing condition (LS) due to releases from low-head pump station
	During wet and above-normal years, the volume of spills over Stone Dam would be reduced compared to the existing condition.	LS	Similar to proposed program (LS)
Section 5.5.5, Fisheries			
Impact 5.5.5-1: Effects on fishery resources in Crystal Springs Reservoir.			
	Elevated water levels in Crystal Springs Reservoir would inundate approximately 1,500 linear feet of trout spawning habitat upstream of the reservoir along Laguna and San Mateo Creeks.	PSU	Similar to but less than proposed program (PSU)
Impact 5.5.5-4: Effects on fisheries resources in Pilarcitos Reservoir.			
	Proposed operations would be within the same range as existing conditions, although replacement Measure 5.5.3-2a would cause Pilarcitos Reservoir to be drawn down earlier in the summer compared to existing conditions. This would reduce the volume and quality of coldwater habitat available for resident fish species. *(Note: The Draft PEIR determined this impact to be PSM, and with the refined impact analysis for the Pilarcitos Creek watershed, implementation of a replacement mitigation measure would result in this impact determination remaining PSM.)*	PSM	Effects offset by aeration system (LS)
Impact 5.5.5-5: Effects on fisheries resources along Pilarcitos Creek below Pilarcitos Reservoir.			
	Under the WSIP, the extended period of no or very little flow in Pilarcitos Creek below Pilarcitos Reservoir during summer months of dry years would result in significant impacts on resident trout, other resident fish species and aquatic resources, and habitat quality and availability for anadromous steelhead. Increased drawdown of Pilarcitos Reservoir would increase the temperature of releases in summer and fall and reduce the quality and availability of habitat for coldwater fish species.	PSM	Similar to existing condition (LS) due to releases from low-head pump station
	A reduction in the frequency and magnitude of spills over Stone Dam would reduce flows along the lower reach. Reduced instream flows during winter months would adversely affect migratory fish habitat.	PSM	Similar to proposed program (PSM)

TABLE 14.10-6 (Continued)
SUMMARY OF SIGNIFICANT WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP AND MODIFIED WSIP ALTERNATIVE
PENINSULA WATERSHED

Impact	Impact Description	WSIP	Modified WSIP Alternative
Section 5.5.6, Terrestrial Biological Resources			
Impact 5.5.6-1: Impacts on biological resources in Upper and Lower Crystal Springs Reservoirs.			
▪ Sensitive Habitats	Implementation of the Lower Crystal Springs Dam Improvements project (PN-4) would raise average monthly water levels in Crystal Springs Reservoir and result in a short-term reduction in the overall extent of freshwater marsh as the reservoir fills. Proposed changes in operations would maintain maximum reservoir levels during summer for longer periods than under existing conditions, which could affect the composition and structure of riparian habitats. In addition, sensitive upland habitats that are unable to tolerate these longer periods of inundation would be lost.	PSM	Similar to but less than proposed program (PSM)
▪ Key special-status species	Elevated reservoir levels would inundate existing populations of special-status plant species, including serpentine-associated fountain thistle and Marin western flax, and their habitat could be permanently lost. The extent of available habitat for San Francisco garter snake and California red-legged frog would be temporarily reduced during reservoir refill, but wetland habitat that would establish at higher elevations could be more extensive. Raised reservoir levels would provide greater opportunities for largemouth bass and other predators to access frogs and snakes. Periodic drawdown during planned maintenance could adversely affect San Francisco garter snake foraging habitat.	PSM	Similar to but less than proposed program (PSM)
▪ Other species of concern	Changes in wetland habitat due to reservoir refill and proposed operations would adversely affect reptile and bird species of concern, particularly if permanent changes in the composition of wetland vegetation occur. Permanent loss of upland habitat, including upland trees, grassland, and coastal scrub, would result in significant impacts on several bird and mammal species of concern. Serpentine- and grassland-associated plant species unable to tolerate extended periods of inundation would be lost.	PSM	Similar to but less than proposed program (PSM)
▪ Common Habitats and species	Due to the extent of area involved, impacts on common habitats and species would be significant.	PSM	Similar to but less than proposed program (PSM)
Impact 5.5.6-4: Impacts on biological resources in Pilarcitos Reservoir.			
▪ Key special-status species	Proposed operations would be within the same range as existing conditions, although replacement Measure 5.5.3-2a would cause Pilarcitos Reservoir to be drawn down earlier in the summer compared to existing conditions. This would affect the extent of suitable habitat for California red-legged frog and San Francisco garter snake. Special-status species that utilize adjacent upland vegetation would not be affected. *(Note: The Draft PEIR determined this impact to be PSM, and with the refined impact analysis for the Pilarcitos Creek watershed, implementation of a replacement mitigation measure would result in this impact determination remaining PSM.)*	PSM	Effects offset by monitoring and compensation program (LS)
Impact 5.5.6-5: Impacts on biological resources along Pilarcitos Creek.			
▪ Sensitive habitats	In summer months of dry years, an extended period of no or little flow in Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam could stress riparian vegetation, but existing vegetation appears to be adapted to periods of dryness. *(Note: The Draft PEIR determined this impact to be PSM, but due to the refined impact analysis for the Pilarcitos Creek watershed, this impact determination is revised to LS.)*	LS	Similar to existing condition (LS)

LS = Less than Significant, no mitigation required
SM or PSM = Significant or Potentially Significant, can be Mitigated to less than significant
SU or PSU = Significant Unavoidable or Potentially Significant Unavoidable, cannot be mitigated to less than significant

to the Modified WSIP Alternative. However, the Modified WSIP Alternative would include some additional facilities that could have environmental impacts in addition to those identified for the WSIP, as shown in Table 14.10-1, above. New or modified water management facilities in the service areas of TID, MID, or another water agency would likely be needed to enable the conserved water transfer that is part of the Modified WSIP Alternative. New or modified facilities might include sprinkler and drip irrigation systems, tailwater recycling systems, and lined canals. Under the Modified WSIP Alternative, the increased conservation, water recycling, and groundwater use in the wholesale customer service area could require the construction of new facilities such as wastewater reclamation plants and groundwater wells and associated pipelines and transmission facilities (Vol. 4, Chapter 9, pp. 9-35 and 9-93). These facilities would be subject to separate CEQA review; however, in general, it is expected that these facilities would be constructed in previously disturbed areas (within either agricultural or urban lands) and that all construction and operational impacts could be mitigated to a less-than-significant level.

Supply and System Operations Impacts

After publication of the Draft PEIR, the SFPUC conducted updated and refined water supply modeling using the HH/LSM, and quantitative data became available to allow a more detailed analysis of the potential impacts of the Modified WSIP Alternative than the qualitative assessment presented in the Draft PEIR. As described in Section 13.3 (Vol. 7, Chapter 13), the updated HH/LSM results included refinements in the input assumptions, so data from the updated analyses are not always directly comparable to the HH/LSM results presented in the Draft PEIR. However, the updated model results enable a direct comparison of the effects of the WSIP and the Modified WSIP Alternative to those under the existing condition. **Appendix O** (Vol. 8) provides supporting information on the updated HH/LSM assumptions and results for the WSIP and Modified WSIP Alternative.

Tuolumne Watershed Impacts

As shown in Table 14.10-3, diversions from the Tuolumne River at Hetch Hetchy Reservoir under the Modified WSIP Alternative would increase by an annual average of 15 mgd compared to the existing condition. This amount is 9 mgd less than would occur with the WSIP. The reduction in flow in the upper Tuolumne River below Hetch Hetchy Reservoir as a result of increased diversions by the SFPUC would manifest itself as a delay in the spring releases from Hetch Hetchy Reservoir. As described in the Draft PEIR (Vol. 3, Chapter 5, pp. 5.3.7-21 and 5.3.7-22), the delay in the spring releases from Hetch Hetchy Reservoir attributable to the WSIP would have a significant adverse impact on terrestrial biological resources in the streamside meadows and riparian corridor downstream of O'Shaughnessy Dam. Although the delay would be less with the Modified WSIP Alternative than with the WSIP, it would still have a potentially significant adverse effect on terrestrial biological resources in the Poopenaut Valley downstream of the dam; the same mitigation measure, Measure 5.3.7-2, Controlled Releases to Recharge Groundwater in Streamside Meadows, would reduce this impact to a less-than-significant level.

As described in the Draft PEIR (Vol. 3, Chapter 5, pp. 5.3.1-21 to 5.3.1-37), the SFPUC's increased diversions of water from the Tuolumne River would result in a decrease in flow in the river below

La Grange Dam. Again, the decrease would manifest itself as a delay in the late spring/early summer releases from La Grange Dam, together with a reduction in episodic releases from the dam in the fall and winter. As described in Sections 5.3.3, 5.3.6, and 5.3.7 of the Draft PEIR (Vol. 3, Chapter 5), increased water temperature, the delay in late spring/early summer releases, and the reduction in average flow attributable to the WSIP would have a significant adverse impact on fisheries and terrestrial biological resources in the Tuolumne River downstream of La Grange Dam. However, the Modified WSIP Alternative includes a transfer of conserved water from TID, MID, or another water agency (as described in Section 14.10.2, above) that would offset the effects of the SFPUC's increased diversions of water from the Tuolumne River. As a result, the Modified WSIP Alternative would have a less-than-significant impact on fisheries and terrestrial biological resources in the Tuolumne River below La Grange Dam.

The conserved water transfer that is a part of the Modified WSIP Alternative could result in impacts on local groundwater or surface water resources, but conservation projects typically have minor environmental impacts with some tradeoffs in environmental effects. However, those impacts cannot be fully assessed until the characteristics of the projects needed to enable the conserved water transfer are defined. If an agreement for the conserved water transfer were to be made between TID/MID and the SFPUC, additional project-level CEQA review may not be required. The transferring agencies, TID and MID, would serve as the responsible agencies for CEQA compliance and could use the PEIR to make their own findings, as required by CEQA Guidelines Section 15096. If it became apparent that the projects needed to enable the conserved water transfer could have environmental impacts that were not described and analyzed in the Draft PEIR, then additional CEQA review would likely be required. TID and/or MID would be the lead agency for the subsequent, project-specific CEQA review.

If the agreement for a conserved water transfer were to be made between another water agency and the SFPUC, it is expected that the impacts on the Tuolumne River would be less than those described in the Draft PEIR, although impacts could occur in neighboring watersheds. In this case, either the SFPUC or the transferring agency would serve as lead agency for CEQA compliance, and impacts on neighboring watersheds would be evaluated in a project-level CEQA document prior to any discretionary action required for the transfer. Whether the PEIR could be used to provide general background information would be determined at that time and in light of contemporaneous facts and circumstances.

Alameda Watershed Impacts

With the exception of the reach of Alameda Creek between the diversion dam and the confluence with Calavaras Creek, the impacts of the Modified WSIP Alternative in the Alameda Creek watershed would be essentially the same as those of the WSIP, as described in the Draft PEIR (Vol. 3, Chapter 5, Section 5.4). Under the Modified WSIP Alternative, the only difference in system operations in the Alameda Creek watershed would be the incorporation of Mitigation Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek (as revised due to changes in the project description of the Calaveras Dam Replacement project [SV-2], Vol. 7, Chapter 13, Section 13.2); this measure requires a monitoring program and site-specific studies to determine if proposed bypass flows would be adequate to support trout spawning and egg

incubation, as well as an operations plan that would ensure the bypass flows are adapted as needed based on monitoring results and best available scientific information. For both the WSIP and the Modified WSIP Alternative, incorporation of this measure would reduce potentially significant impacts on fishery and biological resources (key special-status species) along Alameda Creek below the diversion dam (Impacts 5.4.5-3 and 5.4.6-2, respectively, Vol. 3, Chapter 5, pp. 5.4.5-18 to 5.4.5-20 and 5.4.6-18 to 5.4.6-19) to a less-than-significant level.

The impact on flow along Alameda Creek below the diversion would be similar for the Modified WSIP Alternative and the WSIP, and for both would be significant and unavoidable. Other potentially significant impacts on biological resources identified in the Draft PEIR for the WSIP (Impacts 5.4.6-1, 5.4.6-3, and 5.4.6-4 [Vol. 3, Chapter 5, pp. 5.4.6-14 to 5.4.6-23] related to biological resources in Calaveras Reservoir, Calaveras Creek, and Alameda Creek between Calaveras and San Antonio Creeks, respectively) would be the same for the Modified WSIP Alternative, and implementation of Draft PEIR Measure 5.4.6-1, Compensation for Impacts on Terrestrial Biological Resources, and Measure 5.4.6-3, Operational Procedures for Calaveras Dam Releases (Vol. 4, Chapter 6, pp. 6-54 and 6-55) would reduce these impacts to a less-than-significant level.

Peninsula Watershed Impacts

Crystal Springs Reservoir. As described above in Section 14.10.2, the Modified WSIP Alternative would alter the proposed operations of Crystal Springs Reservoir compared to the proposed operations under the WSIP. The Modified WSIP Alternative would impose a maximum water surface elevation for most of the year that is 4 feet lower than the maximum elevation under the WSIP, thus reducing the area of inundation and reducing the magnitude of impacts on habitat and related biological resources around the periphery of the reservoir. However, the operating assumptions for the Modified WSIP Alternative would not eliminate the impacts on biological resources, and the potentially significant impact identified in the Draft PEIR (Impact 5.5.6-1, Vol. 3, Chapter 5, pp. 5.5.6-14 to 5.5.6-17) would also be potentially significant under the Modified WSIP Alternative. Implementation of Measure 5.5.6-1a, Adaptive Management of Freshwater Marsh and Wetlands at Upper and Lower Crystal Springs Reservoir, and Measure 5.5.6-1b, Compensation for Impacts on Terrestrial Biological Resources, would still be required, though to lesser degree, to reduce this impact to a less-than-significant level.

Similarly, the Draft PEIR identified a potentially significant, unavoidable impact on fishery resources in Crystal Springs Reservoir (Impact 5.5.5-1, Vol. 3, Chapter 5, pp. 5.5.5-6 and 5.5.5-7) due to elevated water levels, which would inundate trout spawning habitat upstream of the reservoir along Laguna and San Mateo Creeks. While the Modified WSIP Alternative would reduce the maximum water surface elevation in the reservoir and reduce the magnitude of the impact compared to the WSIP, this impact would remain potentially significant and unavoidable.

These impacts will be evaluated in detail at a project-level as part of the environmental review of the Lower Crystal Springs Dam Improvements project (PN-4).

Pilarcitos Watershed. The WSIP would result in significant adverse effects on water quality, fisheries, and terrestrial biological resources in the Pilarcitos Creek watershed, as described in

Sections 5.5.3, 5.5.5, and 5.5.6 of the Draft PEIR (Vol. 3, Chapter 5), and recommended mitigation measures would reduce all impacts to a less-than-significant level. As described above in Section 14.10.3, the Modified WSIP Alternative would incorporate Measure 5.5.3-2a, Low-Head Pumping Station at Pilarcitos Reservoir; Measure 5.5.3-2b, Aeration System at Pilarcitos Reservoir; Measure 5.5.3-2c, Habitat Monitoring and Compensation; and Measure 5.5.5-5, Establish Flow Criteria, Monitor and Augment Flow. Thus, the impacts of the Modified WSIP Alternative in the Pilarcitos Creek watershed would be the same as those of the WSIP after the inclusion of the mitigation measures.

Growth-Inducement Impacts

The growth-inducement impacts of the Modified WSIP Alternative would be the same as those of the WSIP.

Environmentally Superior Alternative

As described in the Draft PEIR (Vol. 4, Chapter 9, pp. 9-95 and 9-96), the Modified WSIP Alternative is considered the environmentally superior alternative. This conclusion is further supported by the detailed analysis presented above. The Modified WSIP Alternative would reduce key impacts of the WSIP on natural resources along the lower Tuolumne River, along Alameda Creek below the diversion dam, at Pilarcitos Reservoir and along Pilarcitos Creek, and in Crystal Springs Reservoir. Importantly, it would also achieve the WSIP's goals and level of service objectives.

As stated above, compared to the proposed program, the Modified WSIP Alternative could result in additional facilities-related impacts associated with increased conservation, water recycling, and local groundwater projects, including conservation projects within agricultural areas. However, while the construction of new facilities would cause temporary disruption and related environmental impacts, the long-term implementation of these conservation, water recycling, and local groundwater projects would substantially reduce long-term impacts on the Tuolumne River. The impacts associated with these projects would occur in previously disturbed areas in either agricultural or urban use, and could likely be mitigated with standard mitigation measures.

Depending on the extent to which increased conservation, water recycling, and local groundwater projects could be implemented in the wholesale customers' service areas, the SFPUC's need to divert water from the Tuolumne River would be reduced. The Modified WSIP Alternative includes 5 to 10 mgd of regional conservation, water recycling, and local groundwater projects in the wholesale customers' service areas. Assuming that projects resulting in 10 mgd are implemented by 2030, the SFPUC's diversion of water from the Tuolumne River at Hetch Hetchy Reservoir would be reduced by an annual average of 9 mgd compared to the WSIP. In addition, by implementing a transfer of conserved water under the Modified WSIP Alternative, the SFPUC would be able to offset the WSIP's increased diversions from the upper reaches of Tuolumne River such that the average annual releases below La Grange Dam would be similar to those under existing conditions.

14.11 Master Response on Climate Change

14.11.1 Introduction

Overview

This master response addresses issues raised by commenters concerning the discussion on climate change and global warming presented in the Draft PEIR. Commenters primarily raised questions about how the PEIR addresses the effects of climate change on the SFPUC's water supply sources and how those effects would combine with WSIP-related impacts; some commenters also referred to the WSIP's potential to increase greenhouse gas emissions and contribute to global climate change. This master response is organized by the following subtopics:

14.11.2 Update of Climate Change Studies on Water Resources in California and Climate Change Regulatory Framework
14.11.3 Review of Water Agencies' Water Supply Management Approach to Climate Change
14.11.4 Climate Change and the SFPUC Regional Water System
14.11.5 SFPUC's Actions to Address Climate Change

Commenters

Comments on climate change/global warming were received from the following entities:

Federal Agencies

- National Park Service, Yosemite National Park – F_NPS-YOS

State Agencies

- Regional Water Quality Control Board, San Francisco Bay Region – S_RWQCBSF

Local/Regional Agencies

- Alameda County Flood Control and Water Conservation District – L_ACFCWD
- Modesto Irrigation District and Turlock Irrigation District – L_MID-TID
- Tuolumne County – L_Tuol1

Groups

- Acterra – SI_ACT
- Citizens Advisory Committee to PUC – SI_CAC1, SI_CAC2
- California Native Plant Society, East Bay Chapter – SI_CNPS-EB1
- Center for Resource Solutions – SI_CRS
- Clean Water Action – SI_CWA2
- Greenpeace – SI_GreenP
- Pacific Institute – SI_PacInst

- Sierra Club – SI_SierraC2, SI_SierraC3, SI_SierraC7
- San Francisco Planning and Urban Research Association – SI_SPUR
- Tuolumne River Trust – SI_TRT7, SI_TRT8
- Tuolumne River Trust/Clean Water Action/Sierra Club, San Francisco Bay Chapter – SI_TRT-CWA-SierraC

Citizens

- Bail, Christopher – C_Bail
- Chodeu, Bernie – C_Chode
- Clark, Ann – C_Clark1, C_Clark2
- Collin, Robert – C_Colli
- Garbarino, Caroline – C_Garba
- Gelman, Robert – C_Gelma
- Genovese, Marylyn – C_Genov-02
- Greene, David – C_GreenD
- Hasson, Tomer – C_Hasso
- Kaliner-MacKellen, Gwynn – C_Kalin
- Lee, Aldora – C_Lee
- Martin, Michael – C_MartiM-01
- Materman, Len – C_Mater
- Mijac, Ivo – C_Mijac
- Owen, Ellie – C_Owen
- Raffaeli, Paul – C_Raffa
- Steinhart, Peter – C_Stein
- Sugars, Marc – C_Sugar
- Tubman, Marianna – C_Tubma
- Walker, Patricia – C_Walke
- Williams, Doris – C_Willi

PEIR Section Reference

The Draft PEIR (Vol. 2, Chapter 4, Section 4.9, pp. 4.9-14 to 4.9-20 and pp. 4.9-42 to 4.9-47) addresses the potential impacts of the WSIP facility improvement projects relative to greenhouse gas (GHG) emissions and presents a program-level analysis of GHG emissions. This information is also discussed in the following sections: Vol. 1, Summary, Section S.3, pp. S-28 and S-63; and Vol. 1, Chapter 3, Section 3.10, p. 3-82. The analysis concluded that construction and operation of the facility improvement projects would not conflict with the state's goal of reducing GHG emissions to 1990 levels by 2020 because WSIP-related GHG emissions would not result in a substantial contribution to a global climate change. This determination was based on the ongoing implementation of GHG reduction actions by the City and County of San Francisco (CCSF) and the SFPUC and additional GHG reduction actions that the SFPUC would implement as part of the WSIP (see the Draft PEIR, Vol. 1, Chapter 3, p. 3-82). Furthermore, implementation of mitigation measures related to exhaust controls, criteria pollutant emissions, waste reduction, and energy efficiency would further reduce GHG emissions associated with construction and operation of the facility improvement projects.

The Draft PEIR (Vol. 4, Chapter 7, pp. 7-60, 7-61, and 7-76) addresses the potential impacts of the WSIP-related growth inducement, which could indirectly result in increases in GHG emissions. No comments were received regarding the adequacy of the GHG emissions analysis in Draft PEIR Chapters 4 and 7, and commenters did not identify any other significant issues related to GHG emissions associated with facility construction and operations. Therefore, this master response does not provide any further discussion of WSIP-generated GHG emissions beyond that provided in Chapters 4 and 7.

The Draft PEIR addresses the potential effects of global climate change on the SFPUC's water resources in the following location: Vol. 3, Chapter 5, Section 5.7.6, pp. 5.7-92 to 5.7-96.

Comments received on the Draft PEIR related to climate change were focused almost exclusively on issues addressed in Chapter 5 of the Draft PEIR; therefore, this master response provides further discussion to update and augment the analysis of climate change issues presented in Chapter 5.

14.11.2 Update of Climate Change Studies on Water Resources in California and Climate Change Regulatory Framework

Comment Summary

This section of this master response responds to all or part of the following comments:

F_NPS-YOS-01	SI_PacInst-18	SI_TRTCWA-SierraC-78
S_RWQCBSF-16	SI_SierraC2-03	SI_TRTCWA-SierraC-130
L_ACFCWCD-05	SI_SierraC3-03	SI_TRTCWA-SierraC-133
L_MID-TID1-11	SI_SierraC7-06	SI_TRTCWA-SierraC-135
L_MID-TID1-26	SI_SPUR-04	SI_TRTCWA-SierraC-159
SI_ACT-04	SI_SPUR-05	SI_TRTCWA-SierraC-168
SI_ACT-05	SI_TRT8-06	C_Gelma-02
SI_CAC2-04	SI_TRTCWA-SierraC-20	C_Hasso-04
SI_CNPS-EB1-06	SI_TRTCWA-SierraC-22	C_Lee-04
SI_CRS-04	SI_TRTCWA-SierraC-34	C_Mater-01
SI_CWA-01	SI_TRTCWA-SierraC-70	C_Owen-01
SI_GreenP-04	SI_TRTCWA-SierraC-77	C_Unreadable1-01

Summary of Issues Raised by Commenters

- The PEIR lacks up-to-date research.
- The California Department of Water Resources (DWR) has made predictions related to climate change effects on state water resources that should be included in the impact analysis.
- Projections by the Intergovernmental Panel on Climate Change (IPCC) should be addressed.
- The PEIR only addresses one of many possible patterns of global climate change.
- The PEIR does not consider climate science in the impact analysis.
- The PEIR impact analysis does not consider that studies indicate global warming will reduce the Sierra snowpack by 5 percent by 2030 and 33 percent by 2060.

Response

Climate Change Literature Review

The following review of climate change literature relevant to the WSIP and the Draft PEIR was prepared by CH2M HILL (2007) and the SFPUC (2008) to augment and update the annotated bibliography presented in the Draft PEIR (Vol. 3, Chapter 5, pp. 5.7-93 and 5.7-94). The literature review focuses on information related to climate change effects on California water

supplies and water management, including many of the references cited in comments received on the Draft PEIR. The key findings of this literature review are briefly summarized below, followed by an annotated review of relevant climate change science and policy/guidance literature in Tables 14.11-1 and 14.11-2. The findings from this literature review are then used in Section 14.11.4, below, to assess the effects of climate change on the impact analysis of water resources presented in the Draft PEIR.

Summary of Literature Review

In California and throughout the West the signs of climate change are evident. During the last 50 years, trends have shown a slight increase in winter and spring temperatures, snow levels in the Sierra Nevada mountains have moved to a higher average elevation, and snowmelt has been occurring earlier in the season. Observed temperature increases in California are higher than the global average. The causes of these recent climate changes are complex and are in part due to the levels of GHG emissions throughout the globe. Climate scientists are studying possible future conditions under a range of future GHG emissions. Under all future emission scenarios, the level of warming is expected to increase and would significantly accelerate under higher emission scenarios. Temperature increases in the range of 1.7 to 5.8 degrees Celsius (°C) are possible by 2100 with a mid-range estimate of 3.1 to 4.3 °C. However, despite the general consensus on future warming for California (and the globe), the scientific studies show no clearly discernible trend in precipitation changes in California over the next century. There is a wide range of differences in model projections for precipitation changes due to global warming, with some models projecting increases in precipitation and others predicting no increase or decreases over the century; still other studies indicate that even with no change in annual precipitation, the number of days with precipitation could decline, resulting in more intense precipitation on those fewer days with precipitation.

A number of analyses have been performed over the past 5 to 10 years to assess the hydrologic impacts of climate change on California's water resources. Some of the more robust findings among the studies listed in Table 14.11-1 are presented below:

- The Sierra Nevada spring snowpack is expected to continue to decrease due to an increase in the elevation of the freezing line, more precipitation falling as rain rather than snow, and an earlier snowmelt (DWR, 2006; California Climate Change Center, 2006; Mote et al., 2005; Roos, 2005).

- Rivers and streams fed by mountain watersheds are expected to exhibit an increase in stream flow in winter and early spring and a decrease in late spring and summer (Hamlet et al., 2005; Maurer and Duffey, 2005; Hayhoe et al., 2004).

- Greater conflicts among water supply, hydropower, and flood control in reservoir operations are anticipated (DWR, 2006).

- Warmer temperatures are expected to reduce some reservoir coldwater pools, which could affect the temperature of reservoir releases and increase stream temperatures, potentially disrupting aquatic species (DWR, 2006).

- Warmer temperatures could cause increases in water demand in both agricultural and municipal regions (DWR, 2006; Kiparsky and Gleick, 2003).

- Sea level rise will affect coastal areas and estuaries and could threaten levees (IPCC, 2007; DWR, 2006).

These six major findings are further discussed below in Section 14.11.4 (see Table 14.11-3) with respect to how climate change may be expected to affect the SFPUC regional water system and how climate change considerations would affect the WSIP impacts presented in the Draft PEIR.

In summary, the literature review (Table 14.11-1) indicated that quantitative assessments of potential climate change effects have been developed for the major watersheds in the Central Valley, and these studies have provided information useful to the SFPUC regional water system. These studies indicate a potential loss in Sierra spring snowpack of 12 to 50 percent by mid-century, depending on the degree of warming. The DWR's most recent climate change study (DWR, 2006) evaluated a range of future climate conditions on water resources in the Central Valley using output from two climate models and four climate change scenarios selected from the IPCC studies; DWR found that under three of the four climate change scenarios (those assuming a modest decline in total precipitation), water deliveries to State Water Project (SWP) and Central Valley Project (CVP) contractors would significantly decrease by 2050. The water resources in lower to mid-elevation basins, such as the upper Sacramento River and Feather River basins, would be substantially affected due to a reduction in snowpack and changes in runoff. Higher elevation basins, such as those providing inflow to Hetch Hetchy Reservoir, would be less sensitive to warming and would not lose as much winter-season snowpack as those with average elevations near the freezing line. The DWR reported that when these climate change scenarios are applied to Don Pedro Reservoir, there would be a reduction in Tuolumne River annual inflow to the reservoir as well as a shift in the timing of inflow by 2050. No focused studies of the upper Tuolumne River basin were identified in this literature review (outside of the initial modeling efforts performed by the SFPUC of the Hetch Hetchy system, as summarized in the Draft PEIR and described further below), although many researchers have analyzed the broad effects of climate change on the Sierra drainages, including the Tuolumne River watershed.

Various researchers and agencies have used different approaches and applied different climate change scenarios to assess the impacts and vulnerabilities of water resource systems to future climate change. One approach used by the DWR and the California Climate Change Center applies a range of future emission scenarios coupled with two general circulation models to quantify possible impacts. The quantitative assessments performed using this approach have utilized results from the research community as inputs to existing operational models. The applications of this approach vary from the use of specific scenarios to multi-model ensemble scenarios to perform the assessments. Another approach recently used by the U.S. Bureau of Reclamation in the Colorado River basin relies on paleoclimatological (tree ring) data over several centuries to characterize hydrologic variability and to predict future climate trends. A third approach used by several entities including the East Bay Municipal Utility District (EBMUD) evaluates system vulnerability to climate change and rates future management options

based on flexibility to adapt to a changed climate. The approach being used by the SFPUC to address climate change is described in Sections 14.11.4 and 14.11.5 of this master response.

Tables 14.11-1 and **14.11-2** summarize the recent literature on climate change science and policy relevant to California water supplies and water management that was reviewed for this PEIR.

Regulatory Framework – Climate Change

This section summarizes recent California statues and executive orders that specifically pertain to global climate change, and augments the regulatory framework included in the Draft PEIR (Vol. 2, Chapter 4, pp. 4.9-14 and 4.9-15). The additional regulatory framework information provides a more comprehensive basis for evaluating climate change policy issues related to the SFPUC regional water system, but does not change the analysis in the Draft PEIR. It should be noted that all regulatory policy and guidance related to climate change pertain to GHG emissions.

Assembly Bill 1493

Approved in 2002, Assembly Bill 1493 addresses GHG emissions from motor vehicles. It requires that the California Air Resources Board (CARB) develop and adopt, by January 1, 2005, regulations that achieve "the maximum feasible reduction of GHGs emitted by passenger vehicles and light-duty truck and other vehicles determined by the CARB to be vehicles whose primary use is noncommercial personal transportation in the state."

Executive Order S-3-05

Approved on June 1, 2005 by Governor Schwarzenegger, Executive Order S-3-05 formally recognizes California's vulnerability to the impacts of climate change, including the fact that increased temperatures threaten to reduce snowpack in the Sierra Nevada, which serves as one of the state's primary sources of water. Additionally, the order notes that climate change could influence human health, coastal habitats, microclimates, and agricultural yield. To address these potential impacts, the order mandates the following GHG emission reduction targets: by 2010, reduce GHG emissions to 2000 levels; by 2020, reduce GHG emissions to 1990 levels, and by 2050, reduce GHG emissions to 80 percent below 1990 levels. In addition, the order requires biannual reports starting in January 2006 describing: progress made toward meeting GHG emission targets; global warming impacts in California on water supply, public health, agriculture, the coastline, and forestry; and mitigation and adaptation plans to combat these impacts.

Assembly Bill 32 – California Global Warming Solutions Act

Approved in 2006, the California Global Warming Solutions Act (Assembly Bill 32) establishes a timetable for the CARB to adopt emission limits, rules, and regulations designed to achieve, among other objectives, a statewide GHG emissions cap for 2020 that is equivalent to the 1990 emissions levels. The act requires the CARB to adopt regulations to require the reporting and verification of statewide GHG emissions as well as regulations to achieve the maximum technologically feasible and cost-effective reductions in GHGs. Refer to the Draft PEIR (Vol. 2, Chapter 4, pp. 4.9-14 and 4.9-15) for further description of this act.

TABLE 14.11-1
CLIMATE CHANGE SCIENCE REFERENCES

Reference	Summary
Barnett, T.P., D.W. Pierce, H.G. Hidalgo, C. Bonfils, B.D. Santer, T. Das, G. Bala, A.W. Wood, T. Nozawa, A.A. Mirin, D.R. Cayan, and M.D. Dettinger, Human-Induced Changes in the Hydrology of the Western United States, in: *Science* 319:1080-1082, 2008.	This study provides statistical validation that observed changes in the hydrological cycle in the western United States from 1950 to 1999 are due to human-caused climate changes related to GHGs and aerosols. The authors conducted a regional, multivariable climate change detection and attribution study using a high-resolution hydrologic model combined with global climate models and sophisticated data analysis. The results show that up to 60 percent of the climate-related trends of river flow, winter air temperature, and snow-pack between 1950 and 1999 are human-induced.
Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2007: The Physical Science Basis, Summary for Policymakers,* 2007.	This brief report provides a summary of the IPPC Working Group I findings in its Fourth Assessment Report (AR4). The report summarizes the most current scientific consensus-based findings regarding recent observations of climate change, a paleoclimate perspective, and projections of future climate change.
Christensen, J.H., B. Hewitson, A. Busuioc, A. Chen, X. Gao, I. Held, R. Jones, R.K. Kolli, W.T. Kwon, R. Laprise, V. Magaña Rueda, L. Mearns, C.G. Menéndez, J. Räisänen, A. Rinke, A. Sarr, and P. Whetton, *Regional Climate Projections*, in: *Climate Change 2007: The Physical Science Basis, Contribution of Working Group I to the Fourth Assessment Report of the Intergovern-mental Panel on Climate Change,* 2007.	This chapter of the IPCC Assessment Report 4 provides a summary of the most recent regional climate projections and attempts to synthesize the most overarching issues. North America is considered as one region, although some greater geographical detail is provided. An assessment is provided regarding the general skill (capability of simulating observed climate) of the current suite of AOGCMs. General conclusions regarding temperature increases, precipitation changes, extreme events, atmospheric circulation, and snowpack-snowmelt-runoff are provided. In addition to the findings reported elsewhere of temperature increases and precipitation uncertainty, the report indicates greater climate variability during the 21st century. It indicates both a greater frequency in extreme temperature events and diurnal range, as well as greater frequency of extreme precipitation events (both wet and dry).
California Department of Water Resources (DWR), *Progress on Incorporating Climate Change into Planning and Management of California's Water Resources,* Technical Memorandum Report, July 2006.	This report is DWR's response to the governor's 2005 order establishing targets for GHG emissions and requiring biennial reporting by state agencies. This report describes the progress made to incorporate climate change into water resources planning and management. The report describes potential changes in precipitation and runoff, sea level, water demand, and fisheries. Based on research by Knowles and Cayan (2002) and the 2001 IPCC findings, the report projects the following loss of April snowpack averaged across the entire Sierra in snow-water-equivalent. Snow-water-equivalent is a measure of the volume of water that would be produced by melting snow and is used to translate snowpack to water volume. • 0.6 °C rise, ~5 percent loss • 1.6 °C rise, ~33 percent loss • 2.1 °C rise, ~50 percent loss These three levels of average temperature rise were projected by Knowles and Cayan to occur by 2030, 2060, and 2090, respectively. The water supply analyses included in this report utilized the results from four climate change scenarios described below in CalEPA (2006): PCM A2, GFDL A2, PCM B1, and GFDL B1. All four of these scenarios show a warming trend by the end of the 21st century; three of the four scenarios show a modest drying trend in precipitation with the fourth scenario showing a weak precipitation increase. There was no consistent trend for precipitation. Due to the coarse scale of the AOGCMs, the results from these climate change scenarios were "downscaled," a process of translating AOGCM output to a smaller regional or watershed scale (such as the major watersheds of the Central Valley) using the statistical methods described by Wood et al (2002, 2004) and Maurer et al. (2007). After downscaling, hydrological analyses were performed using the macro-scale Variable Infiltration Capacity model for each major watershed. The effects on runoff were analyzed for a historical period centered around 1976 (1961–1990) and for a climate change future period centered around 2050 (2035–2064). The fractional changes in runoff from historical gage measurements and future scenarios were then applied as monthly perturbation ratios to adjust the inflows to the CALSIM II Hydrology and Operations model to reflect

TABLE 14.11-1 (Continued)
CLIMATE CHANGE SCIENCE REFERENCES

Reference	Summary
	the climate change future. The perturbation ratios are simply multipliers applied to historical inflows to reflect the effects of climate change. For example, the historical inflow to Oroville Reservoir for July 1985 was approximately 2,189 cubic feet per second (cfs), and the perturbation ratio for July under the GFDL A2 scenario is 0.68. The inflow to Oroville for this simulated month under the GFDL A2 climate change scenario would then be 1,489 cfs (2,189 cfs multiplied by 0.68). For the major watersheds contributing stream flow to the Central Valley (including Tuolumne River inflow to Don Pedro Reservoir), the DWR found there was generally an increase in runoff from December through April and a decrease in May through November due to: more precipitation falling as rain rather than snow and, a reduced snowpack in the warmer climate. This shift occurred regardless of whether the climate change scenario was considered wetter or drier than historical records due to the temperature effect on the snowpack. The long-term average annual inflows to Shasta, Oroville, and Folsom Reservoirs were found to be decreased in three of the four scenarios (those assuming a decline in total precipitation). Only the PCM B1 scenario, the less-sensitive AOGCM combined with the lower emissions, produced increased annual inflows to these reservoirs. The DWR performed model simulations to analyze the long-term potential impacts on State Water Project (SWP) and Central Valley Project (CVP) delivery capability and found that total project impacts ranged from virtually no change to up to 10 percent, depending on the climate change scenario. The DWR also reported potential changes in monthly patterns of Tuolumne River inflow to Don Pedro Reservoir. The shift in the *fraction* of monthly inflows ranged from an increase of 6 to 25 percent for the December through April period and a decrease of 4 to 29 percent for the May through November period. Note that these percentages are an average of the fractional changes and are not equivalent to volumetric shifts in inflow. Volumetric changes in inflow were not documented in the DWR report. However, using the perturbation factors presented in this report and historical inflows to Don Pedro Reservoir, average annual inflow would also decrease for three of the four climate change scenarios (those assuming a decline in total precipitation). Only the wetter PCM B1 scenario produces increased average annual inflow. The report, however, did not specifically analyze climate change effects on the Hetch Hetchy system.
California Environmental Protection Agency (CalEPA), *Climate Action Team Report to Governor Schwarzenegger and the Legislature,* March 2006.	This report provides a general overview of climate processes and summarizes a broad range of climate change impacts on various resources in California. Strategies for controlling GHG emissions and potential adaptation measures are provided. Importantly, the report summarizes climate change scenarios used in the analysis of each of the resource areas. The report uses the results from three emission scenarios developed by the IPCC: a higher emission scenario (A1Fi), a medium-high emission scenario (A2), and a lower emission scenario (B1). To capture the range of uncertainty among climate models, the report relies on projections of the climate changes under these emission scenarios from three atmosphere-ocean general circulation models (AOGCM): the low-sensitivity Parallel Climate Model (PCM) from the National Center for Atmospheric Research (NCAR) and Department of Energy (DOE), the medium-sensitivity Geophysical Fluids Dynamic Laboratory (GFDL) CM2.1 model from the National Oceanic and Atmospheric Administration (NOAA), and the slightly higher-sensitivity Hadley Centre Climate Model, Version 2 (HadCM3) from the U.K. Met Office Hadley Center. The range of scenarios considered in this report exhibits projected temperature increases for the period of 2000 to 2100 of 1.7 to 3.0 °C for the lower range, 3.1 to 4.3 °C in the medium range, and 4.4 to 5.8 °C in the higher range. Despite the consensus among scenarios in projecting warming for California (and the globe), there is no clear trend for overall precipitation results for California over the next century. Only one scenario (PCM B1) projected an increase in precipitation, while all others indicated no change or a decrease.
California Climate Change Center, *Scenarios of Climate Change in California: An Overview,* February 2006.	This white paper was largely incorporated into the March 2006 CalEPA report to Governor Schwarzenegger. It describes the basis of climate change scenarios and gives an overview of the potential impacts on various resources in California. The impacts on water resources are briefly summarized. Hydrologic modeling performed for California was used to estimate changes in snowpack throughout the century. These studies projected reductions in Sierra snowpack with increased temperature and showed large snowpack losses associated with the higher ranges of temperature increases. The paper indicates that in the Sierra Nevada, by the 2035–2064 period, snowpack could be reduced by 12 to 47 percent from historical levels under the lower range of warming and 26 to 40 percent under the higher range of warming. By the end of the century, snowpack may be reduced by as much as 90 percent at the higher end of warming.

TABLE 14.11-1 (Continued)
CLIMATE CHANGE SCIENCE REFERENCES

Reference	Summary
	Two modeling approaches were applied to evaluate the effects on water supply in the Central Valley. The first approach is that described in DWR (2006) using the CALSIM model with climate change "perturbed" inflows. The second approach uses the Water Evaluation and Planning (WEAP) model with direct temperature and precipitation inputs. Both methods indicate a likely decrease in stream flows by mid-century, with more dramatic changes by the end of the century. In addition, the analyses indicate a greater propensity for "critically dry" year classification (using unadjusted indices) than the historical hydrology. Analyses using the CALSIM model indicated that by the end of the century deliveries to the SWP and CVP could be reduced by 15 to 30 percent under the lower warming scenarios and by as much as 40 to 50 percent under the medium and higher warming scenarios. These studies did not include the effects of increased agricultural or outdoor urban demands, but suggested that these could increase by 2 to 13 percent by the end of the century.
California Climate Change Center, *Our Changing Climate, Assessing the Risks to California*, A Summary Report from the California Climate Change Center, 2006.	This brief report is a summary of the "Climate Scenarios" project, which analyzed a range of impacts that would likely result with rising temperatures in California. It is largely a summary of other work. In summarizing the potential effects on the Sierra snowpack, the reports states that "if heat-trapping emissions continue unabated, more precipitation will fall as rain instead of snow, and the snow that does fall will melt earlier, reducing the Sierra Nevada spring snowpack by as much as 70 to 90 percent." The report also indicates there is continued uncertainty regarding the future changes in precipitation, which would affect the magnitude of the snowpack loss. It indicates that if emissions are significantly curbed and temperatures remain in the lower range of projections, the loss of snowpack will likely be half that expected if temperatures reach the higher range of projections.
Sansone, Amy and Pascal Storck, *The Implications of Climate Change on a Snow Melt Dominated Watershed in Western Washington,* 3TIER Environmental Forecast Group Inc., HydroVision, 2006.	The goal of this paper was to evaluate the effect of global warming by 2025 and 2045 on the snowpack in the watershed that supplies a portion of the city of Seattle's water supply. The results from eight global climate simulations were evaluated, and the analysis showed a 1.5 °C change over a 30-year period from 1995 to 2025. The study also showed a shift in runoff from the months of April, May, and June to the months of January, February, and March.
Maurer, E., *Uncertainty in Hydrologic Impacts of Climate Change in the Sierra Nevada Mountains, California under Two Emissions Scenarios,* April 2005.	This manuscript reports on an evaluation of hydrologic impacts in the Sierra Nevada with climate projected by 11 different AOGCMs under two emission scenarios. The intent of the study was to identify the projected hydrologic changes that have high statistical confidence for the period of 2071–2100. High statistical confidence was found under the projections for increasing winter stream flow and decreasing late spring and summer flow. Less snow at the end of winter and earlier arrival of the annual flow volume were identified as confident projections. The two emission pathways investigated, SRES A2 and B1, showed differing impacts with high confidence, leading to the author's conclusion that future emission scenarios play a significant role in the degree of impacts on water resources in California.
Dettinger, Michael D., *From Climate-Change Spaghetti to Climate-Change Distributions for 21st Century California,* San Francisco Estuary and Watershed Science, U.S. Geological Survey, March 2005.	The goal of this paper was to derive a statistically based conclusion from the variable results from runs of many differing Global Circulation Models (GCMs). The paper uses the same figure (temperature change over time from a variety of GCMs) that is used in the Cayan 2004 Ground Water Conference presentation, but it explores a statistical resampling technique to construct projection distribution functions to reduce the variance in the results. When North American GCM results are emphasized in the resampling process, an increase of 3 °C by 2050 and 6 °C by 2100 temperature change is found.
Mote, P.W., A.F. Hamlet, M.P. Clark, and D.P. Lettenmaier, *Declining Mountain Snowpack in Western North America*. Bulletin of the American Meteorological Society, January 2005.	This article presented the results of research utilizing 824 snow stations from the Natural Resources Conservation Service, DWR, and Ministry of Sustainable Resource Management for British Columbia. The authors found decreases in April 1 snow water equivalent between 1950 and 1977 at the majority of the sites, with the largest decreases found in western Oregon and Washington and northern California. Some upward trends in snow water equivalent were found for the Southwest, including the southern Sierra. Some of the increasing trend was attributed to long-term climatic signals such as the Pacific Decadal Oscillation and the El Niño Southern Oscillation.

TABLE 14.11-1 (Continued)
CLIMATE CHANGE SCIENCE REFERENCES

Reference	Summary
Maurer, E and P.B. Duffy, *Uncertainty in Projections of Streamflow Changes due to Climate Change in California,* Geophysical Research Letters, Vol. 32, L03704, 2005.	This paper examines the effects of stream flow under a range of climate projections with the goal of analyzing uncertainty between models and confidence in hydrologic impacts. The effects of climate change on stream flow at three northern Sacramento Valley rivers (Sacramento River at Shasta Dam, Feather River at Oroville, American River at Folsom) and four San Joaquin Valley rivers (Stanislaus River at New Melones, Tuolumne River at New Don Pedro, and Merced River at Lake McClure) were examined under a range of carbon dioxide increase scenarios. The AOGCMs applied were those available for the Coupled Model Intercomparison Project, but are not comparable to those used by Maurer to support the DWR (2006) analyses. This paper confirmed the robust result of increases in stream flow in December through March and decreases in June through October. In addition, the authors found that the March–April flows in the higher elevation south basins were more highly influenced by projected temperature changes than in the lower elevation north basins. This appears to contradict findings by Hamlet et al. (2005), who found that trends in snow water equivalent at high-elevation basins were less affected by warming than lower basins; however, Hamlet's study covered the entire western United States, whereas this study focuses on California. The perturbed climate scenarios utilized in this study indicated a shift in stream flow timing for the Tuolumne River at New Don Pedro, but also indicated an increase in overall annual runoff due to increased precipitation projections.
Roos, M., *Accounting for Climate Change,* California Water Plan Update 2005, Vol. 4, 2005.	This report by Maurice Roos, State Hydrologist for California, examines the broad implications of climate change on California water resources. It provides a good narrative of historical trends in temperature, sea level rise, and water resource systems. The report states that the "most important parameter in determining runoff and therefore water supply is precipitation" and that "regional precipitation predictions in the huge general circulation models of the atmosphere have not been reliable, and vary greatly among the different models." Roos states that on a global scale, warming would increase evaporation, and thus increase overall precipitation, but highlights that "where and when the precipitation falls is all-important." The report discusses initial efforts by the DWR that indicated a much greater trend for warming impacts on northern Sierra snowpack and runoff decreases compared to southern Sierra snowpack and runoff, due to the elevation of these watersheds. Roos reports that with recent models it is possible to project increases in southern Sierra snowmelt runoff under wetter climate scenarios (although from less area), while this phenomenon is not shown for the northern Sierra. Roos also discusses implications for water resources in the state and concludes that not all basins would be equally affected. The report references the differences in the ratio of storage to average annual inflow in watersheds as an indicator of the level of impact. Due to a greater capacity to store runoff, the Stanislaus River with a ratio of 2.5 (storage to inflow) would be expected to have a smaller impact than the American River, where the ratio is about 0.64. Roos also analyzed the past hydrologic record for the Sacramento River and identified declining trends in April–July runoff. The trend was found to exist for most major drainages to the Central Valley, with smaller declines in the southern Sierra. This report also mentions work by researchers that has shown an increased risk for large storms and flood events for several AOGCM scenarios. An increase in flood control space would conflict with operations for water supply, power, and recreation for many of the reservoirs in California. Roos suggests that if increased winter flood control capacity were required, then one would expect greater difficulty in filling reservoirs in the spring. Finally, Roos discusses potential changes (increases) in agricultural water use with increasing temperature and difficulties in managing cold–water pools for anadromous fish. Cold-water pools in reservoirs, and within the watershed, would be expected to decrease, and river water temperatures could warm beyond the tolerable limits for salmon and steelhead in the summer. Roos suggests that multi-level outlets in reservoirs should be considered for more effective cold-water release management.
Hamlet, A., P.W. Mote, M.P. Clark, and D.P. Lettenmaier, *Effects of Temperature and Precipitation Variability on Snowpack Trends in the Western United States,* Journal of Climate, 2005.	This paper summarizes hydrologic simulation studies that were used to examine trends in snow water equivalent for the western U.S. The authors found that widespread warming occurred during 1916–2003, resulting in downward trends in April 1 snow water equivalent for large areas of the western U.S. However, as in previous work, the authors indicate upward trends in snow water equivalent in the Southwest and southern Sierra. Importantly, the paper finds that almost all upward trends in snow water equivalent are due to modest upward trends in precipitation, while all downward trends are associated with widespread warming. Decadal variability (such as the Pacific Decadal Oscillation) is reported to account for the winter trends of precipitation. Trends for stations at high elevations are less affected by warming than those at lower elevations.

TABLE 14.11-1 (Continued)
CLIMATE CHANGE SCIENCE REFERENCES

Reference	Summary
Hayhoe, K., D. Cayan, C.B. Field, P.C. Frumhoff, E.P. Maurer, N.L. Miller, S.C. Moser, S.H. Schneider, K.N. Cahill, E.E. Cleland, L. Dale, R. Drapek, R.M. Hanemann, L.S. Kalkstein, J. Lenihan, C.K. Lunch, R.P. Neilson, S.C. Sheridan, and J.H. Verville, *Emissions Pathways, Climate Change, and Impacts on California*, 2004.	This study represents one of the earlier versions of the "scenarios" project for California, in which a broad range of climate impacts were analyzed under various emission pathways. The study found that California temperature increases nearly double from the lower to the higher emission scenarios and three of four simulations showed greater summer increases than winter increases. By the end of the century, Sierra snowpack was projected to decrease by 30 to 70 percent under the lower emission scenario and up to 90 percent under the higher emission scenario. The study found that the main differences between scenarios were apparent in the second half of the century, but were strongly dependent on emissions from the preceding decades.
Cayan, Dan, *Climate Change: A Challenge Looming for California*, 2004.	This reference is for a presentation given at the Ground Water Conference, Sacramento, California on October 26, 2004 by Dan Cayan, Scripps Institution of Oceanography, Climate Research Division and the U.S. Geological Survey with input from Mike Dettinger, Iris Stewart, and Noah Knowles, sponsored by the NOAA OGP RISA element, California Energy Commission PIER program. The presentation showed modeled temperature changes for Northern California that range from 1.5 to 4.5 °C by 2050 and from 2 to 10 °C by 2100. A midpoint in these ranges was selected for each date: 3 °C by 2050 and 6 °C by 2100. The presentation concluded that: • Humans have altered the atmospheric composition and thus are altering the earth's climate; greenhouse gases have long lifetimes, so choices made now and in the future will determine future climate. Warming is already underway and coming fast. • California temperature projections are broadly in consensus (increases from 2 to 6 °C by 2100). • Warming would produce more rain, less snow, earlier flows, more floods, higher sea level, and drier summers. • California precipitation projections are scattered, with most projections showing small changes. • "Shoulders" of watershed elevations at 6,000–8,000 feet would generate more immediate runoff. • Better monitoring and modeling is crucially needed.
Kiparsky, M. and P.H. Gleick, *Climate Change and California Water Resources: A Survey and Summary of Literature*, California Water Plan, Vol. 4, Reference Guide, 2003.	This report summarizes the research and studies (as of 2003) of climate change effects on various California resources. It also highlights areas of greater uncertainty and provides recommendations for further research. The report concludes with suggested strategies for adapting to potential climate change impacts. This report provides a good summary of research, but is somewhat outdated with the rapid advance of climate change analyses in recent years.
Miller, N.L. and K.E. Bashford, *Climate Change Sensitivity Study of California Hydrology: A Report to the California Energy Commission*, Lawrence Berkeley National Labs Technical Report No. 49110, 2001.	This report describes the methodology and results of a study to analyze the effects of climate change on the major drainages of the Central Valley. The study utilized two AOGCM projections from the IPCC Third Assessment Report to analyze temperature and precipitation changes, and eventually snowpack, snowmelt, and runoff. Of particular note in this study, the authors utilized a range of temperature shifts and precipitation ratios to the Sacramento Soil Moisture Accounting Model and Anderson Snow Model in order to determine hydrologic sensitivities. Climate temperature shifts and precipitation ratios were utilized to constrain the changes from the historical climate in order to use existing operational models and "increase credibility and public acceptance" of hydrologic response. Such an approach was deemed valid, although it removed the variance in the time-series that may indicate extreme events. Results indicated that a larger proportion of the streamflow volume will occur earlier in the year and that the amount and timing is dependent on the characteristics of each basin, particularly the elevation of the freezing line. In general, higher elevation basins are less sensitive and do not lose as much winter season snowpack as those with centroid elevations near the freezing line. The paper also reported that there would likely be an increase in high flow days under the scenarios analyzed.

SOURCES: CH2M HILL, 2007; SFPUC, 2008.

TABLE 14.11-2
SELECTED CLIMATE CHANGE POLICY AND GUIDANCE REFERENCES

Reference	Summary
Natural Resources Defense Council (NRDC), *In Hot Water: Water Management Strategies to Weather the Effects of Global Warming,* 2007.	This recent report highlights the potential effects of climate change on water resources and ecosystems and suggests approaches for future water management. Potential impacts on water supply, flood management, aquatic ecosystems, water quality, and hydropower are summarized largely through reference to other studies. The foundation of the report, however, is in identifying approaches for incorporating climate change into water planning and management. The report suggests the following strategies for water managers: (1) evaluate the vulnerability of water systems to global warming impacts, (2) develop response strategies to reduce future impacts of global warming, (3) prevent future impacts by reducing greenhouse gas emissions, and (4) increase awareness of global warming and water impacts. The report also provides an assessment of the performance of various water management strategies after considering global warming effects. This report is included here as it was referenced by a commenter on the Draft PEIR.
California Department of Water Resources (DWR), *State Water Project Delivery Reliability Report-2005,* April 2006.	The 2005 State Water Project (SWP) Delivery Reliability Report addressed the need to incorporate some of the uncertainties of global warming with regard to planning and operation of the SWP. "Until the impacts of climate change on precipitation and runoff patterns in California are better quantified, future weather patterns are usually assumed to be similar to those of the past, especially where there is a significant historical rainfall record. The State Water Project analyses contained in this report are based upon 73 years of historical records (1922 to1994) for rainfall and runoff that have been adjusted to reflect the current and future levels of development in the source areas by analyzing land use patterns and projecting future land and water use. These series of data are then used to forecast the amount of water available to the SWP under current and future conditions. The assumption that past rainfall-runoff patterns will be repeated in the future has an inherent uncertainty, especially given the evolving information on the potential effects of global climate change." Note: This report has been updated in 2007 to incorporate recent interim changes in fishery protection actions required by court decisions. The report also presents SWP reliability information with consideration given to the climate change scenarios described in DWR July 2006 above.
Gleick, P.H., H. Cooley, and D. Groves, *California Water 2030: An Efficient Future*. Pacific Institute, September 2005.	This report is not specifically on climate change, but investigates the water "scenarios" approach to decision-making as applied to the California Water Plan. The report argues that the scenarios approach allows for robust decision-making without explicitly quantifying all ranges of uncertainty. This report is included here as it was referenced by a commenter on the Draft PEIR.

SOURCE: CH2M HILL, 2007.

Senate Bill 1368

Approved in 2006 as the companion bill of Assembly Bill 32, Senate Bill 1368 requires the California Energy Commission, in consultation with the California Public Utilities Commission and the CARB, to establish and adopt by June 2007 a GHG emission performance standard and implementing regulations for all long-term baseload generation commitments made by electric utilities. The legislation requires the California Energy Commission to reevaluate and continue, modify, or replace the GHG emission performance standard when an enforceable GHG emissions limit is established and in operation.

Executive Order S-1-07

Executive Order S-1-07, the Low Carbon Fuel Standard, was issued on January 18, 2007 and calls for a reduction of at least 10 percent in the carbon intensity of California's transportation fuels by 2020. The order instructs the California Environmental Protection Agency to coordinate activities among the University of California, the California Energy Commission, and other state agencies to develop and propose a draft compliance schedule to meet the 2020 target. Furthermore, the order directs the CARB to consider initiating regulatory proceedings to establish and implement the Low Carbon Fuel Standard. In response, the CARB identified the Low Carbon Fuel Standard as an early action item with a regulation to be adopted and implemented by 2010.

Senate Bill 97

Senate Bill 97 was signed into law in August 2007. This bill requires the Office of Planning and Research to prepare, develop, and transmit to the State of California Resources Agency guidelines for the feasible mitigation of GHG emissions or the effects of GHG emissions by July 1, 2009. The Resources Agency would be required to certify and adopt those guidelines by January 10, 2010. The Office of Planning and Research is required to periodically update the guidelines to incorporate new information or criteria established by the CARB pursuant to the California Global Warming Solutions Act of 2006 (described above). The Office of Planning and Research recently released a technical advisory on CEQA and climate change. The technical advisory offers "informal guidance regarding the steps lead agencies should take to address climate change in their CEQA documents" (OPR, 2008).

14.11.3 Review of Water Agencies' Water Supply Management Approach to Climate Change

Comment Summary

This section of this master response responds to all or part of the following comments, which reference actions by other water agencies to address climate change:

F_NPS-YOS-01	SI_GreenP-04	SI_TRTCWA-SierraC-133
S_RWQCBSF-16	SI_SPUR-04	SI_TRTCWA-SierraC-135
L_ACFCWCD-05	SI_SPUR-05	SI_TRTCWA-SierraC-159
L_MID-TID1-11	SI_TRT8-06	SI_TRTCWA-SierraC-168
L_MID-TID1-26	SI_TRTCWA-SierraC-20	C_Gelma-02
SI_ACT-04	SI_TRTCWA-SierraC-22	C_Hasso-04
SI_ACT-05	SI_TRTCWA-SierraC-34	C_Lee-04
SI_CAC2-04	SI_TRTCWA-SierraC-70	C_Mater-02
SI_CNPS-EB1-06	SI_TRTCWA-SierraC-77	C_Owen-01
SI_CRS-04	SI_TRTCWA-SierraC-78	C_Unreadable1-01
SI_CWA-01	SI_TRTCWA-SierraC-130	

Summary of Issues Raised by Commenters

- The PEIR should follow an approach to climate change similar to that used by EBMUD, which has quantified possible climate change impacts and developed operation models.

- Turlock Irrigation District (TID) staff conducted preliminary modeling of global warming effects on the Tuolumne River and the PEIR needs to address the impacts of global warming on this river system.

Response

East Bay Municipal Utility District

EBMUD has been actively monitoring the progress of climate change research to understand and predict potential future impacts on its water supply and operations and has used the results from climate change studies to analyze these impacts (Sykes, 2006). In general, the results have indicated only a modest impact on the utility's water supply reliability. EBMUD used its water supply model to simulate the 80-year historical hydrologic record under a changed climate scenario to analyze the potential effects on water supply reliability at a 2020 level of development. These simulations assumed no change in total annual precipitation, but assumed that a warmer climate (3 °C increase in temperature) would cause 28 percent of the historical runoff to occur earlier in the year. The results of the study indicated that an earlier runoff would have little impact on EBMUD's water deliveries for four main reasons: the large percentage of spring runoff in the system's water supply watershed, the steepness of the area-elevation curve (see Figure 14.11-2), the timing and amount of demands, and the reservoir storage-to-runoff ratio. The climate change scenario used in their model resulted in fewer flood control releases due to decreased spring runoff and no significant effect on carryover storage. In addition, the amount of demand under this scenario is less than the average annual runoff, and the storage volume is greater than the average annual runoff. Nonetheless, EBMUD has taken actions to prepare for climate change, including diversifying its water supply portfolio to reduce vulnerability to geographical variation in precipitation and reinforcing its system to prepare for the effects of a 3-foot sea level rise on its Delta facilities. It is also promoting water conservation and water reclamation and a reduction in emissions of GHGs.

EBMUD has embarked on an evaluation of water supply management options through the year 2040. The focus of EBMUD's initial climate change plan is on the vulnerability of its system to climate change. As part of this effort, the district will conduct sensitivity analyses to evaluate and score the flexibility of each water supply portfolio considered in the Water Supply Management Plan 2040 to respond to climate change. The district will also consider secondary (or backup) elements for use under the predicted worsening climate conditions. This proposed approach represents a "bottom-up" methodology that would initially be limited to climate change scenarios and would not rely on the results of the "downscaled" atmosphere-ocean general circulation models (AOGCM) being used by the DWR (see the description in Table 14.11-1, above, under DWR's *Progress on Incorporating Climate Change into Planning and Management of California's Water Resources,* 2006).

As described in more detail below, many of EBMUD's strategies to address climate change are similar to those being implemented by the SFPUC. The SFPUC used one of the same key assumptions as EBMUD in its near-term planning for climate change (i.e., no change in the total annual precipitation but a shift in runoff patterns to earlier in the year that would be expected to result from warmer climate). However, unique aspects of the EBMUD and SFPUC systems

necessitated some differences in the analyses of climate change effects on the systems' water resources and deliveries as well as in the long-term planning approaches. For example, the SFPUC conducted preliminary modeling of near-term climate change effects (to 2030) using temperature projections that were consistent with those of the IPCC, while EBMUD's period of analysis was to 2020 and used different temperature figures. As described below in Section 14.11.4, the SFPUC analysis used a potential mean annual temperature increase of 1.5 °C by 2025–2030, based on climate change studies that forecast a mean annual temperature increase of 3 °C by 2050 (Dettinger, 2005; Sansone and Storck, 2006). EBMUD's use of a 3 °C temperature increase by 2020 accelerates the projected temperature increase compared to the findings of current climate change studies and thus represents a very conservative assumption. The SFPUC's long-term water supply planning to prepare for the effects of climate change (as described in Section 14.11.5, below) has some of the same elements as EBMUD's program, including diversifying its water supply portfolio.

Turlock Irrigation District

TID has conducted some preliminary analyses of the possible impacts of global warming on Tuolumne River watershed runoff. The ongoing study, performed in collaboration with the SFPUC, uses a physical process model—the Hydrologic Forecasting Analysis Model—calibrated to the Tuolumne River basin for the period 1931 to 2000. The model is designed to explicitly analyze evapotranspiration,[1] snowpack, precipitation as rain or snow, and heat budget to determine effects on runoff timing and volume. This initial work compares the existing temperature (base case) with increasing temperature inputs of 0.6 and 1.7 °C (1 and 3 °F). The SFPUC is currently working with TID in reviewing the model assumptions and preliminary results. However, the work is still in progress, and no conclusions have been reached to date. As described in Section 14.11.5 below, the SFPUC is working with TID to further develop this model for use in long-term planning for climate change effects.

California Department of Water Resources

The DWR's climate change planning efforts are described above in Table 14.11-1. The SFPUC is using information provided by the DWR as general guidance in addressing climate change effects on its water system, although the results of specific DWR modeling do not address the Hetch Hetchy system and therefore are not directly applicable. (Please refer to Table 14.11-1 for descriptions of DWR's climate change planning documents.)

Sacramento Municipal Utility District

Because the Sacramento Municipal Utility District (SMUD) system includes reservoirs in the Sierra Nevada at elevations similar to those in the Hetch Hetchy system, the SFPUC contacted SMUD regarding its ongoing actions related to climate change. SMUD is following the scientific literature and DWR's analyses on climate change, particularly with respect to potential effects on the runoff patterns and quantities that could affect its system. Although SMUD does not provide water supply services, it operates and maintains hydroelectric facilities that are dependent on

[1] The return of water from the soil and from plants to the atmosphere by evaporation and transpiration.

runoff patterns that could be altered by climate change. SMUD's hydroelectric project in the upper American River watershed includes three major reservoirs, at elevations of approximately 4,500, 5,500, and 6,300 feet. Because the drainage basin includes areas at 9,000-foot elevations, climate change effects associated with rising snowlines would not be expected to affect SMUD's system in the near future. SMUD has not conducted modeling or other analyses to determine any special issues for its reservoirs and watershed (McFadden, 2008).

14.11.4 Climate Change and the SFPUC Regional Water System

Comment Summary

This section of this master response responds to all or part of the following comments:

F_NPS-YOS-01
S_RWQCBSF-16
L_ACFCWCD-05
L_MID-TID1-11
L_MID-TID1-26
SI_ACT-04
SI_ACT-05
SI_CAC2-04
SI_CNPS-EB1-06
SI_CRS-04
SI_CWA-01
SI_GreenP-04
SI_PacInst-18
SI_SierraC2-03
SI_SierraC3-03
SI_SierraC7-06
SI_SPUR-04
SI_SPUR-05
SI_TRT7-09
SI_TRT8-06
SI_TRT-CWA-SierraC-20
SI_TRT-CWA-SierraC-22
SI_TRT-CWA-SierraC-34
SI_TRT-CWA-SierraC-70
SI_TRT-CWA-SierraC-77
SI_TRT-CWA-SierraC-78
SI_TRT-CWA-SierraC-130
SI_TRT-CWA-SierraC-133
SI_TRT-CWA-SierraC-135
SI_TRT-CWA-SierraC-159
SI_TRT-CWA-SierraC-168
SI_TRT7-09
SI_TRT8-06
SI_TRT-CWA-SierraC-20
SI_TRT-CWA-SierraC-22
C_Chode-01
C_Clark1-04
C_Clark1-07
C_Clark1-08
C_Clark1-12
C_Clark2-03
C_Colli-02
C_Garba-03
C_Gelma-02
C_Genov-02
C_Colli-02
C_Garba-03
C_Genov-02
C_GreenD-03
C_GreenD-03
C_Hasso-04
C_Kallin-01
C_Lee-04
C_MartiM-04
C_Mater-02
C_Mijac-01
C_Owen-01
C_Raffa-06
C_Stein-03
C_Stein-04
C_Sugar-02
C_Tubma-02
C_Unreadable1-01
C_Walke-02

Summary of Issues Raised by Commenters

- The PEIR should analyze the effects of increased diversions coupled with the effects stemming from climate change and global warming, including impacts on biological resources.
- The PEIR should analyze the effects on the Tuolumne River watershed, including the SFPUC's Tuolumne River system firm yield, due to climate change and associated effects on the SFPUC's system operations and water yield.
- The PEIR should analyze the effects of climate change on demand, water use patterns, and the frequency of future rationing.

- Use of historical hydrology in the impact analysis overestimates water availability and underestimates the impacts of removing water from the Tuolumne River. Changes within the historical range are not the same as no impact, and modeling shown in the PEIR does not capture the range of impacts.
- The analysis should be expanded to include the effects resulting from changes in the frequency and duration of extreme climatic events.
- The water system needs to be robust enough to withstand any future climate scenario.

Response

Chapter 5 of the Draft PEIR (Vol.3, pp. 5.7-92 to 5.7-96) describes the SFPUC's initial modeling of potential climate change effects, which indicated that warming of 1.5 °C would effectively raise the snowline by 500 feet and transfer a portion of each year's runoff from spring/summer to fall/winter. This initial modeling of the SFPUC's regional water system indicates that, by 2025, about 7 percent of the current runoff to Hetch Hetchy Reservoir would occur earlier in the year. The Draft PEIR indicates that this degree of change is within the interannual variation in runoff, and that the potential impacts of global warming on the SFPUC's regional system would not affect the proposed WSIP operations through 2030. Consistent with the approach presented in the Draft PEIR, the analysis presented in this master response relies on the best available scientific information to provide further discussion and assessment of potential climate change effects on water resources and the SFPUC regional water system in the context of the environmental impacts of the WSIP.

SFPUC's Current Studies of Climate Change Effects

Background

The SFPUC manages three reservoirs in the Sierra Nevada mountains and five local reservoirs in the Bay Area to provide water supplies for customers in the Bay Area. The mountain watersheds typically have substantial snowmelt runoff from about March through June, filling the three Sierra reservoirs by late in the spring season. The supply from the Sierra reservoirs supplements the water supply provided by the local reservoirs, and in most years it is adequate to meet customer demand through the summer as well as to provide longer term reservoir storage in case subsequent years are dry.

The historical variability of hydrologic year types includes a broad range of annual runoff volumes in the mountain watersheds, ranging from at least 40 to 200 percent of the average annual runoff, and each winter's pattern of storms is different. The SFPUC operates the Hetch Hetchy system based on the "water first" protocol (see the Draft PEIR, Vol. 1, Chapter 2, p. 2-18), and discretionary drafts of the reservoir do not occur until forecasting tools confirm that snowmelt runoff will fill the reservoirs. This policy is designed to protect against water supply shortages in the foreseeable future.

The Hetch Hetchy basin above O'Shaughnessy Dam covers 459 square miles. About 87 percent of the area is above 6,000 feet in elevation, and about 76 percent is above 7,000 feet. The Cherry

Creek drainage basin above Lake Lloyd is 116 square miles; about 76 percent is above 6,000 feet, and about 52 percent is above 7,000 feet. The Eleanor Creek drainage basin above Lake Eleanor is 79 square miles, and about 60 percent is above 6,000 feet and 26 percent is above 7,000 feet.

Based on preliminary modeling of global warming effects, the SFPUC has estimated that the elevation of the snowline in the Sierra watersheds will increase from 6,000 to about 6,500 feet by 2025 (see the Draft PEIR, Vol. 3, Chapter 5, p. 5.7-94). This change means that in the future with climate change more of the precipitation in the SFPUC's Sierra watersheds will fall as rain than as snow due to the increased occurrence of warmer storms compared to historical conditions. It also means that the snowpack, on average, will contain less water and produce less snowmelt runoff. While the total runoff volume is likely to stay about the same, the pattern of the runoff will change. The November-through-March fraction of the runoff is expected to increase, and the April-through-July fraction of the runoff is expected to decrease.

Preliminary Modeling of Near-Term Climate Change Effects

The Draft PEIR (Vol. 3, Chapter 5, pp. 5.7-94 to 5.7-96) summarizes the SFPUC's initial evaluation of climate change effects on the regional system, and a more detailed description of that study is presented in this master response. The SFPUC conducted a preliminary analysis of global warming effects using the Water Supply Forecast Model (WSFM), a statistical model based on a 48-year record of daily temperature and precipitation (Hannaford, 1997). The SFPUC currently uses the WSFM as a tool to assist in the planning and operation of the Hetch Hetchy system to predict unimpaired stream flow conditions, and adapted this model to estimate stream flow effects of near-term temperature increases in the Tuolumne River watershed that appear likely in the next few decades based on the climate change literature. However, because the WSFM is a statistical model based on historical data, the SFPUC is working with TID to develop a different model—a physical process model—for studying long-term climate change effects (see Section 14.11.5, below).

The WSFM makes forecasts using prior precipitation and runoff, the water stored as snowpack in the basin, and future precipitation. The basin's snowpack is quantified by 35 snow courses (snow measuring stations) located throughout the Merced, Tuolumne, and Stanislaus River basins. Historical precipitation is used to estimate the likely range of future precipitation, and historical temperature is used to estimate future snow melt quantity and timing. An advanced statistical procedure is employed to develop equations that are then used, together with current conditions and 48 years of historical temperature and precipitation data, to make monthly forecasts of future runoff volumes.[2]

The database used in the model includes public data collected by state, federal, and cooperating organizations and individuals. Snow course data are coordinated by the California Cooperative Snow Survey Program based in Sacramento. Precipitation and temperature data originate from a variety of sources, including the Snow Survey, the National Weather Service and their

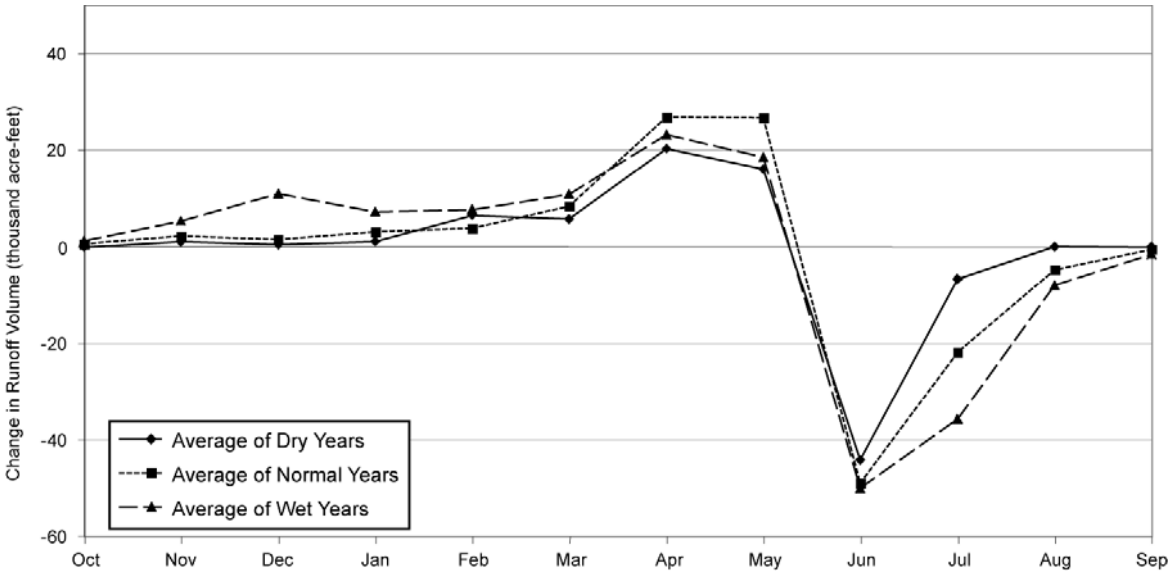
[2] Based on standard errors, the accuracy of the WSFM in predicting total annual runoff is within approximately 5 percent.

cooperators, and irrigation and water supply districts. Runoff data for the model originate from sources such as the U.S. Geological Survey, TID, and MID.

Climate change studies indicate that there will be an increase of 3 °C mean annual temperature from 2000 to 2050 (Dettinger, 2005; Sansone and Storck, 2006). Because the PEIR period of analysis is through 2030, a projected temperature increase of 1.5 °C (about 3 °F) by 2025 was selected for analysis, which is assumed to approximate the 2030 condition. Thus, a 1.5 °C warming factor was added to historical temperatures, and the SFPUC calculated runoff volumes by month for the 1948–1995 period using the WSFM to depict a climate change scenario. Differences in the monthly volumes between the historical and climate change scenarios were analyzed for the entire analysis period, and the years were also sorted into wet, normal, and dry categories to determine if differences were evident for the various wetness regimes. This analysis assumed that no changes in annual precipitation would occur, even though the scientific literature has reported a range of differences in various model projections for precipitation changes due to global warming. Since the scientific literature indicates no clear trend for precipitation changes in California over the next century (see the description in Table 14.11-1, above, under CalEPA's *Climate Action Team Report to Governor Schwarznegger and the Legislature*, 2006), it was determined that no change in annual precipitation from historical/existing conditions was a reasonable assumption for the purposes of this near-term analysis (i.e., use of this assumption would be sufficient to characterize the general nature of effects that may be expected through 2030 due to climate change). The analysis is not intended to provide the full range of possible outcomes that could occur under the various climate change scenarios, but rather to encompass a reasonable range of effects. In the absence of scientific consensus on a quantifiable change in precipitation, the assumption of no change avoids speculation as to whether precipitation would decrease, increase, or occur at the same level, or whether it would occur on fewer days but at more intense levels.

Preliminary results from the WSFM confirmed that a shift in the timing of runoff from late winter months to early winter months could occur between 2000 and 2025, and inflow to all three of the SFPUC's Sierra reservoirs shows an average shift in runoff of about 7 percent. For the 48-year period, about 7 percent of the runoff shifted from the April–July period to the November–March period. In dry years, the runoff volume is smaller, and 8.5 percent shifted, corresponding to a volume of about 35,000 acre-feet out of 410,000 acre-feet as an average runoff volume for that year type. For normal years, 7 percent shifted, corresponding to a volume of about 50,000 acre-feet out of 677,000 acre-feet as an average runoff volume. For wet years, 6 percent shifted, corresponding to a volume of about 70,000 acre-feet out of 1,410,000 acre-feet. **Figure 14.11-1** graphically depicts the shift in the volume and timing of runoff that would be expected to occur by 2025 compared to historical conditions based on a 1.5 °C increase in temperature.

The capacity of Hetch Hetchy Reservoir is 360,000 acre-feet, and in normal and wet years over 700,000 acre-feet of water flows into the reservoir, resulting in large spills/releases to the Tuolumne River. Modest amounts of spill occur even in dry years. The WSFM results indicate that a shift in the timing of runoff volumes ranging from 35,000 to 70,000 acre-feet could occur by 2025 due to global warming. These predicted changes are well within the range of current and



Note: Zero represents average historical conditions from 1948 to 1995.

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SOURCE: SFPUC, 2008.

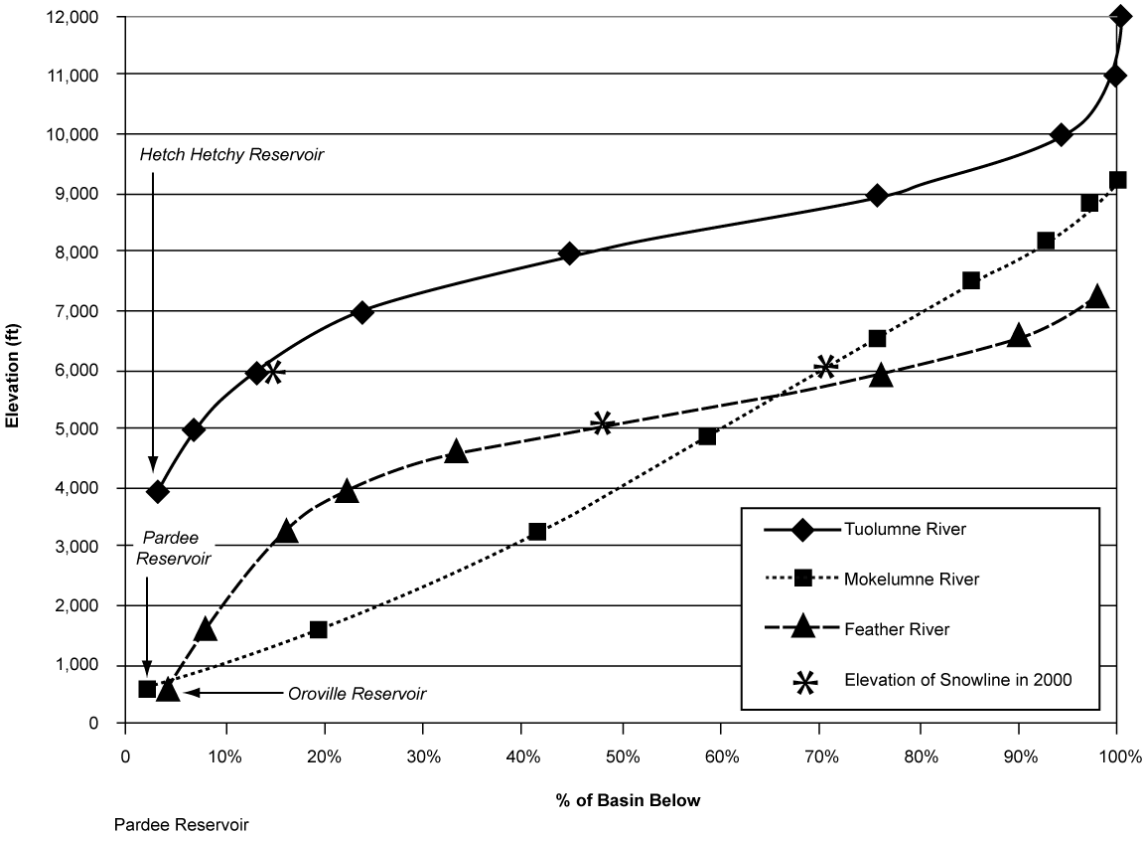
Figure 14.11-1
Modeled Shift in Runoff to Hetch Hetchy Reservoir
Comparing Historical Patterns with a Global Warming Scenario
of 1.5 °C Increase in Temperature

historical variability in annual runoff patterns. Year-to-year historical variability has shown much larger shifts between early and late winter runoff than the 2025–2030 global warming effect projected by the WSFM. Therefore, while global warming is projected to result in changes in runoff patterns in the Hetch Hetchy watershed, the SFPUC operators have determined that the magnitude of the predicted near-term changes is within the range of current/historical runoff patterns, and therefore it is not expected that substantial changes in SFPUC management practices or operations would be required through 2030. In dry years, if runoff ends earlier than in normal or wet years, the SFPUC has established operational procedures to minimize spills or discretionary power releases. A shift in the timing of runoff volumes (ranging from 35,000 to 70,000 acre-feet) to earlier in the season could cause releases/spills from the reservoir to cease a few days earlier each year. For current Hetch Hetchy Reservoir operations, the period when spills cease typically ranges from June 1 to August 15 depending on the hydrologic conditions of any given year. Under global warming conditions in the 2025–2030 timeframe, any change in the timing of when spills from Hetch Hetchy Reservoir cease would be minor compared to current/historical year-to-year variability. For these reasons, the SFPUC operators have determined that the change in runoff timing due to near-term global warming is not expected to cause substantial operational changes in the SFPUC's water supply system or its reliability.

The critical factor behind the relatively small shift in runoff timing and volume due to the predicted 1.5 °C warming at Hetch Hetchy Reservoir is the high elevation of the Hetch Hetchy watershed. The higher the elevation of a snow-covered basin, the greater the warming needed to change a large fraction of the snow-covered area and alter runoff patterns significantly.

Figure 5.7-5 in the Draft PEIR (Vol. 3, Chapter 5, p. 5.7-95) depicts the estimated decrease in snowpack in the Hetch Hetchy watershed due to predicted temperature increases by 2030 associated with global climate change.

Thus, the expected near-term climate change effects on the SFPUC regional system are different from those predicted for other California water supply and hydroelectric systems with reservoirs at much lower elevations. For example, EBMUD's Mokelumne River watershed and the SWP's Feather River watershed contain much lower proportions of their overall drainage basin as high-elevation snowpack compared to the Tuolumne River watershed. As shown in **Figure 14.11-2**, the overall basin elevation and the shape (steepness) of the area-elevation curve are indicative of a system's sensitivity to temperature change. The Feather River basin, for example, is sensitive to temperature change because its area-elevation curve is very flat, and for modest temperature changes, large areas of the basin could shift from snow-covered to rain-influenced lands.



SFPUC Water System Improvement Program ▪ 203287

SOURCE: SFPUC, 2008.

Figure 14.11-2
Relationship between Area and Elevation for the Tuolumne, Mokelumne, and Feather River Basins

Reservoirs at higher elevations, such as Hetch Hetchy, are less likely to be affected by increased air temperatures from global warming in the next 25 to 30 years than those at lower elevations in terms of reservoir water temperatures and stream flow releases. A shift in the timing of runoff would not likely cause a substantial change in the magnitude or schedule of the minimum stream flow releases from reservoirs at higher elevations, since these releases are routinely made from the bottom of the reservoir (i.e., below the upper layer of water in the reservoir that is affected by air temperature). If summer air temperatures become significantly higher with global warming, streams may warm more rapidly than under historical conditions; however, air temperature is dynamic and highly variable, and thermal refuges such as cool, deep pools exist in most stream reaches.

In conclusion, the preliminary WSFM results indicate that the near-term effects of climate change through 2030 are not expected to affect the current water supply planning or operations of the SFPUC regional water system.

Since the planning horizon for the WSIP is 2030, the results of the preliminary WSFM modeling are adequate for the purposes of the PEIR environmental analysis. A description of the SFPUC's long-term planning with respect to climate change is provided in Section 14.11.5, below, for informational purposes. Further detail on the effects of climate change as they relate to the proposed WSIP is presented below using the results of the WSFM modeling.

It should be noted that the current state of atmospheric science and global circulation models is not yet advanced enough to provide specific information on phenomena such as changes in total precipitation, seasonal precipitation allocation, or the more frequent or more intense droughts or larger storm events that some scientists believe may occur. Thus, at this time, it would be speculative to predict the magnitude and characteristics such events and attempt to analyze them with operational planning models. The SFPUC now uses a design drought in its operational planning models that is longer and more intense than any drought on record, and is thereby planning for the more intense droughts predicted to occur under some climate change scenarios using prudent judgment and the best available scientific information.

Qualitative Assessment of WSIP Impacts with Consideration of Climate Change Effects

In response to the numerous comments on the Draft PEIR related to climate change, this master response presents a qualitative assessment of potential WSIP impacts in the context of potential climate change effects in order to confirm the impact analysis of proposed WSIP water supply and system operations presented in the Draft PEIR (Vol. 3, Chapter 5).

In the 2005 *State Water Project Delivery Reliability Report*, the DWR stated:

> Until the impacts of climate change on precipitation and runoff patterns in California are better quantified, future weather patterns are usually assumed to be similar to those of the past, especially where there is a significant historical rainfall record.

Consistent with this statement, the impact analysis of the WSIP water supply and system operations presented in Chapter 5 of the Draft PEIR is largely based on results obtained from the Hetch Hetchy/Local Simulation Model (HH/LSM), which simulates system operations over an 82-year period of historical hydrology (from 1920 to 2002). Although there is inherent uncertainty regarding whether historical hydrology will be repeated in the future—especially given the evolving information on the potential effects of global climate change—the use of historical data over 82 years provides a wide enough range of inter-annual variation to address the climate change effects expected by 2030. The HH/LSM represents the best available tool for depicting overall regional system operations and predicting potential future effects on resources downstream of SFPUC water system facilities. The validity of this methodology to account for the future effects of climate change through 2030 was corroborated by the results of the WSFM modeling described above, which indicated that, independent of WSIP implementation, the existing SFPUC system operations and management practices provide adequate flexibility to accommodate the projected effects of climate change through the WSIP planning year of 2030.

Nevertheless, in response to comments received on the Draft PEIR, a qualitative analysis was conducted to determine how climate change might affect the environmental impacts of the WSIP identified in the Draft PEIR. The qualitative assessment was conducted by first reviewing the key findings from the scientific literature (summarized in Section 14.11.2, above) and assessing the applicability of each finding to the SFPUC regional water system. The qualitative analysis then reexamined the impacts of the WSIP assuming that a certain climate change scenario would occur between now and 2030 using the findings from the WSFM modeling described above. The qualitative analysis was based on an understanding of regional system operations and operating constraints combined with an understanding of the changes in system operations that would result from WSIP implementation as identified through the HH/LSM.

Table 14.11-3 lists the key findings from the literature review on climate change variables and describes how each variable relates to the HH/LSM assumptions and how those assumptions could be adjusted to account for climate change. The table indicates that, with the exception of the shift in the seasonal timing of runoff to the Hetch Hetchy system reservoirs and Don Pedro Reservoir, no other adjustments to the assumptions used in the HH/LSM or the Draft PEIR impact analysis would be required, either because any revised assumption would be too speculative at this time or because the existing operational protocols and planning process include adequate flexibility to account for expected climate change effects through 2030.

Methods and Assumptions for Qualitative Assessment

This qualitative analysis was based on a reasonable prediction of climate change effects in the next few decades as they pertain to the SFPUC regional water system. Although it does not encompass the wide range of climate change projections and variability described in the scientific literature, this approach provides a reasonable basis for the purposes of the PEIR for estimating the nature and magnitude of the environmental impacts of the WSIP while accounting for climate change through 2030. This qualitative assessment assumed global climate change would increase air temperatures in California by an average of 1.5 °C by 2030, but that no change in average annual precipitation would occur. These assumptions are generally consistent with the results of

TABLE 14.11-3
CLIMATE CHANGE VARIABLES AND THE SFPUC REGIONAL WATER SYSTEM

Climate Change Variable	Existing HH/LSM Modeling Assumptions That Could Be Affected	Adjusted Assumptions to Account for Climate Change Variable for the Qualitative Assessment
1. Sierra snowpack will likely decrease due to an increase in snowline elevation, resulting in increased amount of precipitation falling as rain rather than snow and an earlier snowmelt. Since there is no clear trend for precipitation changes in California, this variable assumes no change in total average annual precipitation.	• Unimpaired runoff to Hetch Hetchy system reservoirs and to Don Pedro Reservoir • Tuolumne River entitlements among CCSF, TID, and MID • Forecasted runoff procedures and operation protocols	Shift in monthly distribution of inflow within a year: • Increased inflow to reservoirs in fall, winter, and spring (approximately October to May) • Decreased inflow to reservoirs in late spring and summer (approximately June to September)
2. Rivers and streams fed by mountain watersheds are expected to exhibit an increase in stream flow in fall, winter, and spring, and a decrease in late spring and summer.	Instream flow requirements are based on hydrology and fishery needs that establish releases from: • Lake Lloyd (Cherry Reservoir) • Lake Eleanor • Hetch Hetchy Reservoir • Don Pedro Reservoir	No change in current mandated minimum releases for fisheries from affected reservoirs. At this time, it would be speculative to assume that future resource objectives and flow requirements would be different from the existing condition.
3. Warmer air temperatures are expected to increase water temperature in reservoirs, potentially increasing temperature of releases to streams; instream water temperatures may increase.	Instream flow requirements are based on hydrology and fishery needs that establish releases from: • Lake Lloyd (Cherry Reservoir) • Lake Eleanor • Hetch Hetchy Reservoir • Don Pedro Reservoir	No change in current mandated minimum releases for fisheries from affected reservoirs (see above). There would be negligible changes in SFPUC reservoirs during all but the most extreme droughts due to the size of the coldwater pool in the reservoirs and minimal changes in reservoir operations.
4. Conflicts among water supply, hydropower, and flood control in reservoir operations are expected.	Reservoir operations	No change in protocols for SFPUC reservoir operations. Protocols would continue to prioritize water supply. No change in protocols for Don Pedro Reservoir operations by TID and MID.
5. Warmer temperatures could cause increases in water demand in both agricultural and municipal regions.	• 300 mgd, 2030 purchase request • Availability of water in Don Pedro Reservoir	No change in delivery assumptions for the SFPUC. While demand of SFPUC customers may increase, delivery is limited to the contractual amount. Agricultural demand of TID and MID may evolve, since warmer conditions could lead to increased demand for irrigation. However, other factors such as land use conversion and agricultural market forces may have a larger effect on demand for irrigation than climate change, making alternative demands too speculative to predict.
6. Sea level rise will affect coastal areas and estuaries.	Not applicable	Not applicable
7. Increased risk for more extreme weather and climate events (i.e., more intense precipitation and drought events) is likely.	• Historical and design drought sequences included in the HH/LSM to establish system firm yield and rationing needs • Flood control studies have been performed for regulatory requirements	No change in existing SFPUC operation protocols, which were developed to address a wide range of conditions, including extreme weather events. The SFPUC planning process already incorporates a more extreme drought scenario than any from historical hydrology (i.e., the design drought). No change in SFPUC operations related to flooding because the SFPUC facilities have no flood control functions. Assume no change for TID and MID flood control operations for Don Pedro Reservoir.

the literature review presented above in Section 14.11.2, with the understanding that an increase of 1.5 °C by 2030 may be on the high side (and is therefore a conservative assumption with respect to determining potential impacts). The following analysis considers the effects of this temperature increase on hydrology within the SFPUC regional water system based on the WSFM results, and compares the environmental effects that would stem from this hydrologic change with the impact analysis presented in the Draft PEIR.

The WSFM, described above, was used to estimate inflow into reservoirs on the Tuolumne River under this climate change scenario (an average of 1.5 °C warming by 2030). As noted earlier, the primary effect of the climate-change-induced temperature rise would be to increase precipitation falling as rain, decrease precipitation falling as snow, and cause snowmelt to occur earlier in the season. Using the numerical reservoir inflow estimates provided by the WSFM, the qualitative analysis was performed by tracking the movement of water through the SFPUC regional water system, noting where reservoir storage and releases to rivers would increase or decrease due to climate change effects compared to the analysis presented in Chapter 5 of the Draft PEIR. The general scale of increases and decreases was also noted. However, due to the broad assumptions used in the analysis regarding climate change effects, no numerical values for increases or decreases of reservoir storage and releases are presented, since they would give a misleading impression of the precision of this assessment.

The following assessment is organized by watersheds and reflects a three-step process. First, it summarizes the environmental impacts of the WSIP compared to existing conditions as presented in Chapter 5 of the Draft PEIR. It then describes how climate change could affect reservoir storage and releases by 2030. Finally, the impacts of the WSIP presented in the Draft PEIR are discussed in light of possible climate change effects.

Upper Tuolumne River Watershed

Under the existing condition, only the required minimum stream flow releases are made to the Tuolumne River from Hetch Hetchy Reservoir for most months of the year. In the late spring, snowmelt runoff fills the reservoir and releases in excess of the minimum required are made to the river (typically in May and June). With the WSIP in 2030, the SFPUC would draw down Hetch Hetchy Reservoir farther prior to the snowmelt period than it does under the existing condition in order to serve the increased purchase requests, thus lowering the water level in the reservoir. As a result, a greater proportion of the snowmelt runoff would be needed to refill the reservoir, and spring stream flow releases in excess of the minimum required would be delayed by a few to several days, and the total volume of releases over that time period would be reduced. Terrestrial biological resources in the Poopenaut Valley would be adversely affected by the delay and reduced volume of the spring release (see Draft PEIR, Impact 5.3.7-2, Vol. 3, Chapter 5, pp. 5.3.7-21 and 5.3.7-22).

With climate change effects in 2030, snowmelt is expected to occur earlier in the year. Assuming no change in annual precipitation, the total volume of the spring release would not be altered but its seasonal timing would be. Hetch Hetchy Reservoir would have lower water levels due to serving the increased purchase requests under the WSIP, and it would fill with snowmelt runoff

earlier in the year due to climate change; thus, releases to the river in excess of the minimum would begin earlier. Thus, it is possible that the delay in spring releases to the river (by a few to several days) that was identified as a consequence of the WSIP might not occur when the combined effects of climate change and the WSIP are considered together. If this were to happen, terrestrial biological resources in the Poopenaut Valley would not be subjected to a delay in spring releases, and the Poopenaut Valley would probably experience the greatest release several weeks earlier than under the existing condition. When climate change is considered, the effect on biological resources in the Poopenaut Valley would be the same as, or possibly less than, that described in Draft PEIR Impact 5.3.7-2.

The WSIP and climate change combined could still adversely affect terrestrial biological resources if peak flows were reduced compared to the existing condition and opportunities for groundwater recharge in the Poopenaut Valley were reduced. However, as identified in the Draft PEIR for the impacts of the WSIP, the combined effects of the WSIP and climate change on these resources could be reduced through the operational strategies described in Mitigation Measure 5.3.7-2 (Vol. 4, Chapter 6, pp. 6-49 and 6-50). These strategies involve shaping the releases from Hetch Hetchy Reservoir to maximize opportunities for inundation of the valley in an effort to achieve the necessary groundwater recharge, and, as specified in the measure, can be modified as needed to achieve the mitigating effect of sustaining the existing meadow communities.

The Draft PEIR determined that the WSIP would have a less-than-significant effect on whitewater river recreation in the upper Tuolumne River watershed (Impact 5.3.8-2, Vol. 3, Chapter 5, pp. 5.3.8-27 to 5.3.8-32). With the WSIP in 2030, the delay in spring releases could slightly reduce the number of days when flow in the river is suitable for rafting in some years; however, when climate change effects are also considered, the earlier snowmelt could cause releases to the river to begin earlier, possibly offsetting the effects of the WSIP. When climate change is considered, the effect on whitewater river recreation would be the same as, or possibly less than, that described in Draft PEIR Impact 5.3.8-2.

Lower Tuolumne River Watershed

Under the existing condition, only the minimum required stream flow releases are made to the Tuolumne River from La Grange Dam in most months. During the summer and fall, Don Pedro Reservoir is drawn down to meet water supply needs. One of the goals of dam operators is to fill the reservoir in the following winter and spring with rainfall and snowmelt runoff by the end of the snowmelt period. The operators' ability to meet this goal is constrained by the requirement that space must be retained in Don Pedro Reservoir to accommodate flood flows and reduce the risk of downstream flooding. Water in excess of the minimum required is typically released from La Grange Dam to the Tuolumne River in a number of pulses. During large winter storms, operators may have to release water to maintain the flood reservation in the reservoir, creating a pulse release of a few days to a few weeks. The need to maintain the flood reservation declines in the late spring, and the operators use snowmelt runoff to fill Don Pedro Reservoir. If more water is available than is needed to fill the reservoir, releases in excess of the minimum required are made to the Tuolumne River below La Grange Dam. In many years, the release from the reservoir during the snowmelt period is the largest of the pulse releases.

With the WSIP in 2030, increased purchase requests in the SFPUC service area would cause Don Pedro Reservoir to be drawn down farther prior to the snowmelt period than it is under the existing condition. As a result, a greater proportion of reservoir inflow from winter rainfall and snowmelt runoff would be needed to fill the reservoir. Because the reservoir would be drawn down farther than under the existing condition, runoff from winter storms could be more easily contained in the reservoir without encroaching on the flood reservation. As a result, some of the wintertime pulse releases to the Tuolumne River from La Grange Dam that occur under the existing condition would be eliminated or reduced in volume with the WSIP. The increased reservoir drawdown with the WSIP would also delay (by several days or weeks) the larger pulse release in the snowmelt period and reduce its total volume. The delay and reduction in the spring pulse release would have adverse effects on anadromous fish in the Tuolumne River and biological resources along the river below La Grange Dam (see Draft PEIR, Impacts 5.3.6-4 and 5.3.7-6, Vol. 3, Chapter 5, pp. 5.3.6-28 to 5.3.6-32 and pp. 5.3.7-25 to 5.3.7-26).

With climate change effects in 2030, rainfall and snowmelt runoff would enter Don Pedro Reservoir earlier in the season than it does under the existing condition. As the dam operators would be unable to accommodate the earlier wintertime runoff in the reservoir because of the flood control reservation, they would have to release water in excess of the minimum required to the Tuolumne River. The earlier runoff could offset the effects of the WSIP on reservoir water levels. When the effects of WSIP and climate change are considered together, the wintertime pulse releases could occur much as they do under the existing condition.

Based on the assumptions and results from the WSFM analysis, climate change is not expected to have much effect on the total average annual volume of water released from La Grange Dam by 2030.[3] As noted above, the WSIP would delay the spring pulse release by several days or weeks compared to the existing condition. The WSIP and climate change together would delay the spring release and also reduce its volume because a higher proportion of inflow to the reservoir would be in the winter and be released to the stream at that time.

The adverse effects of the WSIP on anadromous fish would be attributable to the delay and reduction in volume of the spring release from La Grange Dam and would not be much affected by the WSIP-caused reductions in wintertime pulse releases. When the WSIP and climate change are considered together, the reduction in spring release would be greater than with the WSIP alone, and therefore the effects on anadromous fish could be greater. If increases in spring water temperatures due to climate change are also considered, the effects on anadromous fish could be even more severe. Implementation of Mitigation Measure 5.3.6-4a, Avoidance of Flow Changes by Reducing Demand for Don Pedro Reservoir Water, or Mitigation Measure 5.3.6-4b, Fishery Habitat Enhancement (Vol. 4, Chapter 6, pp. 6-48 and 6-49), would avoid the impacts attributable

[3] As described in Section 14.11.2, above, the DWR reported that when some climate change scenarios are applied to Don Pedro Reservoir, there would be a reduction in Tuolumne River annual inflow to the reservoir as well as a shift in the timing of the inflow by 2050. The results of this qualitative assessment corroborate the DWR prediction that climate change will cause a shift in the timing of runoff; however, unlike the DWR results, due to differences in the assumptions used in the climate change scenarios, this qualitative assessment assumes the total annual inflow to Don Pedro Reservoir would remain the same.

to the WSIP. Since implementation of this measure would fully mitigate the adverse effects of the WSIP, the effects of climate change on anadromous fish would be independent of the WSIP.

The identified adverse effects of the WSIP on terrestrial biological resources along the Tuolumne River below La Grange Dam are primarily attributable to the reduction in average peak flows and total flows in the river. Thus, the effects on biological resources due to the WSIP and climate change combined could be essentially the same as those due to the WSIP alone (as described in Draft PEIR Impact 5.3.7-6), since climate change effects are not expected to result in much change in the total volume of winter and spring releases from La Grange Dam based on the assumptions used in the WSFM. Implementation of Mitigation Measure 5.3.6-4a (Vol. 4, Chapter 6, p. 6-48) would avoid the impacts attributable to the WSIP.

The shift in the timing of snowmelt and runoff in the Tuolumne River watershed due to climate change is not expected to affect SFPUC system deliveries to the San Joaquin Pipelines and Bay Area customers.

Alameda Creek Watershed

Climate change effects by 2030 are not expected to change the total volume of water the SFPUC diverts from the Tuolumne River. Since this analysis assumed no change in total annual precipitation, and since the Alameda Creek watershed is at a much lower elevation than the Sierra watersheds and is not affected by snowmelt, there would be no change in local hydrology and runoff patterns due to increasing snowline elevations. While some studies indicate that climate change could result in more extreme weather or climate events, there are insufficient data to make any assumptions regarding how these extreme weather events might affect a specific watershed or operation of local SFPUC facilities. None of the SFPUC reservoirs in the Alameda Creek watershed currently provide or are proposed to provide flood control functions under the WSIP, so any operational changes attributable to extreme flooding events due to climate change would occur independent of the WSIP. Similarly, SFPUC operational practices during drought events would remain the same, regardless of whether the WSIP is implemented, and the SFPUC would continue to meet all legal requirements for the protection of fish and other wildlife habitat. Consequently, the 2030 operations of water supply facilities in the Alameda Creek watershed with the WSIP and with the WSIP and climate change considered together would likely be the same. Therefore, the environmental effects of SFPUC water system operations in the Alameda Creek watershed with the WSIP and with the WSIP and climate change combined would also likely be the same, as described in the Draft PEIR (Vol. 3, Chapter 5, Section 5.4).

Peninsula Watershed

As stated above, climate change would not affect the total volume of water the SFPUC would divert from the Tuolumne River by 2030. Since this analysis assumed no change in total annual precipitation, and since the San Mateo Creek and Pilarcitos Creek watersheds are at much lower elevations than the Sierra watersheds and are not affected by snowmelt, there would be no change in local hydrology and runoff patterns due to increasing snowline elevations. While some studies indicate that climate change could result in more extreme weather or climate events, there are insufficient data to make any assumptions regarding how these extreme weather events might

affect a specific watershed or operation of local SFPUC facilities. None of the SFPUC reservoirs in the Peninsula watershed currently provide or are proposed to provide flood control functions under the WSIP,[4] so any operational changes attributable to extreme flooding events due to climate change would occur independent of the WSIP. Similarly, SFPUC operational practices during drought events would remain the same, regardless of whether the WSIP is implemented, and the SFPUC would continue to meet all legal requirements for the protection of fish and other wildlife habitat. Consequently, the 2030 operations of water supply facilities in the Peninsula watershed with the WSIP and with the WSIP and climate change considered together would likely be the same. Therefore, the environmental effects of SFPUC water system operations in the Peninsula watershed with the WSIP and with the WSIP and climate change combined would also likely be the same, as described in the Draft PEIR (Vol. 3, Chapter 5, Section 5.5).

Summary of Qualitative Assessment of WSIP Impacts and Climate Change

The assessment demonstrates that, in all cases, the impacts of the WSIP through 2030 on resources in the Tuolumne River, Alameda Creek, and Peninsula watersheds identified in the Draft PEIR remain valid when climate change effects are also considered. In most cases, when WSIP effects are considered in combination with a climate change scenario, the resulting impacts are either comparable to those described in the Draft PEIR or possibly less severe due to an offsetting effect of the timing of snowmelt compared to the WSIP-induced changes in reservoir storage or releases. In all cases, mitigation measures identified in the Draft PEIR would apply whether or not climate change is considered. Thus, the impact analysis of WSIP water supply and system operations presented in Chapter 5 of the Draft PEIR provides a reasonable, and sometimes conservative, assessment of environmental effects that accounts for potential climate change through the SFPUC planning horizon of 2030.

14.11.5 SFPUC's Actions to Address Climate Change

Comment Summary

This section of this master response responds to all or part of the following comments:

F_NPS-YOS-01	SI_SPUR-04	C_Chode-01
S_RWQCBSF-16	SI_SPUR-05	C_Clark1-04
L_ACFCWCD-05	SI_SPUR-07	C_Clark1-07
L_MID-TID1-11	SI_TRT7-09	C_Clark1-08
L_MID-TID1-26	SI_TRT8-06	C_Clark2-03
L_Tuol1-07	SI_TRT-CWA-SierraC-20	C_Gelma-02
SI_ACT-04	SI_TRT-CWA-SierraC-22	C_Hasso-04
SI_ACT-05	SI_TRT-CWA-SierraC-34	C_Lee-04
SI_CAC2-04	SI_TRT-CWA-SierraC-70	C_MartiM-04
SI_CNPS-EB1-06	SI_TRT-CWA-SierraC-77	C_Mater-01
SI_CRS-04	SI_TRT-CWA-SierraC-78	C_Mijac-01

[4] The Lower Crystal Springs Dam Improvements project (PN-4) would include improvements to protect downstream areas from the probable maximum flood; however, the Lower Crystal Springs Dam is generally not operated as a flood control facility. Crystal Springs Reservoir reduces peak flow in San Mateo Creek most of the time, and the SFPUC operates the reservoir to allow space for floodwaters when major storms are expected.

SI_CWA-01	SI_TRT-CWA-SierraC-130	C_Owen-01
SI_GreenP-04	SI_TRT-CWA-SierraC-133	C_Raffa-08
SI_PacInst-18	SI_TRT-CWA-SierraC-135	C_Unreadable1-01
SI_SierraC2-03	SI_TRT-CWA-SierraC-159	C_Willi-04
SI_SierraC3-03	SI_TRT-CWA-SierraC-168	
SI_SierraC7-06	C_Bail-02	

Summary of Issues Raised by Commenters

- Proactive climate change management strategies should be the first priority.

Response

SFPUC Water Supply Management Approach to Climate Change

As part of its ongoing operations and management of the regional water system, the SFPUC is addressing climate change with respect to both the near-term and long-term implications for the system. While some short-term trends over the next 20 to 25 years are discernible to a degree, the uncertainty associated with the range of climate conditions that could develop late in the 21st century from the continued accumulation of greenhouse gases in the atmosphere presents a greater challenge to water supply management.

The SFPUC is now taking steps to evaluate its water supply planning with respect to climate change effects. In addition, the SFPUC is working at a broader level to organize the utility community around climate change issues, to advocate for improved climate science, and to help develop better decision support tools that can address uncertainties related to long-term climate change effects.

Planning for Long-Term Climate Change Effects

The SFPUC is investigating the effects of global warming on the Tuolumne River basin water supply at time scales that extend well beyond the planning horizon for the WSIP and the PEIR. At these longer time scales (such as by 2100), a potential 6 °C change would have a range of effects that are more significant than the effects estimated to occur by 2025 or 2030. Physical processes subject to long-term climate change effects, such as evapotranspiration (ET), the lack of permanent snow cover, and midwinter melting, could change runoff timing in a significant way and even alter runoff volumes due to increased ET losses.

The SFPUC has begun collaborative research with TID (as described above in Section 14.11.3) and plans to assess the longer time-scale changes with a physical process model that TID has had calibrated to the Tuolumne River basin. The TID model is an explicit physics-based simulation model that incorporates the physical processes that occur during the accumulation and ablation (loss) of a watershed's snowpack and that produce runoff, and is thus better suited to examining the large changes in temperature and other variables that could occur between 2025 and 2100. The TID model analyzes ET and snowpack accumulation by allocating precipitation (as rain or snow) on 800 sub-watersheds based on elevation and other factors, and then performs heat budget calculations for the snowpack. It is expected that the model will depict representative effects of

long-term climate change on runoff timing and volume. The TID model output can then be used as the input to an operations or planning model to investigate changes in operations, firm yield, and other issues of interest for the period from 2050 to 2100 and beyond. Operations models using these new inflow time series can be changed to assess ways of adapting current project operations to compensate for the expected larger changes in runoff timing and volume in this longer timeframe. As regional downscaling of global circulation models begins to provide better projections of climate change effects in the Tuolumne River basin, the TID model will be used to refine the analysis of changes in temperature and precipitation on runoff timing and quantity.

SFPUC Climate Change Activities

In August 2006, the SFPUC Commission held a special public hearing to begin outlining the local and regional steps needed to prepare the utility and its customers for the expected impacts of global climate change on the SFPUC's water, wastewater, and power services. In January and February 2007, the SFPUC convened the Water Utility Climate Change Summit, which was attended by managers and board members from 30 water utilities from eight states; representatives from 17 regional, state, and federal agencies; leaders from non-governmental organizations and business communities; and members of the public. The summit was designed for the utility community with a focus on adaptation to climate change ("adaptation" is the term used to describe efforts to respond to the effects of climate change rather than to address the causes). For two days, top experts from around the country discussed the implications of climate change with respect to water supply, operations, and sea level rise, as well as the state of climate science in determining the nature of climate change impacts. The second day was focused on brainstorming action items, such as enhancing technical tools to help better predict climate change impacts, increasing funding for data gathering related to snowpack, streamflow, and related issues, and developing a collective voice for the water utility community.

Eight of the attending utilities have since formed a coalition, called the Water Utility Climate Alliance, to build on the recommendations that emerged from the summit. Chaired by the SFPUC, the alliance also includes Seattle Public Utilities, Metropolitan Water District of Southern California, New York City Department of Environmental Protection, San Diego County Water Authority, Southern Nevada Water Authority, Portland Water Bureau, and Denver Water. Combined, these utilities deliver water to over 36 million Americans. Thus far, the focus has been on addressing adaptation concerns while also enhancing mitigation programs. The group has identified the following two priorities: (1) lobbying for more funding for climate research, and greater focus on regional climate forecasting, in order to improve the ability to predict the effects of climate change on water supply and infrastructure; and (2) adapting decision support tools that might assist utilities in developing frameworks for long-term planning in the face of the extensive uncertainties regarding the scope of climate change effects. Utilities in the alliance are also learning from one another in developing adaptation programs, gathering information on federal initiatives such as the Climate Change Science Program (and commenting in an integrated fashion on that program), educating each other about efforts to downscale global circulation models to improve forecasting at a regional level, and tracking federal legislation. Guest speakers representing the Western Water Assessment in Colorado, National Center for Atmospheric Research, Association of Metropolitan Water Agencies, American Water Works Association

Research Foundation, and U.S. Environmental Protection Agency have participated in the activities of the Water Utility Climate Alliance.

In addition to these efforts, the SFPUC participated in the American Water Works Association Research Foundation (AwwaRF) Climate Change Research Needs Workshop on January 8 and 9, 2008. The SFPUC's water quality manager, Andrew DeGraca, served as chair of the workshop and is chairing a new strategic initiative at AwwaRF focused on improving climate change research to assist water utility planning efforts.

Other activities at the SFPUC include: (1) in May 2007, SFPUC General Manager Susan Leal represented Mayor Gavin Newsom at the international C40 Large Cities Climate Summit hosted by Mayor Michael Bloomberg in New York; and (2) during 2007, SFPUC staff presented their climate change-related work on panels at the Association of Metropolitan Water Agencies fall conference, the Colorado Water Congress annual meeting, the annual California Water Policy Conference of Public Officials for Water and Environmental Reform (POWER), and at a workshop on Climate Change, Urban Drainage, and Adaptation sponsored by Seattle Public Utilities.

Reducing the SFPUC's Carbon Footprint

In addition to the steps the CCSF and the SFPUC are taking to reduce GHG emissions described in the Draft PEIR (Vol. 2, Chapter 4, pp. 4.9-16 to 4.9-20), the SFPUC is taking other actions as well. The SFPUC is developing a comprehensive Sustainability Plan, which will incorporate consideration of the agency's carbon footprint and adaptation of system operations to adjust for climate change effects.

As a clean power generator whose water supply is largely gravity fed, the SFPUC currently has a small carbon footprint compared to that of most utility districts. Nonetheless, the SFPUC Power Enterprise manages a number of programs that develop renewable energy facilities and energy efficiency programs for the CCSF.

Two key programs managed by the Power Enterprise—renewable energy generation and energy efficiency—are helping the SFPUC contribute to San Francisco's effort to reduce its carbon footprint. By the end of 2007, a total of 2 megawatts of peak solar capacity had been installed on city facilities (including Moscone Center, San Francisco International Airport, the SFPUC's City Distribution Division, and other locations), generating an estimated 2.5 million kilowatt-hours of electricity per year, or approximately 1,000 tons of carbon-dioxide-equivalent[5] per year.

On the energy efficiency front, the SFPUC has an aggressive program in several city departments; projects include lighting and HVAC (heating, ventilation, and air conditioning) upgrades at San Francisco General Hospital, and conversion of the city's traffic signals to LED technology. The resulting energy savings of these projects is an estimated 24 million kilowatt-

[5] Carbon dioxide equivalency is a quantity that describes, for a given mixture and amount of greenhouse gas, the amount of carbon dioxide that would have the same global warming potential when measured over a specified timescale (generally 100 years).

hours of electricity and 300,000 therms of natural gas per year, a GHG emissions reduction of approximately 11,000 tons of carbon-dioxide-equivalent per year.

The SFPUC recycles a substantial amount of potential GHG at its wastewater treatment plants. Methane gas produced in the anaerobic digesters at both wastewater treatment plants (Southeast and Oceanside) is used to fuel the engine generators and boilers, which in turn produce the energy used in plant operations. The engine generators produce electrical power, and the engine generators and boilers both produce hot water to heat the digesters and run the plant's HVAC system. Without this system, this methane gas—a more damaging GHG than carbon dioxide—would be released into the atmosphere.

The CCSF's newly adopted Green Building Ordinance (Chapter 7 of the Environment Code) requires city construction projects over 5,000 square feet in size to be built to Leadership in Energy and Environmental Design (LEED) Silver standards and to be certified by the U.S. Green Building Council. The San Francisco Municipal Green Building Program is mandatory for most aboveground buildings, including those proposed under the WSIP, regardless of whether or not they are used to house facilities or people. The San Francisco Department of the Environment has also been working with the SFPUC and other CCSF departments on certain municipal projects that are not required to obtain LEED Silver Certification (such as pipelines) to try to ensure these projects are constructed with recycled, environmentally friendly building materials that are sourced locally to minimize transportation fuel. City officials estimate this ordinance could reduce carbon dioxide emissions in the city by 60,000 tons and save 220,000 megawatt-hours of power by 2012.

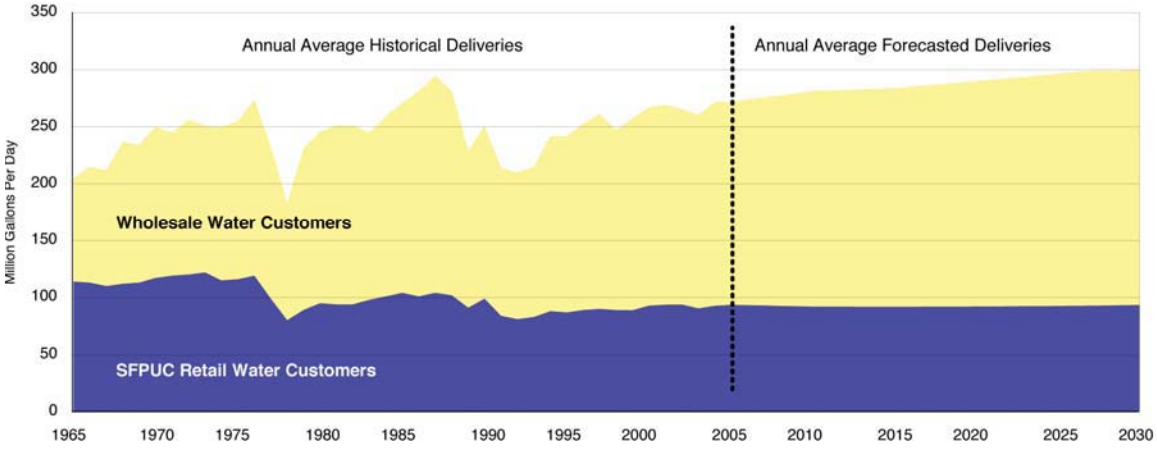
Finally, the CCSF is a member of the California Climate Action Registry and became the first city to certify its emissions with the Registry in 2006. The SFPUC's emissions were certified as part of the overall city/county certification process using the Registry's Power Utility Protocol.

Volume 3, Chapter 5

5.1 Overview

Section 5.1.3, page 5.1-5. This is the same revision as described above in Section 3.6.2, page 3-36, in the first bullet under the first paragraph under the heading "Proposed Drought-Year Water Supplies."

Section 5.1.3, page 5.1-6, Figure 5.1-2: The label on the right-hand side of the figure is revised as shown on the following page in response to a comment (see **Response L_BAWSCA1-57**).



SFPUC Water System Improvement Program ▪ 203287

SOURCE: SFPUC, 2007b

Figure 5.1-2
Annual Average Historical and
Projected Future Customer Purchase Requests

Section 5.1.4, page 5.1-9. The second paragraph under the heading "Hetch Hetchy/Local Simulation Model" is revised as follows and text is added to provide information regarding the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

> A general overview of this modeling tool and the basic assumptions about the system included in the model are described in this section. **Appendix H1** provides a more detailed description of the model and how it was used for the PEIR water supply and system operations impact analysis; **Appendix H2** provides supporting details and an explanation of the 2007 raw data output from the model.
>
> Following publication of the Draft PEIR, the SFPUC conducted updated model runs in 2008 using more recent input assumptions for several model parameters as part of its ongoing system planning and management. The revised input assumptions included: adjusted capacity for Crystal Springs Reservoir from recent survey data; more accurate assumptions for Pilarcitos facilities operations; improved data regarding the historical hydrology in the Alameda Creek watershed; updated agricultural demands in the Modesto and Turlock Irrigation Districts service area to be consistent with data used in recent

statewide planning documents; and a refinement of water release protocols at Don Pedro Reservoir. Review of the 2008 model output indicated that the results are generally consistent with the 2007 results used in the Draft PEIR analysis, and that the analyses and impact determinations presented in the Draft PEIR remain valid. With one exception, no changes in the impact approach, analysis or conclusions presented in the Draft PEIR are necessary for the water supply and system operations impact assessments that were based on the 2007 results. The sole exception is the approach to the impact analysis of Pilarcitos watershed resources, for which only semi-quantitative data were previously available. Therefore, the 2008 data were used to conduct a refined impact analysis of the Pilarcitos watershed resources; no new impacts were identified. The results of the refined impact analysis for the Pilarcitos watershed are summarized in Chapter 13 (Section 13.3, pp. 13-6 to 13-7), and the complete refined impact analysis is presented in Chapter 16, Staff-Initiated Text Changes, under the heading "Volume 3, Chapter 5" under Section 5.5.

Section 5.1.4, page 5.1-14: The last paragraph is deleted as follows to reflect the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

~~For example, the HH/LSM was used to estimate baseline and with-WSIP water levels in all SFPUC reservoirs except for Pilarcitos Reservoir. Model results for the Pilarcitos watershed were not directly used to analyze existing and projected water levels in Pilarcitos Reservoir or flows in Pilarcitos Creek. The model does not currently reflect a complete contemporary depiction of the physical operation of the Pilarcitos watershed's facilities. Although adequate for SFPUC's systemwide water supply planning purposes, HH/LSM results for the Pilarcitos watershed at times required supplemental refinement and analysis to accurately reflect the physical infrastructure in place in the watershed.~~

Section 5.1.4, page 5.1-17: The first sentence of the first paragraph is revised as follows to reflect the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

The HH/LSM was ~~also~~ used to estimate baseline and with-WSIP flows in the Tuolumne River, ~~and~~ Alameda Creek, and Pilarcitos Creek.

Section 5.1.4, page 5.1-17. The third paragraph is revised as follows to provide information regarding the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

For the reasons noted above, HH/LSM results were not used to predict ~~water levels in Pilarcitos Reservoir, flows in Pilarcitos Creek, or~~ the magnitude and timing of spills or releases from Crystal Springs and San Antonio Reservoirs. In addition, HH/LSM results were not used to predict the magnitude and timing of spills or releases from Crystal Springs Reservoir. In these cases, the likely effects of the WSIP were determined through a review of historical data and consultation with individuals knowledgeable about the past and predicted future reservoir operating practices as well as output from the updated 2008 HH/LSM results.

5.2 Plans and Policies

Section 5.2.2, page 5.2-4, Table 5.2-1: The following rows are added under the heading State of California in response to two comments as shown on the following page (see **Response L_BCDC-04** and **Response SI_TRT-CWA-SierraC-84**).

Section 5.2.2, page 5.2-6: The following text is added at the end of the fourth full paragraph in response to a comment (see **Response S_RWQCBCV-08**).

> Under Section 401 of the Clean Water Act, every applicant for a federal permit for any activity that may affect waters of the state must obtain a water quality certification that the proposed activity will comply with state water quality standards.

Section 5.2.2, page 5.2-6: The following text is added under the heading Federal Statutes and Agreements in response to a comment (see **Response L_Tuol2-06**).

> ***National Forest Management Act***
>
> The National Forest Management Act, enacted by Congress in 1976, is the primary statute governing the administration of national forests. The act requires the Secretary of Agriculture to assess forest lands, and to develop and implement a resource management plan for each unit of the National Forest System. The management plans must: ensure consideration of both economic and environmental factors; provide for wildlife and fish; provide for the diversity of plant and animal communities; ensure timber harvesting will occur only where water quality and fish habitat are adequately protected from serious detriment; and ensure clearcutting and other harvesting will occur only where it may be done in a manner consistent with the protection of soil, watersheds, fish, wildlife, recreation, aesthetic resources, and regeneration of the timber resource. The management plans must be updated at least once every 15 years. In the overall WSIP region, the Sierra Nevada Framework is the management plan governing Stanislaus National Forest. The provisions of the Sierra Nevada Framework are implemented by the U.S. Forest Service.

Section 5.2.2, page 5.2-10: The following text is added under the State Agencies heading in response to a comment (see **Response SI_TRT-CWA-SierraC-84**).

> ***California Fish and Game Commission***
>
> The California Fish and Game Commission (Commission) has the statutory authority to formulate guidance policies for the California Department of Fish and Game (CDFG). The Commission has over 200 powers and duties listed in the statutes of the Fish and Game Code. Principal among these are legislatively granted powers for the regulation of the sport take and possession of birds, mammals, fish, amphibians, and reptiles. The Commission oversees the establishment of wildlife areas and ecological reserves and regulates their use, and prescribes the terms and conditions under which permits or licenses may be issued by the CDFG. A primary responsibility of the Commission is to afford an opportunity for full public input and participation in the decision- and policy-making process of adopting regulations or taking other actions related to the well-being of California's fish and wildlife resources.

TABLE 5.2-1
APPLICABLE FEDERAL, STATE, AND LOCAL STATUTES AND AGREEMENTS

Statute or Agreement / Responsible Agency[a]	Summary Description	Associated Statutes and Plans	Applicability to WSIP Water Supply and System Operations Issues
State of California			
McAteer-Petris Act / BCDC	Promotes responsible planning and regulation of San Francisco Bay. Establishes BCDC as the agency responsible for carrying out the provisions of the act and of the SF Bay Plan.	San Francisco Bay Plan	Described in Section 5.2.3 and evaluated in Section 5.2.4 for consistency. Analyzed in Section 5.3.3.
California Fish and Game Code / Fish and Game Commission and CDFG	Provides a system for the restoration and preservation of California's fish and wildlife resources	California Endangered Species Act (CESA), California Environmental Quality Act (CEQA), Lake and Streambed Alterations	CEQA review of the proposed water supply and system operations aspects of the WSIP is presented in Chapter 5, including the impacts of the WSIP on species listed under CESA, as discussed in Sections 5.3.7, 5.4.6, and 5.5.6.

The Commission sets policy for the CDFG, while the CDFG is the lead state agency charged with implementing, safeguarding, and regulating the uses of fish and wildlife.

California Department of Fish and Game

The mission of the CDFG is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. The CDFG enforces multiple programs dedicated to the conservation and preservation of habitats and species in California, including the California Endangered Species Act (CESA), California Environmental Quality Act (CEQA), and California Fish and Game Code. Under CESA, the CDFG is responsible for consulting with state lead agencies to determine if their actions would affect a state-listed threatened or endangered species. Under CEQA, the CDFG is responsible for consulting with lead and responsible agencies and providing the requisite biological expertise to review and comment upon environmental documents and impacts arising from project activities. The CDFG is also responsible for enforcing the provisions of the California Fish and Came Code.

Section 5.2.2, page 5.2-11: The following text is added under the State Statutes and Agreements heading in response to a comment (see **Response SI_TRT-CWA-SierraC-84**).

California Fish and Game Code

The Fish and Game Code provides a system for the protection of California's fish and wildlife resources and includes: provisions related to fish and wildlife protection and conservation; fish and game management; wetlands mitigation banking; endangered species; and operation of dams, conduits, and screens.

Section 5.2.2, page 5.2-12: The following paragraph is added above the heading Porter-Cologne Water Quality Control Act in response to a comment (see **Response L_BCDC-04**).

McAteer-Petris Act

The McAteer-Petris Act was passed by the state legislature in 1965 to promote responsible planning and regulation of San Francisco Bay. The act designates the San Francisco Bay Conservation and Development Commission (BCDC) as the agency responsible for maintaining and carrying out the provisions of the act and the SF Bay Plan (for additional information on the act, see Chapter 4, Section 4.2, p. 4.2-8).

Section 5.2.2, page 5.2-12: The following paragraph is added under the heading Local and Regional Agencies heading, above City and County of San Francisco, in response to a comment (see **Response L_BCDC-04**).

San Francisco Bay Conservation and Development Commission

The San Francisco Bay Conservation and Development Commission (BCDC) is the agency responsible for maintaining and carrying out the provisions of the McAteer-Petris Act and

the SF Bay Plan. In the public interest, BCDC is authorized to control bay filling and dredging and bay-related shoreline development. Due to the regulatory authority of the State Water Resources Control Board (SWRCB), San Francisco Bay Regional Water Quality Control Board, U.S. Environmental Protection Agency, and the U.S. Army Corps of Engineers, BCDC's scope of authority over water quality issues is limited. (For additional information on BCDC's regulatory authority, see Chapter 4, Section 4.2, p. 4.2-8.)

Section 5.2.3, page 5.2-14: The following text is added under the heading Relevant Plans, Policies, and Planning Actions in response to a comment (see Response **Response L_Tuol2-06**).

U.S. Forest Service, Sierra Nevada Framework

In January 2001, the U.S. Forest Service adopted the Sierra Nevada Forest Plan Amendment (SNFPA or Sierra Nevada Framework), a plan for the management of 11 national forests and 11.5 million acres of national forest land in the Sierra Nevada mountain range, including Stanislaus National Forest. In January 2004, in response to concerns about the flexibility and compatibility of the SNFPA with other programs related to wildland fire management, the U.S. Forest Service amended the Sierra Nevada Framework to provide additional provisions for fire and fuels treatments. The amended Framework outlines procedures used to manage and protect forests, wildlife habitats, and communities from a variety of threats, including catastrophic fires, and provides a programmatic framework within which project-level decisions are designed and implemented. Key aspects of the SNFPA include: a commitment to restoration and protection of old-growth forest habitat; protection of all trees greater than 30 inches on 11 million of the 11.5 million acres of public land managed by the U.S. Forest Service; designation of riparian conservation areas; improvement and protection of suitable habitat for California spotted owl (*Strix occidentalis occidentalis*), northern goshawk (*Accipiter gentiles*), and willow flycatcher (*Empidonax traillii*); adoption of an integrated vegetation management strategy with the primary objective of protecting communities and modifying landscape-scale fire behavior to reduce the size and severity of fires; and provisions for increased land use management, including grazing, timber production, road construction, and recreation activities. The SNFPA is administered by the U.S. Forest Service (USDA Forest Service, 2004). As no WSIP facility improvement projects are proposed within Stanislaus National Forest, and the resources protected by the SNFPA would not be affected by the WSIP water supply and system operations, the WSIP would be consistent with the provisions of the SNFPA.

Bay Delta Conservation Plan

The Bay Delta Conservation Plan (BDCP) is an effort driven by Delta water users to provide for the conservation and management of certain aquatic species, both listed and non-listed, and their habitats, while providing for regulatory assurances related to water supply reliability and water quality for the Sacramento–San Joaquin River Delta. Activities that would be covered under the BDCP include water supply operations related to the State

Water Project and the Central Valley Project, and the power plant operations of the Mirant Corporation. Under the BDCP, water users would pay for new infrastructure, wetlands restoration, and other related projects in return for guaranteed stable water supplies. As the BDCP is still under development and is not yet adopted, no determination regarding potential conflicts of the WSIP with its provisions has been made.

Section 5.2.3, page 5.2-20: The following paragraph is added above the Regional Habitat Conservation Plans heading in response to a comment (see **Response L_BCDC-04**).

San Francisco Bay Plan

The SF Bay Plan, completed and adopted by BCDC in 1968, is an enforceable plan that guides the protection and use of San Francisco Bay and its shoreline. For a discussion of the SF Bay Plan's applicability to individual WSIP facility projects, see Section 4.2 (Vol. 2, Chapter 4, p. 4.2-16).

The SF Bay Plan is founded on the belief that water quality in San Francisco Bay will be maintained at levels sufficiently high to protect the beneficial uses of the bay. The SF Bay Plan includes findings and policies related to freshwater inflow and changes in salinity. The freshwater inflow findings contained in the SF Bay Plan stress the importance of maintaining a balance between fresh and saltwater. The related policies assert that the impact of freshwater diversions should be monitored by the SWRCB to ensure compliance with water quality standards.

Section 5.2.4, page 5.2-27: The second full paragraph is revised as follows in response to a comment (see **Response L_BCDC-04**).

Consistency with Regional Natural Resource Protection Plans

WQCPs [water quality control plans] identify water quality issues and prescribe enforceable water quality objectives/criteria for specific water bodies and their tributaries. Because these standards are based on designated beneficial uses of the respective waterways, violation of the water quality objectives/criteria can adversely affect fish, wildlife, and other protected resources. SFPUC operations currently comply with water quality standards contained in the WQCPs, and the WSIP goals and objectives would be consistent with the applicable WQCPs. Further, as future SFPUC operations would be consistent with the water quality standards contained in the WQCPs, SFPUC operations would also be consistent with the SF Bay Plan freshwater inflow policies. The potential impacts of WSIP implementation on water quality in the Tuolumne River watershed and Sacramento–San Joaquin Delta, Alameda Creek watershed, Peninsula watershed, and Westside Groundwater Basin are analyzed in Sections 5.3.3, 5.4.3, 5.5.3, and 5.6, respectively.

5.3 Tuolumne River System and Downstream Water Bodies

Section 5.3.1.2, page 5.3.1-25: Third full paragraph, last sentence is revised as follows to correct an editorial error.

> Under the existing condition, the model indicates that the minimum release would be made ~~84.2~~ 85.1 percent of the time (837 months in the ~~987~~984-month hydrologic record); with the WSIP the minimum release would be made ~~85.4~~ 85.7 percent of the time (843 months in the ~~987~~984-month hydrologic record).

Section 5.3.1.2, page 5.3.1-34: Third full paragraph, last sentence is revised as follows to correct an editorial error.

> Under the existing condition, the model indicates that the minimum release would be made ~~72.6~~ 72.9 percent of the time (717 months in the ~~987~~984-month hydrologic record); with the WSIP the minimum release would be made ~~74.4~~ 74.6 percent of the time (734 months in the ~~987~~984-month hydrologic record).

Section 5.3.1.1, page 5.3.1-8: The fourth sentence of the second full paragraph is revised as follows to correct an editorial error.

> TID and MID ~~typically~~ divert ~~800,000 to 900,000 afy~~ an annual average of about 867,000 acre-feet from the Tuolumne River.

Section 5.3.3.1, page 5.3.3-1: The following text is inserted at the end of the second full paragraph in response to a comment (see **Response S_RWQCBCV-02**).

> The Tuolumne River flows from the crest of the Sierra Nevada westward to its confluence with the San Joaquin River. The San Joaquin River flows north to the Sacramento–San Joaquin Delta. Water from the Delta discharges to the San Francisco Bay Estuary and the Pacific Ocean. The Tuolumne River system and downstream water bodies are shown in Figure 5.1-1. Beneficial uses of the Tuolumne River, as designated in the *Water Quality Control Plan for the Sacramento and San Joaquin River Basins*, include the following:
>
> - Source to (New) Don Pedro Reservoir: Municipal and Domestic Supply (MUN); Agricultural Supply (AGR); Hydropower Generation (POW); Water Contact Recreation (REC-1); Non-water Contact Recreation (REC-2); Warm Freshwater Habitat (WARM); Cold Freshwater Habitat (COLD); and Wildlife Habitat (WILD)
>
> - New Don Pedro Reservoir: MUN (Potential); POW; REC-1; REC-2; WARM; COLD; and WILD
>
> - New Don Pedro Dam to San Joaquin River: MUN (Potential); AGR; REC-1; REC-2; WARM; COLD; Migration of Aquatic Organisms (MIGR); Spawning, Reproduction, and/or Early Development (SPWN); and WILD

Section 5.3.3.1, page 5.3.3-10, Table 5.3.3-6: The text in the first row, fourth column of Table 5.3.3-6 is revised as follows in response to a comment (see **Response SI_TRT-CWA-SierraC-138**):

6.0 mg/L (September 1 to November 30) and 5.0 mg/L (December 1 to August 30)

Section 5.3.3, page 5.3.3-21: The following reference is added to the end of Section 5.3.3 in response to a comment (see **Response S_RWQCBCV-02**).

State Water Resources Control Board (SWRCB), California Regional Water Quality Control Board, Central Valley Region, *Water Quality Control Plan (Basin Plan) for the Sacramento and San Joaquin River Basins*, Fourth Edition, Revised October 2007 with approved amendments.

Section 5.3.4.2, pages 5.3.4-5 and 5.3.4-6: The last paragraph on page 5.3.4-5 is revised as follows in response to a comment (see **Response SI_TRT-CWA-SierraC-140**).

As described in Section 5.3.1, under existing conditions in the majority of years classified as below-normal or drier, almost all of the winter and spring runoff from the watershed upstream of Don Pedro Reservoir on the Tuolumne River is captured in the reservoir. Only the minimum required releases to the Tuolumne River below La Grange Dam are made. The WSIP would have no effect on flow in the Tuolumne River below La Grange Dam or the San Joaquin River ~~under these conditions~~ in months when only the minimum flows are currently released. In years when the reservoir fills, usually wet or above-normal years, excess water is released in some months to the Tuolumne River. In the future with the WSIP, TID and MID would draw Don Pedro Reservoir down farther in most years than they would under the existing condition, and consequently a greater proportion of spring runoff would be needed to refill the reservoir. As a result, the volume of excess water released to the Tuolumne River would be reduced in ~~some normal, above normal and wet years compared to the existing condition~~ all wet years, most above-normal years, and occasional below-normal and dry years.

Section 5.3.5.1, page 5.3.5-1: The following text is added at the end of the second full paragraph in response to a comment (see **Response S_RWQCBCBV-02**).

The Tuolumne River flows from the crest of the Sierra Nevada westward to its confluence with the San Joaquin River. The San Joaquin River flows north to the Sacramento–San Joaquin Delta. The Tuolumne River system and downstream water bodies are shown in Figure 5.3.1-1. Unless otherwise designated by the California Regional Water Quality Control Board, all groundwaters in the Central Valley region are considered to be suitable or potentially suitable, at a minimum, for municipal and domestic supply, agricultural supply, industrial service supply, and industrial process supply.

Section 5.3.6.2, page 5.3.6-26: Second paragraph under Impact 5.3.6-2, the third to last sentence is revised as follows to correct an editorial error.

The modeling analysis indicates that, under the existing condition, the minimum flow release would be made ~~84.2~~ 85.1 percent of the time (837 months in the ~~987~~984-month hydrologic record), while under the WSIP the minimum flow release would be made 85.4 percent of the time (in 6 more months, or 843 months in the ~~987~~984-month hydrologic record).

Section 5.3.6.2, page 5.3.6-32: The fourth sentence of the first paragraph is revised as follows in response to a comment (see **Response SI_TRT-CWA-SierraC-169**).

These adverse effects on flows and temperature in the river under the WSIP would not substantially alter or degrade ~~fishery habitat~~ salmonid habitat in most years or jeopardize the continuation of the ~~fishery~~ salmonid populations in the lower Tuolumne River ~~in most years~~.

Section 5.3.8.1, page 5.3.8-10: The first and second sentence of the third paragraph is revised as follows in response to a comment (see **Response SI_TROA-03**).

~~A 900-cfs~~ A 1,100-cfs flow at Lumsden Campground is the minimum required for whitewater paddle boats and oar boats; a ~~600-cfs~~ 900-cfs flow is the minimum required for kayaks ~~and oar boats~~, and a ~~1,200-cfs~~ 1,500- to 2,000-cfs flow is considered optimal. The commercial outfitters prefer ~~a six-hour~~ an eight-hour release, but a ~~three-hour~~ four-hour release allows them to launch one-, two- and three-day trips.

Section 5.3.8.2, page 5.3.8-33: The first sentence of the first paragraph under River Recreation Below La Grange Dam is revised as follows to correct an editorial error.

Under existing conditions, most of the time (717 months in the ~~987~~984-month hydrologic record) flow in the Tuolumne River below La Grange Dam consists of the minimum required instream flows.

5.4 Alameda Creek Watershed Streams and Reservoirs

Section 5.4.1.1, page 5.4.1-4: The last sentence of the third full paragraph is revised as follows in response to a comment (see **Response L_ACFCWCD-13**).

A flow control structure known as the BART weir (owned by the ACFCWCD and located where the BART and railroad tracks cross Alameda Creek in Fremont) provides ~~grade control~~ structural protection of the footings of the BART and railroad bridge crossing and is a barrier to fish passage along this reach.

Section 5.4.1.1, page 5.4.1-9: The fourth paragraph, second sentence is revised as follows to better describe existing conditions as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Average monthly storage in Calaveras Reservoir under restricted operations ranges from about ~~31,000~~ 28,000 to 38,000 acre-feet in all conditions and months.

Section 5.4.1.1, page 5.4.1-13: The first paragraph, first sentence is revised as follows to better describe existing conditions as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

> The SFPUC estimates that, prior to lowering Calaveras Reservoir water levels (pre-2002 conditions), about ~~6,000~~ 8,000 afy had been diverted from Alameda Creek to Calaveras Reservoir in years with normal rainfall, with lesser diversions in dry and below-normal years.

Section 5.4.1.1, page 5.4.1-16: In the paragraph under the heading "San Antonio Creek Below San Antonio Reservoir," the first sentence is revised as follows to better describe existing conditions as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

> Modeled uncontrolled releases from San Antonio Reservoir to San Antonio Creek average about ~~1,700~~ 1,000 afy, ranging from no releases in below-normal and dry years to about ~~8,500~~ 3,200 acre-feet in very wet years.

Section 5.4.1.2, page 5.4.1-19: The second paragraph is revised as follows to reflect the change in project descriptions of the Calaveras Dam (SV-2) and Alameda Creek Fishery (SV-1) projects.

> Reservoir storage is constrained to approximately 37,800 acre-feet (except on a temporary basis), about 40 percent of its design capacity. Under the WSIP, Calaveras Reservoir would be restored to its full design capacity (approximately 96,800 acre-feet), which would allow the SFPUC to maximize the use of local watershed supplies. Furthermore, fishery releases from the proposed bypass flow structure at the Alameda Creek Diversion Dam and/or from the reservoir (compliance with the 1997 MOU is measured below the confluence of Alameda and Calaveras Creeks) and flow recapture would be implemented under the WSIP in accordance with the 1997 MOU. The fishery releases from the diversion dam bypass flow structure to Alameda Creek and from Calaveras Reservoir to Calaveras Creek would be recaptured downstream and returned to the SFPUC water supply in compliance with the 1997 MOU.

Section 5.4.1.2, page 5.4.1-19: The fourth paragraph is revised as follows to reflect the change in project description of the Calaveras Dam (SV-2) related to the proposed release of bypass flows at the diversion dam.

> **Figure 5.4.1-5** illustrates the modeled chronological storage and stream releases from Calaveras Reservoir for both the existing condition and the WSIP using hydrologic data from the period 1920 to 2002. Releases to Calaveras Creek from Calaveras Reservoir represent both controlled releases through the cone valve and uncontrolled releases over the spillway. The graphs also show how peak flows in Calaveras Creek downstream of the dam tend to correspond to periods when Calaveras Reservoir is operating at or near capacity. This figure assumes the SFPUC would make fishery releases in compliance with the 1997 MOU from Calaveras Reservoir only and does not account for the proposed bypass flows

from the diversion dam; this represents a worst-case condition for the range of fluctuation in Calaveras Reservoir water levels.

Section 5.4.1.2, page 5.4.1-22: The first, second, third and fourth full paragraphs are revised as follows to reflect the change in project description of the Calaveras Dam (SV-2) project and to refine and update the impact discussion based on the modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Figure 5.4.1-6 presents the estimated change in average monthly reservoir water surface elevation under existing conditions and after implementation of the WSIP. This figure assumes the SFPUC would make fishery releases in compliance with the 1997 MOU from Calaveras Reservoir only and does not account for the proposed bypass flows from the diversion dam; this represents a worst-case condition for the range of fluctuation in Calaveras Reservoir water levels. The water level in Calaveras Reservoir would be higher year-round with the WSIP; the increase in average monthly storage would be mostly attributable to completion of the Calaveras Dam project (SV-2) and the removal of the DSOD storage limitations. During rainy months, the reservoir water level would be kept near the wintertime storage objective, or roughly 20 to 30 feet higher than under existing conditions. The average water surface elevation would be substantially greater than under current conditions, but only 6 to 12 feet higher than pre-2002 conditions (prior to the DSOD restrictions).

With implementation of the WSIP, the change in operation of Calaveras Reservoir storage would affect hydrologic conditions elsewhere in the watershed. As described below, the restored capacity of Calaveras Reservoir would affect the operation of the Alameda Creek Diversion Dam and Tunnel, and thus the inflow to Calaveras Reservoir and flow to Alameda Creek below the diversion dam. The proposed bypass structure at the Alameda Creek Diversion Dam and the ~~The~~ restored storage capacity would also allow for implementation of the 1997 MOU-required releases from either the new bypass structure or Calaveras Reservoir in support of fisheries.

Compared to existing conditions, the WSIP would change the nature of releases from Calaveras Reservoir to Calaveras Creek. With implementation of the fishery releases from the new bypass flow structure at the diversion dam and from Calaveras Reservoir (up to 6,300 afy), there would at times be releases from the reservoir under the WSIP that are not made under existing conditions. These flows would be gaged and maintained below the confluence of Alameda and Calaveras Creeks. Contributing to these flows would be: (1) flows that spill past the Alameda Creek Diversion Dam, (2) unregulated runoff from accretions (inflow) between the diversion dam and the Calaveras Creek confluence, (3) unregulated runoff between Calaveras Dam and the confluence, ~~and~~ (4) operational releases from Calaveras Reservoir for reservoir regulation purposes, and (5) operational releases from the Alameda Creek Diversion Dam to support fishery releases when there is available flow in Alameda Creek.

Figure 5.4.1-7 illustrates the modeled chronological releases of water below Calaveras Dam to Calaveras Creek for both existing conditions and with the WSIP; this figure assumes the

SFPUC would make fishery releases in compliance with the 1997 MOU from Calaveras Reservoir only and does not account for the proposed bypass flows from the diversion dam. Operational releases from Calaveras Reservoir occur in about ~~40~~ 50 percent of the years under the modeled existing condition and ~~slightly less frequently~~ in about 35 percent of the years under the WSIP (with the exception of 1997 MOU releases, which would occur in all years), with most of these years being classified as above-normal or wet. **Table 5.4.1-7** shows the releases from the reservoir for various representative hydrologic year types and assumes the SFPUC would make fishery releases in compliance with the 1997 MOU from Calaveras Reservoir only and does not account for the proposed bypass flows from the diversion dam. As shown in the table, releases with the WSIP would be substantially diminished in the winter months of normal, above-normal, and wet years, with up to a 70 percent reduction. This reduction in the frequency and magnitude of releases would primarily result from removal of the DSOD storage constraint following construction of the Calaveras Dam project (SV-2). With greater operational capacity, more local runoff would be stored and used for water supply. During all months of below-normal and dry years and the majority of months in normal, above-normal, and wet years, the volume of releases would remain nearly the same or would be slightly diminished with the WSIP compared to existing conditions. However, in several scenarios, releases would be eliminated under WSIP operations.

Section 5.4.1.2, page 5.4.1-25: In the first paragraph, the last sentence is revised as follows to reflect the change in project description of the Calaveras Dam (SV-2) project.

With implementation of the WSIP, summer base flows (flows that occur in the absence of any recent rainfall) in Calaveras Creek below the dam would increase due to the required fishery releases below Calaveras Dam (shown in Table 5.4.1-5). The maximum supplemental release of 6,300 afy might not be needed in every year due to other flows reaching the confluence, including bypass flows at the Alameda Creek Diversion Dam~~; therefore, supplemental instream flow releases would range from about 2,250 afy to the full 6,300 afy~~.

Section 5.4.1.2, page. 5.4.1-27: In the partial paragraph at the top of the page, the first full sentence is revised as follows to refine and update the impact discussion based on the modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3, as well as to reflect the change in project description of the Calaveras Dam (SV-2) project.

Flows past the diversion dam would be reduced in ~~all hydrologic year types, and nearly eliminated in below-normal and dry years~~ wet, above normal, and normal year types, although when flow is available, the SFPUC would allow for minimum bypass flows consistent with the requirements of the 1997 CDFG MOU.

Section 5.4.1.2, page. 5.4.1-27: In the first full paragraph, the last sentence is revised as follows to reflect the change in project description of the Calaveras Dam (SV-2) project.

~~Because the~~ The existing diversion dam facilities seep, and therefore, summer and fall base flows of less than about 1 cfs ~~would~~ continue down the creek and these flows would be

expected continue down the creek under the WSIP via the new bypass facilities ~~would not be affected by WSIP operations~~.

Section 5.4.1.2, pages 5.4.1-27 and 5.4.1-33: The last paragraph on page 5.4.1-27 and ending on page 5.4.1-33 is revised as follows to refine and update the impact discussion based on the modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Table 5.4.1-8 presents modeled flow data for the Calaveras confluence in terms of the monthly average flow within year type. As shown in the table, there would be a substantial reduction (up to 44 percent) in wintertime flow at the confluence during normal, above-normal and wet years. As with the upstream reach, peak flows would also be substantially reduced ~~in drier years~~, primarily as a result of renewed upstream diversions. However, overall flows would be increased due to fishery releases.

Section 5.4.1.2, page 5.4.1-32, Table 5.4.1-8: The data in Table 5.4.1-8 showing flow in Alameda Creek below the Calaveras Creek confluence in the units of acre-feet per month are replaced with the same data in the units of cubic feet per second to be consistent with the format of similar tables in the PEIR. Due to rounding, the numbers and percentages representing the difference between existing conditions and the proposed WSIP have slightly changed. The replacement table is shown on the following page and for ease of reading, revised data are not shown in underlined format.

Section 5.4.1.2, page 5.4.1-33: In the second full paragraph, the first sentence is revised as follows to reflect the change in project description of the Calaveras Dam (SV-2) project and to refine and update the impact discussion based on the modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Under the WSIP, the SFPUC would augment flow below the confluence of Calaveras and Alameda Creeks by bypassing/releasing water from the Alameda Creek Diversion Dam and Calaveras Reservoir; as a result, there would be an increase in flow at the confluence in ~~almost all other months~~ April to November of wet and above-normal rainfall years and in all instances of other years.

Section 5.4.1.2, pages 5.4.1-36 and 5.4.1-37: The first and second full paragraphs are revised as follows and Figure 5.4.1-14 (shown on page 16-55) is revised to reflect the updated impact discussion based on the modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

~~**Figure 5.4.1-14** illustrates the modeled chronological operation of San Antonio Reservoir for both the existing condition and with the WSIP. The figure shows the reservoir's storage, inflow from the Hetch Hetchy system, and releases to San Antonio Creek for each condition. As illustrated in the figure, San Antonio Reservoir storage operations are typically cyclical: the reservoir fills in the late winter/early spring and is depleted during the summer. During a drought, reservoir storage would be additionally depleted by the~~

TABLE 5.4.1-8
ESTIMATED AVERAGE MONTHLY FLOW IN
ALAMEDA CREEK BELOW THE CALAVERAS CREEK CONFLUENCE
(cubic feet per second)

	Wet	Above Normal	Normal	Below Normal	Dry	All
Existing Condition (2005)						
Oct	0	0	0	0	0	0
Nov	1	1	0	0	0	1
Dec	56	26	22	1	1	21
Jan	280	114	24	3	1	84
Feb	463	214	55	6	4	147
Mar	272	110	26	7	1	82
Apr	144	25	5	1	1	35
May	5	2	1	1	0	2
Jun	1	0	0	0	0	0
Jul	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sep	0	0	0	0	0	0
WSIP (2030)						
Oct	7	7	7	7	7	7
Nov	5	5	5	5	5	5
Dec	45	18	13	5	5	17
Jan	199	64	18	14	13	61
Feb	434	151	36	22	23	132
Mar	272	106	22	16	13	85
Apr	145	32	9	7	7	40
May	9	7	7	7	7	7
Jun	7	7	7	7	7	7
Jul	7	7	7	7	7	7
Aug	7	7	7	7	7	7
Sep	7	7	7	7	7	7
Difference and Percent Change, Existing Condition (2005) vs WSIP (2030)						
Oct	7	*	7	*	7	*	7	*	7	*	7	*
Nov	4	[400%]	4	[400%]	5	*	5	*	5	*	4	[400%]
Dec	-11	-[20%]	-8	-[31%]	-9	-[41%]	4	[400%]	4	[400%]	-4	-[19%]
Jan	-81	-[29%]	-50	-[44%]	-6	-[25%]	11	[367%]	12	[1,200%]	-23	-[27%]
Feb	-29	-[6%]	-63	-[29%]	-19	-[35%]	16	[267%]	19	[475%]	-15	-[10%]
Mar	0	[0%]	-4	-[4%]	-4	-[15%]	9	[129%]	12	[1,200%]	3	[4%]
Apr	1	[1%]	7	[28%]	4	[80%]	6	[600%]	6	[600%]	5	[14%]
May	4	[80%]	5	[250%]	6	[600%]	6	[600%]	7	*	5	[250%]
June	6	[600%]	7	*	7	*	7	*	7	*	7	*
July	7	*	7	*	7	*	7	*	7	*	7	*
Aug	7	*	7	*	7	*	7	*	7	*	7	*
Sept	7	*	7	*	7	*	7	*	7	*	7	*

NOTE: "Existing Condition (2005)" is based on model run MEA3CHR. "WSIP (2030)" is based on model run MEA5HIN. An overview of the model runs is presented in Section 5.1. Detailed information on the models and underlying assumptions is provided in Appendix H.

Key:

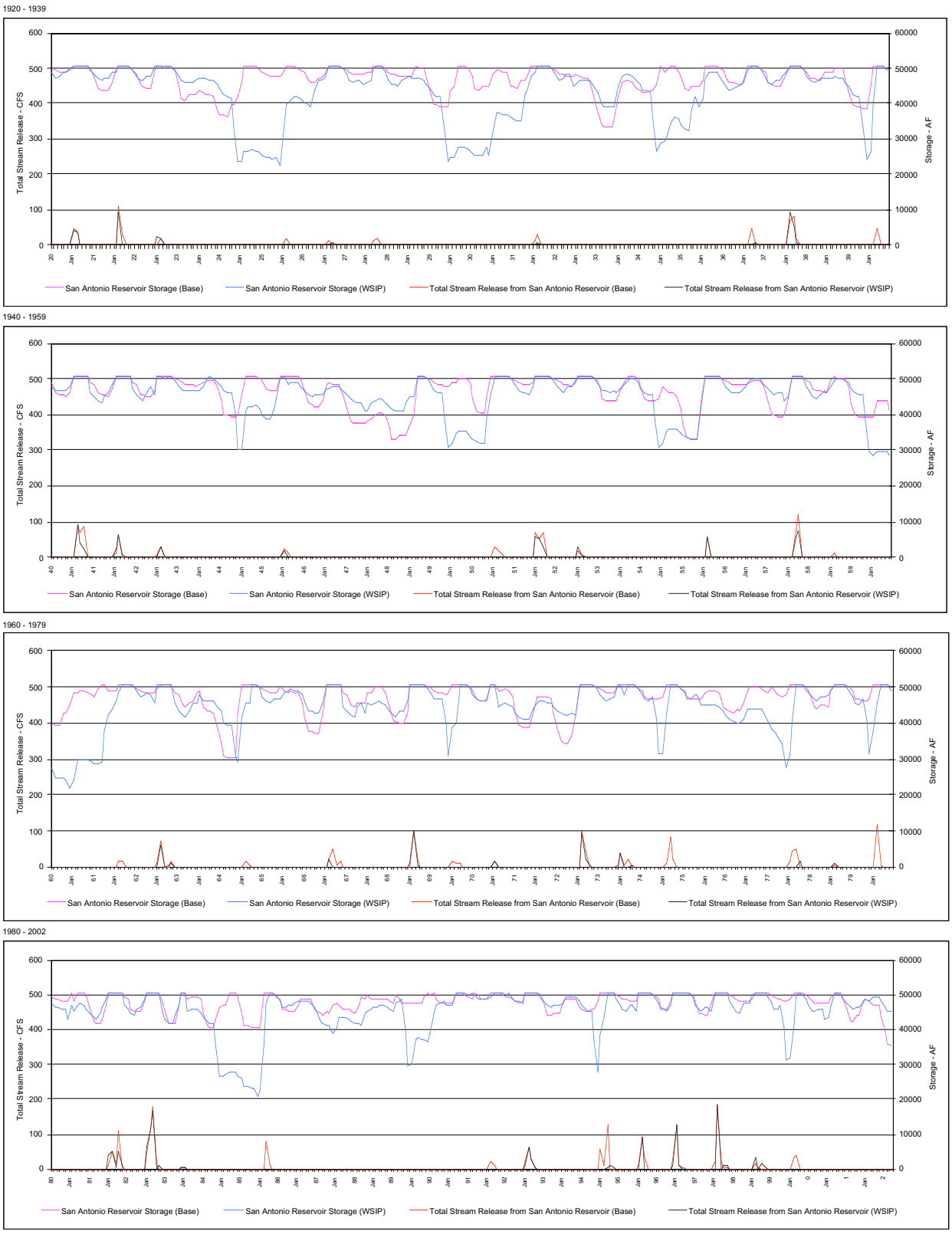
* Indicates a release under the "WSIP (2030)" condition where no release under "Current Condition (2005) currently exists.

> 0%

< 0 to -5%

< -5%

SOURCE: SFPUC, HH/LSM (See Appendix H)



Note: This figure is revised to reflect updated HH/LSM modeling (see Appendix O).

SOURCE: SFPUC, HH/LSM

SFPUC Water System Improvement Program . 203287

Figure 5.4.1-14

Chronological Operation of San Antonio Reservoir

~~slow, successive drawdown due to drafting to the Sunol Valley WTP in excess of watershed runoff and replenishment by Hetch Hetchy flows.~~

~~Typically, San Antonio Reservoir would remain slightly fuller under the WSIP than under modeled existing conditions because the restored capacity of Calaveras Reservoir would provide additional local water supply to serve customer demand, reducing the need to use water from San Antonio Reservoir.~~ WSIP operations involve keeping local reservoirs higher for delivery reliability and system maintenance purposes. This supply would be used to maintain the Sunol Valley WTP's minimum throughput of 20 mgd and to satisfy water demand in excess of Hetch Hetchy flows. ~~The exception to this higher storage would occur e~~Every fifth year storage levels would drop when planned maintenance for the Mountain Tunnel would reduce Hetch Hetchy flows to the Bay Area during the winter. During this period, San Antonio Reservoir would be drawn to replace the flows not provided from the Hetch Hetchy system. The reservoir would refill to typical operating levels within one to two years after the maintenance period.

Section 5.4.12, pages 5.4.1-36 and 5.4.1-39: The fourth full paragraph on page 5.4.1-36 and the fifth partial paragraph starting on page 5.4.1-36 and ending on page 5.4.1-39 are revised as follows to refine and update the impact discussion based on the modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

As indicated in the table, the WSIP would have ~~no~~ minimal effect on flow in San Antonio Creek ~~in dry, below-normal, and normal years~~. The proposed program would result in minor increases and decreases in winter and spring flows in some above-normal years. Occasionally, the WSIP could result in spills to San Antonio Creek that would not occur under existing conditions. ~~These occasional spills would occur because the reservoir would be drawn down less often due to the restoration of Calaveras Reservoir storage capacity, the fishery releases that would be recaptured, and local reservoirs that would be kept slightly fuller for delivery reliability and system maintenance purposes.~~

Figure 5.4.1-15 illustrates the modeled chronological release of water below Turner Dam under the existing condition and with the WSIP. Releases from San Antonio Reservoir to San Antonio Creek have historically been rare and would continue to be rare with the WSIP. Releases past the dam are modeled to occur ~~in about 20 percent of the years under the existing condition and~~ at about the same frequency with the WSIP—mostly in above-normal or wet years. ~~The change in releases would occur primarily during January, February, and March of these years, with increases in average monthly flows of up to 15 cfs in some months countered by decreases of up to 15 cfs in some months countered by decreases of up to 16 cfs in others.~~ It should be noted that under actual operations, these changes in modeled average monthly flows could take the form of a few days of larger releases.

Section 5.4.1.2, page 5.4.1-39: The last full paragraph is revised as follows to refine and update the impact discussion based on the modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Figure 5.4.1-16 illustrates the modeled flow at the confluence during the various rainfall scenarios for the existing condition and with the WSIP. **Table 5.4.1-11** presents modeled flows at the confluence in terms of the average monthly flow within hydrologic year type. As shown in the figure and table, there would be a substantial (8 to 52 percent) reduction in flow volumes at the confluence during January, February, and March of normal or wetter years, depending on the rainfall distribution. The majority of this effect would occur due to the reduction in spills from Calaveras Reservoir and~~, to a lesser degree,~~ increased diversions from the Alameda Creek Diversion Dam during these periods.

Section 5.4.2.2, page 5.4.2-3, Table 5.4.2-1: Impact 5.4.2-2 is revised as follows in response to a comment (see **Response L_ACWD-13**).

TABLE 5.4.2-1
SUMMARY OF IMPACTS – GEOMORPHOLOGY OF THE ALAMEDA CREEK WATERSHED

Impact	Significance Determination
Impact 5.4.2-1: Effects on channel formation and sediment transport along Calaveras Creek	LS
Impact 5.4.2-2: Effects on channel formation and sediment transport along Alameda Creek downstream of the diversion dam and downstream of the San Antonio Creek confluence.	LS
Impact 5.4.2-3: Effects on channel formation and sediment transport along San Antonio Creek downstream of San Antonio Reservoir	LS

LS = Less than Significant impact, no mitigation required

Section 5.4.2.2, page 5.4.2-3: Impact 5.4.2-2 is revised as follows in response to a comment (see **Response L_ACWD-13**).

Impact 5.4.2-2: Effect on channel formation and sediment transport along Alameda Creek downstream of the diversion dam and downstream of the San Antonio Creek confluence.

Section 5.4.2.2, page 5.4.2-4: The following text is added after the first partial paragraph in response to a comment (see **Response L_ACWD-13**).

Implementation of the WSIP would reduce flow in Alameda Creek downstream of the San Antonio Creek confluence in winter months of normal to wet years, ranging from a -18 percent decrease to a +13 percent increase in flow at the USGS Niles gage station. In the majority of winter months (December to March), flows at this location would decrease, but in April and May the flows would exhibit small to moderate increases. Although implementation of the WSIP would result in additional flow in Alameda Creek in summer months as part of the 1997 CDFG MOU releases, these additional flows would not mobilize significant amounts of sediment and could be recaptured at a location downstream of the Sunol Valley WTP. This net decrease in flow in Alameda Creek below the San Antonio

Creek confluence when compared to the existing condition would likely result in a slight decrease in the amount of sediment transported in Niles Canyon and lower Alameda Creek and would therefore decrease sediment and debris loading on lower Alameda Creek facilities.

As noted in Impacts 5.4.2-1 and 5.4.2-3, flows and the resulting impacts on geomorphology upstream of the San Antonio Creek confluence are expected to be within the range of conditions that have been experienced since development of water supply and flood control facilities in the upper and lower Alameda Creek watershed. Therefore, implementation of the WSIP would not significantly alter bed or channel form or introduce substantial new sources of sediment.

As a result of this net decrease in sediment transport in Niles Canyon and the less-than-significant impacts in upper Alameda Creek, the impact related to geomorphologic characteristics and sediment transport along Alameda Creek downstream of the San Antonio Creek confluence would be *less than significant*. It should also be noted that the Arroyo de la Laguna watershed is the major contributor to sediment supply in Niles Canyon and lower Alameda Creek.

Section 5.4.3.1, page 5.4.3-4: The first paragraph under the heading "Alameda Creek Below the Diversion Dam" is revised as follows in response to a comment (see **Response L_ACWD-14**).

Water quality in Alameda Creek is generally good and is protective of beneficial uses. In terms of aquatic life, the key water quality parameter is temperature, which is directly related to hydrologic flow conditions. **Table 5.4.3-3** summarizes weekly water temperature data collected by the ACWD near Sunol, above Arroyo de la Laguna, from 1997 through 2005. ~~The ACWD continuously samples, analyzes, and monitors the quality of water in Alameda Creek at a special monitoring facility located at the mouth of Niles Canyon near Mission Boulevard and at other key locations throughout the watershed (ACWD, 2007).~~ Average monthly water temperatures show an expected seasonal trend (i.e., cooler during the winter and warmer during the summer).

Section 5.4.3.1, page 5.4.3-5: The source footnote in Table 5.4.3-3 is revised as follows in response to a comment (see **Response L_ACWD-14**).

SOURCES: ACWD (raw data provided by Laura Hidas); Merritt Smith Consulting (data reduction). Note that ACWD temperature data may not have been subject to the rigorous QA/QC procedures required for scientific studies, and therefore should be used only to indicate general conditions (unless otherwise specified by the ACWD).

Section 5.4.3.1, page 5.4.3-5: The last two sentences of the first full paragraph are revised as follows in response to a comment (see **Response L_ACWD-15**).

~~In addition, most of the summer and fall flows in Alameda Creek below its confluence with Arroyo de la Laguna originate from the South Bay Aqueduct. This South Bay Aqueduct water may be warmer and is higher in total dissolved solids (TDS) than the flows in Alameda Creek originating from the Sunol Valley watershed.~~ Summer and fall flows in

Alameda Creek and its tributaries are at their seasonal low. Thus, flows in Alameda Creek below its confluence with Arroyo de la Laguna tend to be warm during these periods, because coldwater sources are largely unavailable in these reaches and base flows are low during this time of year, allowing waters to warmer towards their natural temperature in equilibrium with meteorological conditions. In addition, flows in Arroyo de la Laguna appears to be higher in total dissolved solids (TDS) than the flows in Alameda Creek originating from the watershed upstream of Arroyo de la Laguna (RWQCB, 2008).

Section 5.4.3.1, page 5.4.3-6: The source footnote in Table 5.4.3-4 is revised as follows in response to a comment (see **Response L_ACWD-14**).

SOURCES: ACWD (raw data provided Laura Hidas); Merritt Smith Consulting (data reduction). Note that ACWD TDS data may not have been subject to the rigorous QA/QC procedures required for scientific studies, and therefore should be used only to indicate general conditions (unless otherwise specified by the ACWD).

Section 5.4.3.2, page 5.4.3-10: The third paragraph is revised as follows to reflect the change in project description of the Calaveras Dam (SV-2) project.

Studies conducted for the 1997 MOU between the CDFG and CCSF contemplated that a 7-cfs release from Calaveras Reservoir would result in cooler temperatures for the upper half of the stream reach between the Alameda/Calaveras ~~River~~ Creek confluence and the Sunol Valley WTP. Furthermore, the existing oxygenation system, which is also planned to be used in future operations, would maintain desired DO conditions in reservoir waters, which would further enhance DO conditions in the downstream reach. If MOU releases are from Alameda Creek upstream of Calaveras Creek, then Calaveras Creek would not receive the temperature benefits of these releases, and temperatures would remain as in the base case.

Section 5.4.3.2, page 5.4.3-11: The following text is added after the third paragraph under the heading "Reach 1" in response to a comment (see **Response S_RWQCBSF-15**).

Settleable Materials, Suspended Materials, and Turbidity. Sections 5.4.1.1 and 5.4.2.1 describes the SFPUC flushing activities intended to remove accumulations of coarse sediment to protect the facility, maintain storage capacity (and thus diversion capacity) above the Alameda Creek Diversion Dam, and support downstream geomorphic processes by passing sediment. The flushing procedure involves opening the sluice gates to flush coarse sediments from upstream of the diversion dam. Sediment flushing discharges approximately 900 cubic yards of sediment from behind the diversion dam each year, and typically occurs in February. This sediment typically consists of sands and gravels. Operations normally occur over a 48-hour period during high-flow events to develop the necessary velocity to mobilize the coarse sediments behind the dam. Flushing operations occur whether or not flows from the creek are being diverted to the diversion tunnel. The sluice gates remain closed year-round, except during the sluicing procedure. If water is not diverted via the diversion gates to the reservoir, the entire volume of the creek flows through the sluice gates in the dam or over the top of the dam. It is assumed that these SFPUC sediment flushing activities and sluice gate operations would continue under the WSIP.

Three water quality parameters—settleable materials, suspended materials, and turbidity—could be affected by changes in the Alameda Creek Diversion Dam operations and sediment flushing procedures. It is likely that more sediment would be transported to Calaveras Reservoir with the WSIP than under current conditions because of increased flows diverted to Calaveras Reservoir. Many of these sediments would settle out in the reservoir, reducing the overall quantity of sediments in the creek. Therefore, less sediment would be available for transport (either in flows over the dam or via sluicing/flushing operations) down Alameda Creek compared to the existing condition. Therefore, the sluicing/flushing procedures under the WSIP would have less-than-significant water quality impacts with respect to settleable materials, suspended materials, and turbidity.

Section 5.4.3, page 5.4.3-12: The following reference is added after "Merrit-Smith Consultants" in response to a comment (see **Response L_ACWD-15**).

Regional Water Quality Control Board - San Francisco Bay (RWQCB). 2008. Final Order No. R2-2008-0011, NPDES Permit No. CAG982001 General Permit for Discharges from Aggregate Mining, Sand Washing, and Sand Offloading Facilities to Surface Waters. February 15. http://www.waterboards.ca.gov/sanfranciscobay/board_decisions/adopted_orders/2008/february/r2-2008-0011final.pdf

Section 5.4.4.2, pages 5.4.4-6 and 5.4.4-7: The last partial paragraph that begins on page 5.4.4-6 and ends on page 5.4.4-7 is revised as follows in response to a comment (see **Response L_ACWD-17**).

Impact 5.4.4-1: Changes in groundwater levels, flows, quality, and supplies.

Compared to current conditions, increased diversions and storage under the WSIP would reduce peak flows in Alameda Creek between the diversion dam and the confluence with San Antonio Creek. Seasonally, the WSIP would reduce flows in the high-flow months and increase flows in the low-flow months due to fishery releases. It would also increase storage in Calaveras Reservoir. The overall effect of these changes in groundwater supplies downstream in the Sunol aquifer areas is expected to be minor (either slightly positive or slightly negative), depending on the year's rainfall and seasonal conditions. The WSIP would reduce potential infiltration in the Sunol groundwater basin by reducing peak flows in wet years. ~~However, impacts on groundwater in the Niles Cone would be dampened by inflow from non-SFPUC watershed streams and aquifers, removal of the Sunol and Niles Dams, and ongoing withdrawals at the infiltration galleries above the water temple; as a result, impacts are expected to be minimal.~~ Impacts on groundwater in the Niles Cone would be less than significant because flows in Alameda Creek downstream of Niles Canyon would be maintained within the range of flows experienced since the Niles Cone began to be managed and utilized as a water supply resource. The program's minor changes in groundwater levels would not affect groundwater quality. This impact would be *less than significant*, and no mitigation measures would be required.

Section 5.4.5.1, page 5.4.5-9: The first bulleted paragraph is revised as follows in response to comments described in **Section 14.9, Master Response on Alameda Creek Fishery Issues**.

- Alameda County Flood Control and Water Conservation District's BART Weir – several studies have been conducted regarding potential designs to provide passage at this location. The most recent effort is a report (Wood Rogers, 2006) that outlines options ranging from total removal of the structure ("roughened channel") to three ladder and screen alternatives. The range of low flows estimated to allow suitable passage for adult steelhead among these four options is 10–50 cfs. However, other barriers (e.g., ACWD middle and upper rubber dams, PG&E Drop Structure – see below) within Alameda Creek may be impassable at these low flows. ~~There is currently no schedule or budget for this project, and environmental review has yet to begin.~~ On July 31, 2007, the Alameda County Flood Control and Water Conservation District and the Alameda County Water District entered into an agreement to design a fish passage facility over the BART weir and the middle inflatable dam in the Alameda County Flood Control Channel to improve steelhead passage within the Alameda Creek watershed.

Section 5.4.5.1, page 5.4.5-11: The first paragraph under the heading "Potential Steelhead Restoration" is revised as follows in response to comments described in **Section 14.9, Master Response on Alameda Creek Fishery Issues**.

Potential Steelhead Restoration

For the purposes of full disclosure, the PEIR provides this discussion of steelhead in lower Alameda Creek, and the potential for steelhead to be restored to the upper reaches of Alameda Creek (above the BART weir). However, because this steelhead access does not currently exist and there is no current steelhead migration above the BART weir, ~~there would be no~~ the potential impact on steelhead migration, spawning, or juvenile rearing upstream of the BART weir as a result of WSIP implementation is not analyzed in this section, which addresses WSIP impacts relative to existing conditions, but instead is analyzed as a future, cumulative impact in Section 5.7.3. ~~Further, as described in the preceding discussion, since a number of steps are required before steelhead migration further upstream can occur, it is speculative to assess the specific impacts that system operation under the WSIP might have on the potential future restoration of steelhead. Thus, no impact analysis or conclusion is developed in this PEIR. If and when steelhead are restored, the SFPUC will be required to conform its system operations to comply with the applicable Endangered Species Act requirements.~~

Section 5.4.5.2, page 5.4.5-19: The first full paragraph is revised as follows to reflect the change in project description of the Calaveras Dam (SV-2) project.

As described in Section 5.4.1, under the WSIP, reservoir operations would be restored, and the diversion dam would be operated to divert most flows that currently flow down upper Alameda Creek (up to a maximum diversion of approximately 650 cfs) through the diversion tunnel and into the reservoir. Under the proposed program, the SFPUC would construct a bypass flow structure at the Alameda Creek Diversion Dam and would

implement bypass flows consistent with the 1997 CDFG MOU when flows are available ~~there is no requirement for maintaining minimum instream flows within Alameda Creek~~ to support fishery habitat downstream of the dam. The proposed diversion of most Alameda Creek flows below 650 cfs would result in a significant change in hydrologic conditions in Alameda Creek downstream of the diversion dam when compared to existing conditions. Diversion of most or all flows during the late winter and spring months could adversely affect the ability of resident rainbow trout to spawn and for eggs to successfully incubate in this reach, although the proposed bypass flows at the diversion dam would reduce the severity of this effect. In the future, with Calaveras Reservoir storage operating at higher levels for longer periods under the WSIP, diversions to storage are expected to be reduced and the frequency and magnitude of spills from the reservoir increased.

Section 5.4.5.2, page 5.4.5-20: The last paragraph is revised as follows to reflect the change in the description of the Calaveras Dam (SV-2) project.

Overall, WSIP-related impacts on fishery habitat along Alameda Creek immediately downstream of the diversion dam would be *potentially significant*, despite proposed implementation of bypass flows at the diversion dam. Implementation of Measure 5.4.5-3a: Minimum Flows for Resident Trout on Alameda Creek, which would require the SFPUC to develop operational guidelines and implement minimum instream flow requirements for Alameda Creek downstream of the diversion dam from December through April to support resident trout spawning and egg incubation, would reduce this impact to a less-than-significant level. Measure 5.4.5-3a in conjunction with the proposed bypass flows at the diversion dam may be sufficient to fully mitigate WSIP effects on resident trout in Alameda Creek, including the effects of entrainment through the diversion tunnel. If, after monitoring of this measure and adaptive management of the minimum flow requirements, the monitoring indicates that WSIP effects are not fully mitigated, then the SFPUC also will implement Measure 5.4.5-3b: Alameda Diversion Dam Diversion Restrictions or Fish Screens, to either modify seasonal diversions schedules to minimize impacts on fish or screen its diversion facilities. This measure may be refined as it would be developed in more detail and implemented as part of the Calaveras Dam (SV-2) project.

Section 5.4.6.2, page 5.4.6-19: The third full paragraph is revised as follows in response to comments (see **Response S_CDFG2-15** and **Section 14.9)**.

Overall, implementation of the proposed WSIP water supply and system operations would result in *potentially significant* impacts on terrestrial biological resources due to a potential reduction in aquatic breeding habitat for key special-status species. Measure 5.4.1-2, Diversion Tunnel Operation, calls for operation of the diversion tunnel in a manner that ensures that flows not required to maintain storage in Calaveras Reservoir are passed down Alameda Creek at the diversion dam. Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek, calls for developing and implementing an operational plan to provide minimum bypass flows below the diversion dam to support habitat for rainbow trout and other native stream-dependent species from December through April. Implementation of these measures would ensure that minimum flows in Alameda Creek are

allowed to pass by the diversion dam. Taken together, these measures would reduce adverse impacts on key special-status species to a less-than-significant level.

Section 5.4.6.2, page 5.4.6-20: The third and fourth paragraphs are revised as follows to reflect the change in project description of the Calaveras Dam (SV-2) project.

Flows in Calaveras Creek below Calaveras Dam would be altered in two ways during the two- to five-year period when the reservoir is being refilled. First, there would be no cone valve releases into Calaveras Creek below the dam. Second, the SFPUC would initiate required minimum instream flow releases (see Table 5.4.1-9) when construction of the new Calaveras Dam is completed. When flows at the confluence of Alameda and Calaveras Creeks fall below the minimum required flow, generally during protracted dry periods, releases would be made from Calaveras Dam or upstream on Alameda Creek. These releases would ensure that existing riparian habitat would be sustained; therefore, impacts on riparian habitats related to filling the reservoir would be *less than significant*, and no mitigation measures would be required.

Impacts from Minimum Flows. Under the WSIP, minimum flows ~~would~~ may be maintained year-round, ~~an increase over both existing conditions and pre-2002 conditions~~ depending if flow releases are from Calaveras Reservoir or from upstream on Alameda Creek. Sustained minimum flows during the dry season could slightly increase groundwater recharge. It could also facilitate the conversion from riparian habitats that require only seasonally flowing water to those that require permanent flowing water, such as alder riparian forest. This potential replacement of one sensitive riparian habitat with another one (with no change in the total extent of riparian habitat) would be *less than significant*.

Section 5.4.6.2, pages 5.4.6-23 and 5.4.6-24: The last partial paragraph on page 5.4.6-23 continuing to the first paragraph on page 5.4.6-24 and the first full paragraph on page 5.4.6-24 are revised as follows to refine and update the impact discussion based on the modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Sensitive Habitats

Sensitive habitats that could be affected by operations of San Antonio Reservoir include small areas of freshwater marsh and riparian scrub on gently sloping reservoir margins. ~~The average reservoir levels would be higher with the WSIP than under existing conditions, but t~~The maximum reservoir levels would not change. No upland habitats would be affected. ~~The average range of reservoir elevations under the WSIP would be slightly less than under existing conditions. Little perennial freshwater marsh or riparian scrub would be inundated to the extent that it would be permanently lost. Any loss of such habitat would be balanced by development of similar habitat at higher elevations.~~ As discussed in Section 5.4.1, storage levels at San Antonio Reservoir would drop every fifth year for planned system maintenance. The reservoir would be refilled to typical operating levels within one to two years after the maintenance period. The depth and duration of drawdown would be within the range of historic operating conditions. Thus, WSIP impacts on riparian and freshwater

marsh habitat along the margins of San Antonio Reservoir would be *less than significant*, and no mitigation measures would be required.

~~Drawdown once every five years during late fall or early winter would have a less-than-significant impact on habitat, since reservoir levels would be restored within a few months after system maintenance is completed.~~

Section 5.4.6.2, page 5.4.6-24: The second full paragraph, last sentence is revised as follows to refine and update the impact discussion based on the modeling results conducted in 2008 as discussed in Chapter 13, Section 13.3.

However, impacts ~~related to the negligible changes in the extent of~~ on riparian scrub and freshwater marsh habitat would be less than significant, and therefore impacts on the habitat of California red-legged frog and California tiger salamander would be *less than significant*, and no mitigation measures would be required.

Section 5.4.6.2, page 5.4.6-24: The third full paragraph, first sentence is revised as follows to refine and update the impact discussion based on the modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Other Species of Concern

San Antonio Reservoir ~~would be kept near maximum levels for longer periods, the~~ maximum water surface elevation would not change, and ~~only minor~~ fluctuations in water level would occur ~~(apart from maintenance drawdown)~~ that would be within the historic operating range.

Section 5.4.7.1, page 5.4.7-1: The third paragraph is revised as follows in response to a comment (see **Response L_EBRPD-26**).

Alameda Creek Recreation and Visual Quality

Alameda Creek runs through several local parks, ~~and~~ municipalities (including ~~Sunol Regional Wilderness,~~ Alameda County), and the cities of Fremont and Union City. Alameda Creek also runs through the Sunol Regional Wilderness and is adjacent to the Vargas Plateau Regional Preserve, Quarry Lakes Regional Recreation Area, and Coyote Hills Regional Park, all of which are operated by the EBRPD. The recreational uses of the creek are described below.

Section 5.4.7.1, page 5.4.7-3, the following text is added after the first partial paragraph in response to a comment (see **Response L_EBRPD-26**).

Vargas Plateau Regional Preserve

The Vargas Plateau Regional Preserve, managed by the EBRPD, is located adjacent to the SFPUC Alameda watershed along a common boundary line on the east side of the preserve. Its northern boundary touches Alameda Creek for a distance of about 2,500 feet. A portion

of the decommissioned Sunol Aqueduct crosses the park within a utility easement. Currently, the preserve is not suitable for active public use due to the lack of public road access, the need to protect natural or man-made resources, and other factors related to public safety and access. The EBRPD is currently in the process of adopting the *Vargas Plateau Regional Park Land Use Plan*, which would create a regional park that provides trails, outdoor recreation, campgrounds, and nature appreciation areas (EBRPD, 2007e).

Section 5.4.7.2, page 5.4.7-5, Table 5.4.7-1: Table 5.4.7-1 is revised as follows to reflect the change in project description of the Calaveras Dam (SV-2) project.

TABLE 5.4.7-1
SUMMARY OF IMPACTS –
RECREATIONAL AND VISUAL RESOURCES IN THE ALAMEDA CREEK WATERSHED

Impact	Significance Determination
Impact 5.4.7-1: Effects on recreational facilities and/or activities	~~PSM~~LS
Impact 5.4.7-2: Visual effects on scenic resources or the visual character of water bodies	~~PSM~~LS

~~PSM = Potentially Significant impact, can be mitigated to less than significant~~ LS = Less than Significant impact, no mitigation required

Section 5.4.7.2, page 5.4.7-5: The last paragraph is revised as follows to reflect the change in project description of the Calaveras Dam (SV-2) project.

The WSIP would not affect water-related recreational facilities or activities in the Alameda Creek watershed. As described above in Section 5.4.7.1, Setting, water recreation is not allowed on the SFPUC reservoirs; because there would be no change to this policy under the WSIP, impacts on recreation would not occur as a result of water level changes in the reservoir. With respect to recreation in and along the creeks in the watershed~~, for most portions of the watershed,~~ there is either: (1) no or only very limited water recreation occurring at present, and/or (2) the WSIP-related flow changes described in Section 5.4.1 would not change creek flows to an extent that existing recreational use would be affected. ~~However, the~~ The proposed program would ~~substantially~~ reduce peak flows along Alameda Creek in the Sunol Regional Wilderness in the winter and early spring months. The reduced flows would somewhat degrade the recreational experience for hikers on the trails near (or with views of) Alameda Creek, ~~resulting in a *potentially*~~ however, with the proposed minimum flows for resident trout on Alameda Creek to be released from the Alameda Creek Diversion Dam when such flows are present, this would be a *less-than-significant* impact. ~~Implementation of Measure 5.4.1-2, Diversion Tunnel Operation, and Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek, would reduce this impact to a less-than-significant level.~~

Section 5.4.7.2, page 5.4.7-6: The first and second paragraphs are revised as follows to reflect the change in project description of the Calaveras Dam project (SV-2).

> As described in Section 5.4.1, changes in stream flow and reservoir water levels under the WSIP are not beyond the range of flow and water level variation that occurs now. The reductions in peak flows in average, above-average, and wet years under the proposed program would not be visually apparent to most recreational users and others viewing the creeks and reservoirs. The main exception would be the ~~substantial~~ reductions in peak flows in Alameda Creek in the Sunol Regional Wilderness, including the scenic Little Yosemite area, during winter and spring months. Reduced peak flows in Alameda Creek in the Little Yosemite area would ~~result in a *potentially significant* impact on scenic resources. Implementation of Measure 5.4.1-2, Diversion Tunnel Operation, and Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek, would reduce potential impacts on scenic resources along Alameda Creek in the Sunol Regional Wilderness to a less-than-significant level.~~ somewhat degrade the visual character Alameda Creek, however, with the proposed minimum flows for resident trout on Alameda Creek to be released from the Alameda Creek Diversion Dam when such flows are present, this would be a *less-than-significant* impact.
>
> Proposed summer releases to support fisheries would increase flows in Calaveras Creek and downstream in Alameda Creek and would have a beneficial visual effect, because the releases would enhance the creek's appearance in the summer months when recreational use is highest. Therefore, no significant adverse visual impacts would occur, and no mitigation is required.

Section 5.4.7.2, page 5.4.7-6: The following reference is added after (EBRPD, 2007d) in response to a comment (see Response **Response L_EBRPD-26**).

> East Bay Regional Park District (EBRPD), *Draft Vargas Plateau Regional Park Land Use Plan*, October 2007e, available online at http://www.ebparks.org/planning/lup, accessed January 25, 2008.

5.5 San Francisco Peninsula Streams and Reservoirs

Section 5.5.1.1, page 5.5.1-5: The second paragraph, sixth sentence is revised as follows to reflect updated information on the Crystal Springs Reservoir capacity from recent SFPUC studies.

> The current maximum capacities of San Andreas~~, Upper Crystal Springs,~~ and ~~Lower~~ Crystal Springs Reservoirs are 19,000~~, 23,360,~~ and ~~35,040~~ 56,800 acre-feet, respectively.

Section 5.5.1.1, page 5.5.1-9: The last sentence of the third full paragraph is revised as follows in response to a comment (see **Response L_CoastsideCWD-11**).

> After the reservoir has filled, the ~~only water~~ SFPUC attempts to limit releases from Pilarcitos Reservoir ~~is~~ to that amount requested by Coastside CWD to meet its water needs. However, at times, additional water may be released from Pilarcitos Reservoir and diverted

to Crystal Springs Reservoir at Stone Dam or released from Stone Dam (see discussion below regarding experimental releases from Stone Dam to Pilarcitos Creek).

Section 5.5.1.2, page 5.5.1-13: The first paragraph under "Approach to Analysis" is revised as follows to better describe the refined analysis of impacts on resources in the Pilarcitos watershed as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

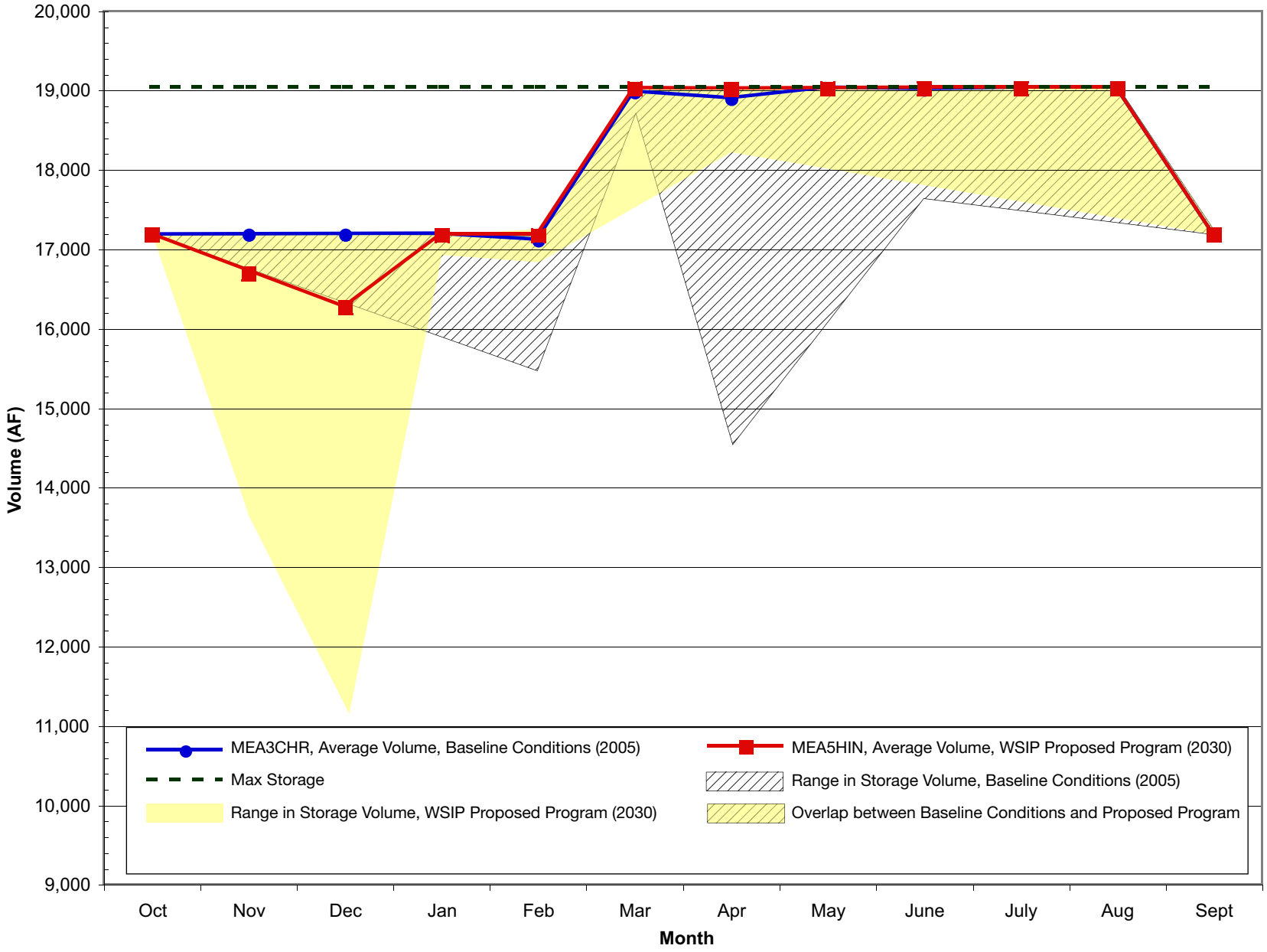
Approach to Analysis

Changes in reservoir storage and water levels attributable to the WSIP in the San Mateo Creek watershed and changes in reservoir storage, water levels and stream flows in the Pilarcitos Creek watershed attributable to the WSIP were estimated using the Hetch Hetchy/Local Simulation Model (HH/LSM). An overview of the model is provided in Section 5.1. Detailed information on the model and the assumptions that underlie it ~~is~~ are provided in Appendix H. Stream flows in San Mateo Creek and stream flows and changes in reservoir storage and water levels for the Pilarcitos Creek watershed were estimated semi-quantitatively based on results from the model in addition to interviews with individuals knowledgeable about historical, current and expected future (with-WSIP) water system operations. Information on the limitations of the HH/LSM and reasons for using supplemental information are provided in Section 5.1. Information on current and expected future operations in the Pilarcitos Creek watershed is provided in Appendix H2-3 and H2-7.

Section 5.5.1.2, page 5.5.1-14: The second paragraph is revised as follows to reflect updated information on the Crystal Springs Reservoir capacity from recent SFPUC studies.

The proposed program would increase average monthly storage in Crystal Springs Reservoir year-round compared to the existing condition. **Figure 5.5.1-7** shows average monthly storage in the reservoir. The increase in average monthly storage would mostly be attributable to the Lower Crystal Springs Dam project (PN-4), but also to improvements to the SFPUC regional water system as a whole. The improvements to Crystal Springs Dam are part of the WSIP and would allow the reservoir to be operated at its full capacity of ~~69,300~~ 68,000 acre-feet, or ~~22.6~~ 22.2 billion gallons. The Division of Safety of Dams currently limits the maximum storage capacity in Crystal Springs Reservoir to ~~58,400~~ 56,800 acre-feet (~~19~~ 18.5 billion gallons) due to concerns regarding the ability of the dam spillway to safely pass the largest floods that could occur in the watershed. …

Section 5.5.1.2, page 5.5.1-18: The legend in **Figure 5.5.1-9** is revised to show the correct range in storage volume of the San Andreas Reservoir. The Draft PEIR incorrectly labeled the yellow area as "Range in Storage Volume, Baseline Conditions (2005)" and the hatched area as "Range in Storage Volume, WSIP Proposed Program (2030)." Figure 5.5.1-9 is revised as shown on the following page.



SOURCE: SFPUC, HH/LSM (see Appendix H)

Figure 5.5.1-9
Average Monthly Storage Volume,
San Andreas Reservoir

Section 5.5.1.2, page 5.5.1-20: The two paragraphs under "Water Storage and Water Levels in Pilarcitos Reservoir" are revised as follows, including insertion of a new figure, Figure 5.5.1-10, to refine the flow analysis in the Pilarcitos watershed as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Water Storage and Water Levels in Pilarcitos Reservoir

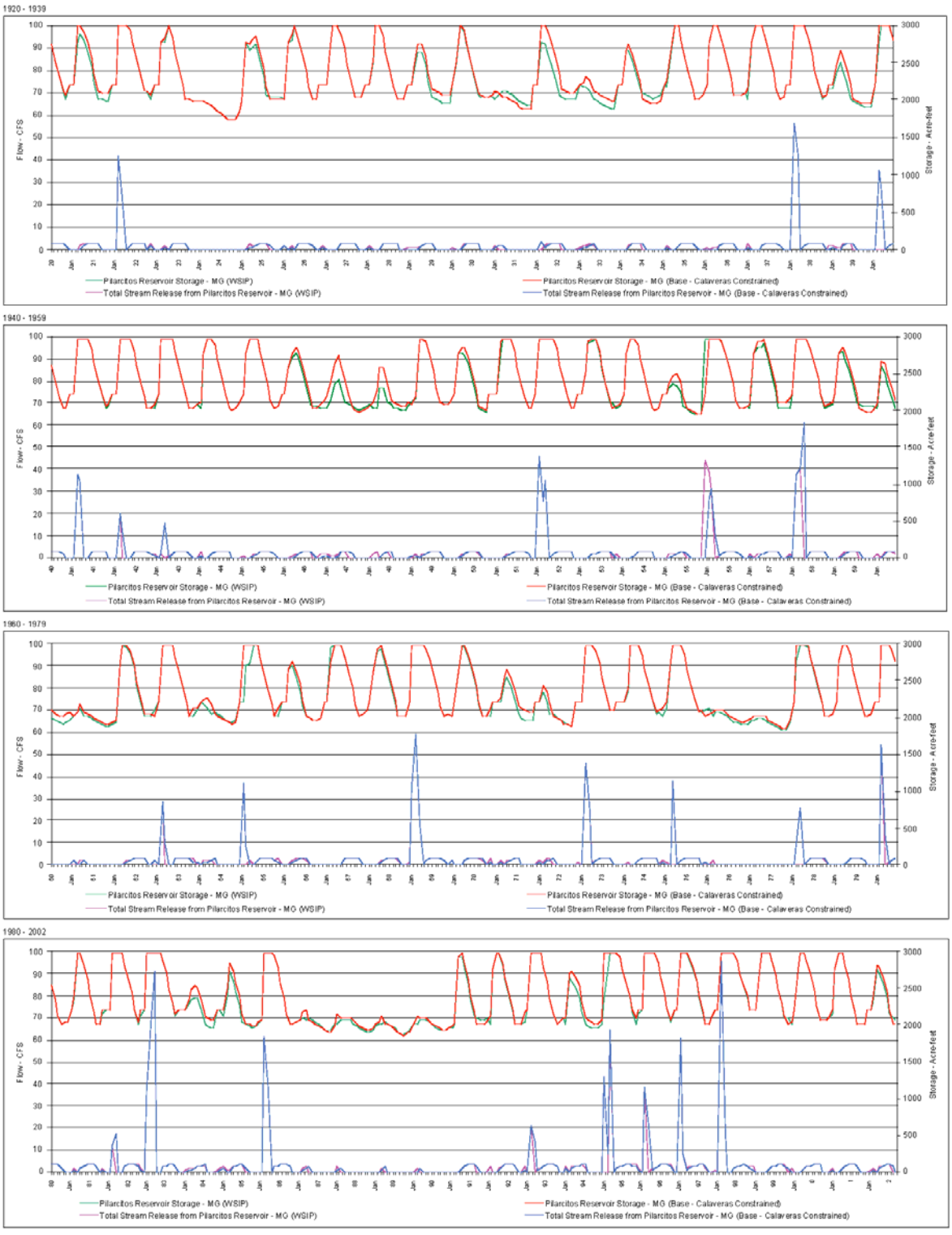
Seasonal changes in storage and water surface elevation in Pilarcitos Reservoir under the existing condition are shown in Figure 5.5.1-6. **Figure 5.5.1-10** shows chronological modeled storage in Pilarcitos Reservoir using hydrology data from the period 1920 to 2002. The figure compares the WSIP to the existing condition. With the WSIP, storage in the reservoir would follow a similar seasonal pattern as under the existing condition, but would average somewhat less than under the existing condition and would be drawn down more rapidly in some years in the late spring and summer. The increased rate of drawdown is primarily attributable to increased water demand in the Coastside CWD service area, which is served by releases from the reservoir, and increased transfers of water to the San Mateo Creek watershed. As water demand increases in the Coastside CWD service area, additional water would be drawn from Pilarcitos Reservoir to meet demand, although diversion of water from Pilarcitos Creek to Coastside CWD is currently limited to a maximum of 2 mgd because of pipeline capacity. The HH/LSM assumes that when Coastside CWD's monthly demand from Pilarcitos Creek exceeds 2 mgd the SFPUC serves Coastside CWD from Crystal Springs Reservoir. Additional water would also be transferred from the Pilarcitos Creek watershed to the SFPUC's reservoirs in the San Mateo Creek watershed with the WSIP than under the existing condition. This is because with the WSIP more reservoir capacity in the San Mateo Creek watershed would be available at times when water is available from Pilarcitos Creek.

~~Storage in Pilarcitos Reservoir with the WSIP would be reduced much of the time, except when the reservoir is full and spilling, or at its minimum elevation and no further diversions can be made.~~ Under existing conditions and in most years ~~dry periods~~, storage in ~~the~~ Pilarcitos ~~r~~Reservoir becomes depleted by the late summer, and the only releases made to Pilarcitos Creek are the consequence of inflow from groundwater and tributary streams. Depletion of the reservoir in dry periods would occur earlier in the year with the WSIP.

Section 5.5.1.2, page 5.5.1-20: A new table, **Table 5.5.1-2**, and the following new paragraph are inserted immediately under the heading "Flow in Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam" to refine the flow analysis in the Pilarcitos watershed as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Flow in Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam

Releases to Pilarcitos Creek from Pilarcitos Reservoir under the existing condition and with the WSIP are shown in Figure 5.5.1-10. In normal, below normal, and dry years, the WSIP would have little or no effect on releases to Pilarcitos Creek from the reservoir. In average wet years and with the WSIP, releases would be reduced by about 6 percent. In average



SOURCE: SFPUC, HH/LSM (see Appendix H)

SFPUC Water System Improvement Program . 203287

Figure 5.5.1-10

Pilarcitos Reservoir Storage and Stream Release

TABLE 5.5.1-2
AVERAGE MONTHLY CHANGES IN PILARCITOS CREEK FLOW
BELOW PILARCITOS RESERVOIR ATTRIBUTABLE TO THE WSIP
(CUBIC FEET PER SECOND)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Year Type
1983	6	4	0	74	131	182	0	0	5	5	6	6	Wet
1998	0	0	2	0	192	37	0	0	3	5	5	6	Wet
1958	0	0	5	0	74	81	-62	0	5	6	6	6	Wet
1941	4	0	0	0	76	69	0	0	5	6	6	6	Wet
1982	0	4	0	0	23	-17	0	0	5	6	6	6	Wet
1995	0	0	0	-43	-8	118	0	2	4	5	6	6	Wet
1956	0	0	131	90	62	-10	3	4	5	6	6	6	Wet
1952	4	0	0	92	51	70	0	4	5	6	6	6	Wet
1938	4	0	0	0	112	84	0	3	5	6	6	6	Wet
1997	6	0	0	122	16	4	5	5	6	6	6	3	Wet
1969	0	0	3	70	119	37	1	4	5	6	6	6	Wet
1973	0	0	3	0	92	51	2	4	5	6	6	6	Wet
1986	0	0	0	0	123	79	0	4	5	6	6	6	Wet
1980	0	0	2	0	109	-13	2	4	5	6	6	6	Wet
1942	6	0	0	0	41	-12	0	0	5	6	6	6	Wet
1967	0	0	0	0	0	0	0	0	5	6	6	6	Wet
1963	0	0	-2	0	57	-10	0	0	5	6	6	6	AN
1940	0	0	0	0	-36	-27	0	4	5	6	6	6	AN
1965	0	0	0	-37	-9	5	0	4	5	6	6	6	AN
1996	6	7	4	0	77	-22	3	4	5	6	6	6	AN
1922	0	0	0	0	83	46	0	4	6	6	6	6	AN
1975	6	0	6	4	0	-38	0	3	5	6	6	6	AN
1974	0	2	0	0	4	0	0	3	5	6	6	6	AN
1978	0	0	0	0	-9	-26	0	4	5	6	6	6	AN
1993	0	0	7	0	43	-13	3	4	6	6	6	6	AN
1951	0	0	0	0	0	0	4	4	5	6	6	6	AN
1943	5	4	5	0	3	-16	1	4	5	6	6	6	AN
1927	0	0	4	0	0	0	0	5	6	6	6	6	AN
1937	0	0	0	8	0	0	0	4	6	6	6	6	AN
2000	6	-2	5	0	0	0	4	5	6	6	6	6	AN
1921	7	4	0	0	0	4	5	5	6	6	5	0	AN
1999	6	7	5	0	0	0	0	3	5	6	6	6	AN
1923	0	6	0	0	0	5	0	5	6	6	6	5	AN
1953	6	0	0	0	1	0	4	4	6	6	6	6	NORMAL
1928	0	0	1	4	1	0	0	5	6	6	6	5	NORMAL
1970	4	0	4	0	0	0	4	5	6	6	6	4	NORMAL
1984	6	0	0	2	4	4	4	4	6	4	0	0	NORMAL
1946	3	0	0	0	0	4	4	4	6	6	6	-2	NORMAL
1926	0	0	0	5	0	5	0	5	6	6	6	4	NORMAL
1936	3	0	0	2	0	2	2	4	6	6	6	6	NORMAL
1945	0	0	0	4	0	0	3	4	6	6	6	6	NORMAL
1971	0	7	0	0	5	2	4	5	6	6	0	0	NORMAL
1935	0	0	0	0	5	0	0	3	6	6	6	6	NORMAL
1932	0	0	0	0	-4	5	6	6	6	6	-3	0	NORMAL
1979	5	0	0	0	0	0	3	5	6	6	6	5	NORMAL
1962	0	0	0	0	0	0	5	5	6	6	6	5	NORMAL
1949	0	0	0	-1	4	0	3	4	6	6	6	6	NORMAL
1992	0	0	0	7	0	0	5	6	6	6	6	4	NORMAL
1981	3	0	0	0	4	0	4	5	6	6	6	4	NORMAL
2001	0	0	0	4	0	0	4	5	6	6	6	4	BN
1930	0	0	0	2	1	0	5	5	6	6	6	0	BN
1954	-2	6	0	0	0	0	3	5	6	6	6	6	BN
1968	5	0	0	0	0	2	4	5	6	6	6	4	BN
1959	6	0	0	0	0	5	5	5	6	6	-2	0	BN
1925	0	0	0	0	0	6	4	3	6	6	6	-2	BN
1944	4	0	0	6	0	0	4	5	6	6	6	6	BN
2002	0	0	0	0	4	0	5	5	6	6	-3	0	BN
1950	0	0	0	0	0	5	4	5	6	6	3	0	BN
1966	4	7	0	1	0	5	6	6	6	2	0	0	BN
1955	0	0	0	0	4	4	4	5	6	-2	0	0	BN
1957	4	0	0	5	0	4	4	3	6	6	6	6	BN
1934	0	0	1	0	0	5	6	6	6	-3	0	0	BN
1985	0	2	4	6	1	1	6	5	6	6	-2	0	BN
1991	0	0	0	0	0	0	5	6	6	6	6	-2	BN
1929	0	0	2	3	3	2	4	6	6	6	0	0	BN
1964	5	7	-1	0	5	6	5	-3	0	0	0	0	BN

TABLE 5.5.1-2 (Continued)
AVERAGE MONTHLY CHANGES IN PILARCITOS CREEK FLOW
BELOW PILARCITOS RESERVOIR ATTRIBUTABLE TO THE WSIP
(cubic feet per second)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Year Type
1947	0	6	4	4	4	3	4	5	6	-3	-2	0	DRY
1994	4	0	0	6	0	6	5	5	6	2	0	0	DRY
1939	6	0	4	5	2	4	5	6	6	-2	0	0	DRY
1948	0	0	0	0	6	9	1	4	6	-3	0	0	DRY
1960	0	0	0	6	0	6	6	6	4	0	0	0	DRY
1972	0	0	1	5	3	7	6	-3	0	0	0	0	DRY
1933	0	0	0	2	5	5	5	3	0	0	0	0	DRY
1961	0	0	0	-2	0	5	3	0	0	0	0	0	DRY
1990	0	0	0	0	5	-1	0	0	0	0	0	0	DRY
1987	4	0	0	0	5	5	-2	0	0	0	0	0	DRY
1988	0	0	0	7	-1	0	0	0	0	0	0	0	DRY
1989	0	0	0	0	0	5	-2	0	0	0	0	0	DRY
1931	0	0	0	6	-1	-1	0	0	0	0	0	0	DRY
1976	6	0	-2	0	6	0	0	0	0	0	0	0	DRY
1977	0	0	0	0	0	0	0	0	0	0	0	0	DRY
1924	0	0	0	0	0	0	0	0	0	0	0	0	DRY

NOTES: Hydrologic year types were determined by rank ordering of total SFPUC Bay Area reservoir inflow.
Year Types: Wet, AN -- Above Normal, Normal, BN -- Below Normal, and Dry

SOURCE: SFPUC, HH/LSM (see Appendix H)

above normal years and with the WSIP, releases would be reduced by about 34 percent. The differences between releases under the existing condition and with the WSIP are shown in Table 5.5.1-2 in every month for the period 1921 through 2002. Negative values indicate the months in which releases to the creek with the WSIP would be less than under the existing condition.

Section 5.5.1.2, pages 5.5.1-20 and 5.5.1-21: The last partial paragraph on page 5.5.1-20 continuing to page 5.5.1-21 and the first full paragraph on page 5.5.1-21 are revised as follows to refine the flow analysis in the Pilarcitos watershed as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Most runoff into Pilarcitos Reservoir occurs between November and April. In normal, above-normal, and wet years, when the reservoir is full and runoff exceeds the capacity of the diversion tunnels to San Andreas and Crystal Springs Reservoirs, or those reservoirs are full, the reservoir spills to Pilarcitos Creek. ~~Because Pilarcitos Reservoir is drawn down to its minimum elevation in late summer in all but the wettest years, the WSIP would have a negligible effect on wintertime spills to Pilarcitos Creek in most years. Some reduction in spills could occur in wet years~~. As shown in Figure 5.5.1-10, the WSIP would not affect wintertime spills in most years, but it would reduce spills in some wet and above normal years. Occasionally (for example, under 1940, 1943, 1965 and 1976 hydrologic conditions), wintertime spills that occur under the existing condition would be completely or almost completely eliminated with the WSIP.

The WSIP would increase flow in Pilarcitos Creek immediately below Pilarcitos Reservoir in some late spring and summer months of most hydrologic year types as a result of increased releases from the reservoir to meet Coastside CWD's needs. The increases are shown as positive values in April, May, June and July in Table 5.5.1-2. In the summer months of ~~dry~~ some years, Pilarcitos Reservoir would become depleted earlier in the year with the WSIP than it does under the existing condition. Coastside CWD would activate its pumps and draw water from Crystal Springs Reservoir earlier in the year than it does under the existing condition. At such times, there would be no releases from Pilarcitos Reservoir to the creek except for dry season inflow to the reservoir. Flow in the creek below the reservoir would be the same as under the existing condition, consisting of inflow releases, seepage from the dam, infiltration from groundwater, and tributary flow. The period of minimal flow below Pilarcitos Reservoir would be extended with the WSIP, because the reservoir would be drawn down to its minimum elevation earlier in the year. Table 5.5.1-2 shows negative values in some years between May and September. These are months in which releases from Pilarcitos Reservoir occur under the existing condition but which would be reduced or eliminated under the WSIP.

Section 5.5.1.2, page 5.5.1-21: The first and second paragraphs under "Flow in Pilarcitos Creek below Stone Dam" are revised as follows to refine the flow analysis in the Pilarcitos watershed as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Flow in Pilarcitos Creek Below Stone Dam

Under the existing condition, water occasionally spills over Stone Dam to Pilarcitos Creek. There is little flow in Pilarcitos Creek immediately below Stone Dam most of the time, and no flow in dry periods. Spills over Stone Dam occur when releases from Pilarcitos Reservoir and runoff into Pilarcitos Creek between the reservoir and Stone Dam exceed the capacity of the diversion at Stone Dam. Occasional spills over Stone Dam would continue under the WSIP. The volume of spills would be reduced by the additional amount of Pilarcitos Creek water the SFPUC supplies to Coastside CWD or diverts to its reservoirs in the San Mateo Creek watershed.

~~In most months of wet years, spills over Stone Dam with the WSIP and under the existing condition would be the same. In some winter and early spring months, spills with the WSIP would probably be less than under the existing condition.~~ Spills at Stone Dam typically occur ~~in wet years~~ when Pilarcitos Reservoir is full, Coastside CWD's demand is met, and the SFPUC cannot transfer water to the San Mateo Creek watershed, either because available water in the Pilarcitos Creek watershed exceeds the capacity of the SFPUC's tunnels to San Andreas and Crystal Springs Reservoirs, or those reservoirs are already full. Spills very rarely occur in dry and below normal years under the existing condition and would very rarely occur with the WSIP. With the WSIP, average annual spills in wet, above normal and normal years would be reduced by about 11, 60, and 25 percent, respectively, compared to the existing condition.

Section 5.5.3.1, page 5.5.3-1: The last full sentence on the page is revised as follows to correct the spelling of "phosphorus" and in response to a comment (see **Response C_Hoel-04**).

> Past studies have shown that the growth of algae in Crystal Springs Reservoir is limited by a lack of nitrogen and phosphor~~o~~us, both of which are plant nutrients; therefore, an increase in the concentration of either could increase the growth of algae.

Section 5.5.3.2, page 5.5.3-4: The first paragraph under "Approach to Analysis" is revised as follows to better describe the refined analysis of impacts on resources in the Pilarcitos watershed as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

> ***Approach to Analysis***
>
> Changes in reservoir storage and water levels in the San Mateo Creek watershed and changes in reservoir storage, water levels and stream flows in the Pilarcitos Creek watershed attributable to the WSIP were estimated using the HH/LSM. An overview of the model is presented in Section 5.1. Detailed information on the model and the assumptions that underlie it ~~is~~ are provided in Appendix H. Changes in stream flows in ~~both~~ the San Mateo Creek ~~and Pilarcitos watersheds and changes in reservoir storage and water levels for the Pilarcitos Creek~~ watershed attributable to the WSIP were estimated semi-quantitatively in consultation with individuals knowledgeable about historical, current, and expected future (with-WSIP) water system operations.

Section 5.5.3.2, page 5.5.3-6: The first partial paragraph and the first full paragraph on page 5.5.3-6 are revised as follows to correct the spelling of "phosphorus" and in response to a comment (see **Response C_Hoel-04**).

> …bottom of the reservoir. If the proposed program increased the volume of oxygen-depleted water at the bottom of the reservoir, it could increase the release of phosphor~~o~~us. Increased release of phosphor~~o~~us and increased phosph~~o~~rous concentrations in reservoir water would have the potential to increase the growth of algae.
>
> Studies completed over the last several years indicate that the growth of algae in Crystal Springs Reservoir has historically been limited by both nitrogen and phosphor~~o~~us concentrations. After the SFPUC began disinfecting Hetch Hetchy water with chloramine, the nitrogen concentration in the reservoir increased, and the concentration of phosphor~~o~~us in reservoir water became the factor limiting the growth of algae. Thus, the addition of more nitrogen as a result of a WSIP-induced increase in the proportion of Hetch Hetchy water in Crystal Springs Reservoir would not alone increase the growth of algae. Increased phosphor~~o~~us concentrations in the reservoir as a result of the more stable thermal stratification induced by the WSIP would increase the growth of algae.

Section 5.5.3.2, page 5.5.3-7: The first paragraph under the heading "Pilarcitos Reservoir" is revised as follows to refine the water quality analysis in the Pilarcitos watershed as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Pilarcitos Reservoir

Figure 5.5.1-6 shows recent past storage levels in Pilarcitos Reservoir from 1998 to 2006. Under the existing condition, the reservoir is drawn down through the summer, reaching minimum storage in October and November, just before the rainy season begins. With the WSIP, drawdown would occur more rapidly in ~~many~~ some years. The ~~increased~~ more rapid drawdown attributable to the proposed program could cause the reservoir to destratify earlier than under existing conditions. This would not adversely affect water quality; in fact, mechanical destratification in the fall has been recommended to the SFPUC as a means of improving water quality (SFPUC, 2002).

Section 5.5.3.2, page 5.5.3-7: The first paragraph under the heading "Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam" is revised as follows to refine the water quality analysis in the Pilarcitos watershed as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Pilarcitos Creek Between Pilarcitos Reservoir and Stone Dam

The WSIP could affect water quality in Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam in two ways – by altering the quality of water released from Pilarcitos Reservoir to the creek and by altering flow in the creek. As discussed above, with the WSIP in place, the volume of the pool of cool water in Pilarcitos Reservoir below the thermocline would be reduced earlier in the year in some years compared to the existing condition, but the quality of water released to Pilarcitos Creek from the reservoir would change little.

Section 5.5.3.2, page 5.5.3-8: The first full paragraph is revised as follows to refine the water quality analysis in the Pilarcitos watershed as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

The proposed program would also reduce flow in Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam in wet months of some wet years. It is not expected that the wet-year flow reductions would have an adverse effect on water quality in the stream because, during the winter, water in the creek would be cool and well oxygenated.

Section 5.5.3.2, page 5.5.3-8: The second paragraph under the heading "Pilarcitos Creek Below Stone Dam" is revised as follows to refine the water quality analysis in the Pilarcitos watershed as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

With the WSIP, less water would pass over Stone Dam in ~~wet~~ winters of wet, above normal, and normal years than it does under the existing condition. It is unlikely that the reductions in spill over Stone Dam would have much effect on water quality in Pilarcitos Creek below Stone Dam. The reductions in spills would occur in wet months of wet, above

normal, and normal years when runoff from the Pilarcitos Creek watershed below Stone Dam would be high. For this reason, the effect of the flow reductions on water quality in the creek below Stone Dam would be minor.

Section 5.5.3.2, page 5.5.3-9: The text under the heading "Impact Summary" is revised as follows to refine the water quality analysis in the Pilarcitos watershed as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Impact Summary

The ~~Overall~~ adverse impacts of the WSIP on water quality ~~in Pilarcitos Reservoir and~~ along Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam would be *potentially significant*; however implementation of Measure 5.5.3-2a~~, Revised Operations Plan for Pilarcitos Watershed Facilities~~ Low-head Pumping Station at Pilarcitos Reservoir, would restore flow to this reach of Pilarcitos Creek in the late summer ~~maintain the current storage levels in the reservoir~~ and reduce the impact to a less than significant level.

The adverse impacts of the WSIP on water quality in Pilarcitos Reservoir would also be potentially significant. Furthermore, Measure 5.5.3-2a, Low-head Pumping Station at Pilarcitos Reservoir, would exacerbate adverse impacts on water quality at the reservoir by lowering the water level in some summers. Implementation of Measure 5.5.3-2b, Aeration System at Pilarcitos Reservoir, would improve water quality and reduce impacts in the reservoir to a less than significant level.

Section 5.5.5.2, page 5.5.5-5: The text under "Approach to Analysis" is revised as follows to better describe the refined analysis of impacts on resources in the Pilarcitos watershed as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Approach to Analysis

Changes in reservoir storage and water levels in the San Mateo Creek watershed and changes in reservoir storage, water levels and stream flows in the Pilarcitos Creek watershed attributable to the WSIP were estimated using the HH/LSM. An overview of the model is presented in Section 5.1. Detailed information on the model and the assumptions that underlie it ~~is~~ are provided in Appendix H. Changes in flow in streams in the San Mateo Creek ~~and Pilarcitos watersheds and changes in reservoir storage and water levels in the Pilarcitos~~ watershed attributable to the WSIP were estimated semi-quantitatively based on interviews with individuals knowledgeable about the historical, current, and expected future (with-WSIP) water system operations.

Section 5.5.5.2, page 5.5.5-6, Table 5.5.5-1: Table 5.5.5-1 is revised as follows to reflect the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

TABLE 5.5.5-1
SUMMARY OF IMPACTS – FISHERIES
IN SAN FRANCISCO PENINSULA STREAMS AND RESERVOIRS

Impact	Significance Determination
Impact 5.5.5-1: Effects on fishery resources in Crystal Springs Reservoir (Upper and Lower)	PSU
Impact 5.5.5-2: Effects on fishery resources in San Andreas Reservoir	LS
Impact 5.5.5-3: Effects on fishery resources along San Mateo Creek	LS
Impact 5.5.5-4: Effects on fishery resources in Pilarcitos Reservoir	PSM*
Impact 5.5.5-5: Effects on fishery resources along Pilarcitos Creek below Pilarcitos Reservoir	PSM

LS = Less than Significant impact, no mitigation required
PSM = Potentially Significant impact, can be mitigated to less than significant
PSU = Potentially Significant impact, unavoidable

* Based on the refined Pilarcitos watershed impact analysis (see Section 13.3), this impact is PSM due to adverse effects that would result from implementing replacement Measure 5.5.3-2a.

Section 5.5.5.2, pages 5.5.5-7 and 5.5.5-8: The text under Impact 5.5.5-4, Effects on fishery resources in Pilarcitos Reservoir, is revised as follows to refine the fishery analysis in the Pilarcitos watershed as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

> Storage in Pilarcitos Reservoir varies seasonally. The reservoir typically fills in the winter and is drawn down in the late spring and summer. By late summer, releases from the reservoir are typically limited to reservoir inflow. The volume of habitat available for resident aquatic species varies seasonally from about 3,000 acre-feet in the winter and spring to 1,600 acre-feet in the late summer or fall.
>
> With the WSIP, the reservoir would be drawn down more rapidly and earlier in the season than under the existing condition. The period in which the reservoir would be at its minimum elevation would be extended by days or weeks. ~~The reduction in summer storage would reduce the~~The volume of habitat ~~potentially~~ available for resident aquatic species would be at its minimum. ~~This impact would be *potentially significant*.~~ Because the WSIP would cause ~~Reductions in~~ the volume of water stored within Pilarcitos Reservoir to reach its seasonal minimum several days or weeks earlier in the year than under the existing condition, it ~~under proposed operations~~ would also be expected to reduce the coldwater pool volume within the reservoir hypolimnion to its seasonal minimum earlier in the year. This ~~which~~ could in turn have an adverse effect on resident coldwater species in the reservoir. However, because water is released from close to the surface of the reservoir, a cool water pool is usually retained below the level of the outlet. ~~Still, WSIP-induced water quality impacts on fishery habitat in the reservoir would be potentially significant.~~ Overall, the impacts of the proposed program on ~~related to a reduction in the volume and suitability of habitat potentially available for~~ resident aquatic species in Pilarcitos Reservoir would be *less than ~~potentially~~ significant.*

Implementation of Measure 5.5.3-2a, ~~Revised Operations Plan for Pilarcitos Watershed Facilities~~ Low-head Pumping Station at Pilarcitos Reservoir, would ~~maintain the current storage levels in the reservoir and reduce these impacts to a less-than-significant level~~ reduce the storage volume in Pilarcitos Reservoir by about 350 acre-feet in the late summer and fall of about one in four years. In these years, the seasonal minimum storage volume in Pilarcitos Reservoir would be 1,600 to 1,700 acre-feet. However, implementation of Measure 5.5.3-2b, Aeration System at Pilarcitos Reservoir, would improve water quality at such times as the reservoir was drawn down. The periodic reduction in volume of water available to aquatic species, attributable to Measure 5.5.3-2a, coupled with the improvement in water quality attributable to Measure 5.5.3-2b would have a *less-than-significant* impact on resident aquatic species.

Section 5.5.5.2, page 5.5.5-8: The text under the heading "Pilarcitos Creek Below Pilarcitos Reservoir" is revised as follows to refine the fishery analysis in the Pilarcitos watershed as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Pilarcitos Creek Below Pilarcitos Reservoir

Flow in Pilarcitos Creek would increase during many spring and early summer months as a result of the WSIP; however, flow reductions would occur during the summer of dry years. Under the WSIP ~~proposed operations~~, instream flow releases (other than dam seepage and reservoir inflow) would cease in Pilarcitos Creek downstream of Pilarcitos Reservoir during summer months of dry years at an earlier date ~~with the WSIP~~ than under the existing condition. Flow reductions in Pilarcitos Creek downstream of Pilarcitos Reservoir under the WSIP ~~proposed operations~~ would result in potentially significant impacts on resident trout, other resident fish species and aquatic resources. ~~and habitat quality and availability for anadromous steelhead.~~

In addition, as described above, releases from Pilarcitos Reservoir to Pilarcitos Creek are made from close to the surface of the reservoir, so summer and fall releases under existing conditions are warm. With the proposed program in place, summer and fall releases would also be warm (possibly warmer at times ~~in the fall~~), because Pilarcitos Reservoir would be drawn down several days or weeks earlier ~~farther~~ than under the existing condition. Exposure to higher water temperatures in the late summer and fall could significantly affect habitat quality and availability for coldwater fish species inhabiting Pilarcitos Creek below Pilarcitos Reservoir, including ~~both~~ resident trout ~~and anadromous steelhead~~. This would be a potentially significant impact.

Section 5.5.5.2, page 5.5.5-8 and 5.5.5-9. The text under the heading "Pilarcitos Creek Below Stone Dam" is revised as follows to refine the fishery analysis in the Pilarcitos watershed as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Pilarcitos Creek Below Stone Dam

~~Pilarcitos Creek below Stone Dam provides potential habitat for anadromous salmonids.~~ Pilarcitos Creek supports a population of anadromous steelhead. The creek channel is used as a migration corridor for upstream migration of adults and downstream migration of both adults and juvenile steelhead between approximately December 1 and May 31. Under the proposed WSIP, winter flows within the creek below Stone Dam, during normal or wetter hydrologic years, would be reduced. Although no specific barriers to passage have been identified downstream of Stone Dam, this reduction in peak winter flows could potentially adversely impact steelhead migratory passage and spawning at critical riffles and gravel bars due to the shallow nature of these habitat types.

Currently, there are occasional spills over Stone Dam when releases from Pilarcitos Reservoir and runoff into Pilarcitos Creek above Stone Dam exceed the capacity of the diversion at the dam. The spills occur in the winter months of wet, above normal and normal years. With implementation of the proposed program, occasional spills over Stone Dam would continue but with ~~somewhat~~ reduced frequency and magnitude. The volume of spills in average wet, above normal, and normal years would be reduced by 11, 60, and 25 percent, respectively.

Approximately, one-third of the Pilarcitos Creek watershed lies upstream of Stone Dam, and most of the runoff from the watershed is used for municipal water supply by the SFPUC and Coastside CWD. Spills over Stone Dam currently provide up to ~~one third~~ 15 percent of the flow in the ~~this~~ lower reach of Pilarcitos Creek in Half Moon Bay, based on data from gages just downstream of Stone Dam and in Half Moon Bay.

With the WSIP, spills would be reduced and flow in Pilarcitos Creek would be reduced in the winter months, when occasional large flows are important to migratory fish. The effects of the reduced spills would be primarily felt in the reach of Pilarcitos Creek from Stone Dam to the first major downstream tributary at Albert Canyon. ~~Consequently, t~~The reduction in flows due to the WSIP ~~operations~~ and related impacts on fish habitat would be potentially significant. In addition, the National Marine Fisheries Service has raised concerns regarding stream flows in Pilarcitos Creek below Stone Dam, and the SFPUC is currently making experimental summer releases and undertaking studies in an effort to address these concerns.

Section 5.5.5.1, page 5.5.5-9: The text under the heading "Impact Conclusions" is revised as follows to refine the fishery analysis in the Pilarcitos watershed as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Impact Conclusions

Overall, impacts on fishery resources along Pilarcitos Creek between ~~below~~ Pilarcitos Reservoir and Stone Dam related to reduced flows, degraded water quality and elevated temperatures in the late summer and fall ~~and reduced flows in the winter months~~ would be *potentially significant*. Implementation of Measures 5.5.3-2a, Low-head Pumping Station at Pilarcitos Reservoir, and Measure 5.5.3-2b, Aeration System at Pilarcitos Reservoir, ~~Revised Operations Plan for Pilarcitos Watershed Facilities~~ would reduce this potential impact to a less-than-significant level.

Impacts on fishery resources in Pilarcitos Creek below Stone Dam related to reduced wintertime flows would be *potentially significant*. Implementation of Measure 5.5.5-5, Establish Flow Criteria, Monitor and Augment Flow, would reduce this potential impact to a *less-than-significant* level.

Section 5.5.6.2, page 5.5.6-14, Table 5.5.6-4: Table 5.5.6-4 is revised as follows to reflect the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

TABLE 5.5.6-4
SUMMARY OF IMPACTS –
TERRESTRIAL BIOLOGICAL RESOURCES IN THE PENINSULA WATERSHED

Impacts	Sensitive Habitats	Key Special-Status Species	Other Species of Concern	Common Habitats and Species
Impact 5.5.6-1: Impacts on biological resources in Upper and Lower Crystal Springs Reservoirs	PSM	PSM	PSM	PSM
Impact 5.5.6-2: Impacts on biological resources in San Andreas Reservoir	LS	LS	LS	LS
Impact 5.5.6-3: Impacts on biological resources along San Mateo Creek below Lower Crystal Springs Dam	LS	LS	LS	LS
Impact 5.5.6-4: Impacts on biological resources in Pilarcitos Reservoir	LS	PSM*	LS	LS
Impact 5.5.6-5: Impacts on biological resources along Pilarcitos Creek below Pilarcitos Reservoir	~~PSM~~LS	LS	LS	LS
Impact 5.5.6-6: Impacts on biological resources along Pilarcitos Creek below Stone Dam	LS	LS	LS	LS
Impact 5.5.6-7: Conflicts with the provisions of adopted conservation plans or other approved biological resource plans	LS			

LS = Less than Significant impact, no mitigation required
PSM= Potentially Significant impact, can be mitigated to less than significant

* Based on the refined Pilarcitos watershed impact analysis (see Section 13.3), this impact is PSM due to adverse effects that would result from implementing replacement Measure 5.5.3-2a.

Section 5.5.6.2, page 5.5.6-19: The first two paragraphs in Impact 5.5.6-4 are revised as follows to refine the biological resources analysis in the Pilarcitos watershed as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Sensitive Habitats

~~Greater~~ The earlier drawdown of the reservoir under the WSIP would not increase the extent of unvegetated, weedy, or seasonal wetland areas below the maximum water levels, although these areas would be exposed several days or weeks earlier than under the existing condition in some years. ~~Existing freshwater emergent vegetation is already limited to areas that receive groundwater seepage or year-round surface water flow at the mouths of the tributary streams. Although the greater drawdown could slightly reduce the extent of areas supporting sensitive freshwater marsh habitat, t~~This impact would be less-than-significant.

Key Special-Status Species

Proposed operations with the WSIP at Pilarcitos Reservoir would have no effect on ~~slightly reduce~~ the extent of suitable habitat at the ~~Pilarcitos R~~reservoir for California red-legged frog and San Francisco garter snake. ~~,a *potentially significant* impact. However,~~ Similarly, the extent and condition of adjacent upland vegetation would not be affected by the proposed reservoir operations. As a result, the WSIP would have no effect on species such as the marbled murrelet that ~~this impact would not apply to~~ nest~~ing~~ or forage~~ing~~ in upland habitats adjacent to the reservoir.~~for species such as the marbled murrelet.~~

Section 5.5.6.2, page 5.5.6-20: The second paragraph on this page is revised as follows to refine the biological resources analysis in the Pilarcitos watershed as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Impact Conclusions

Impacts of the WSIP on sensitive habitats, key special-status species, other species of concern, and common habitats and species at Pilarcitos Reservoir would be *less than ~~potentially~~ significant.* However, ~~I~~implementation of Measure 5.5.3-2a, Low-head Pumping Station at Pilarcitos Reservoir, ~~Revised Operations Plan for Pilarcitos Watershed Facilities, would maintain storage levels similar to existing conditions and~~ would lower the water level in the reservoir by 3 or 4 feet in some summers. This could have a potentially significant impact on the extent of suitable habitat at the reservoir for California red-legged frog and the San Francisco garter snake. Implementation of Measure 5.5.3-2c, Habitat Monitoring and Compensation, would reduce this impact to a less-than-significant level.

Section 5.5.6.2, page 5.5.6-20: The text under Impact 5.5.6-5 under the heading "Sensitive Habitats" is revised as follows to refine the biological resources analysis in the Pilarcitos watershed as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Sensitive Habitats

Under the WSIP, flow in Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam would increase in some spring months ~~during normal and better rainfall years~~, a beneficial impact. In the summer months of some drier ~~dry~~ years, the period during which releases from Pilarcitos Reservoir would be limited to reservoir inflow ~~cease~~ would be extended, potentially for up to three months. Because willows exist ~~White alder, the dominant species~~ in the riparian forest in this section, ~~requires~~ it is apparent that the riparian forest is adapted to periods without flowing water ~~and without it could become stressed or could die~~. ~~Although there is some seepage from Pilarcitos Dam as well as flow from lateral tributaries, this seepage would decrease during an extended drought.~~ The channel-forming processes in Pilarcitos Creek would be reduced insignificantly under the WSIP. Thus, some changes in flow would be beneficial and some adverse. ~~Conservatively, t~~The overall impact on sensitive riparian habitat is considered *less than ~~potentially~~ significant.*

Section 5.5.6.2, page 5.5.6-21: The text under the heading "Impact Conclusions" is revised as follows to refine the biological resources analysis in the Pilarcitos watershed as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Impact Conclusions

Impacts on sensitive riparian habitat at Pilarcitos Creek ~~below~~ between Pilarcitos Reservoir and Stone Dam would be *less than* ~~*potentially*~~ *significant*. ~~Implementation of Implementation of Measure 5.5.3-2, Revised Operations Plan for Pilarcitos Watershed Facilities, would maintain reservoir storage levels similar to existing conditions and would reduce this impact to a less-than-significant level.~~

Section 5.5.7.1, p. 5.5.7-3: The first and second paragraphs are revised as follows in response to a comment (see **Response L_CoastsideCWD-17**).

Pilarcitos Creek starts at Pilarcitos Reservoir within the SFPUC Peninsula watershed. No water recreation or access to this reservoir is allowed. The creek runs south until it reaches Highway 92, then runs west ~~through portions of the Golden Gate National Recreation Area (GGNRA) and Rancho Corral de Tierra~~ to its mouth on the Pacific Ocean within Half Moon Bay State Beach. ~~Numerous public trails throughout the GGNRA and Rancho Corral del Tierra provide access to Pilarcitos Creek.~~ No organized recreational activities are established within or adjacent to the creek in the upper watershed. However, ~~T~~trails within Half Moon Bay State Beach run adjacent to and across Pilarcitos Creek, and the public is allowed access to portions of ~~the~~ this stretch of the creek (Bay Area Hiker, 2007).

5.6 Westside Groundwater Basin Resources

Section 5.6.1.3, page 5.6-8: The last paragraph is revised as follows in response to a comment (see **Response SI_TRT-CWA-SierraC-27**).

Other continued uses of irrigation pumping in the South Westside Groundwater Basin in 2005 were consistent with historical pumping rates and are estimated at up to 2.1 mgd (2,400 afy) of irrigation pumping for cemeteries in Colma, and 0.1 mgd (120 to 150 afy) of irrigation pumping for the California Golf Club[8] in South San Francisco~~, and an undetermined amount of groundwater pumping for irrigation of the Golden Gate National Cemetery in San Bruno~~ (Luhdorff and Scalmanini, 2006). The Golden Gate National Cemetery in San Bruno has historically used groundwater for irrigation, but the cemetery has not been irrigated using groundwater for over 20 years (Schem, 2007).

Section 5.6.1.5, page 5.6-13: The text as follows is added at the end of the third paragraph in response to a comment (see **Response L_DalyCty-38**).

However, Lake Merced has not been used as a potable water supply since the 1930s. Refer to Table 4.5-1 for a description of the existing beneficial uses of Lake Merced.

Section 5.6.1.7, page 5.6-17: The last sentence of the first full paragraph is revised as follows in response to a comment (see **Response L_SBruno-06**).

> The City of San Bruno ~~is~~ constructed~~ing~~ two monitoring well~~s~~ clusters in 2006 along the bay side that ~~should~~ have provided additional geologic information and allow for monitoring of groundwater levels and groundwater quality at different depths along the bay margin. ~~insight into the mechanisms preventing seawater intrusion.~~

Section 5.6.1.8, page 5.6-17: The last sentence of the third full paragraph is revised as follows in response to a comment (see **Response L_SBruno-07**).

> In the South Westside Groundwater Basin, manganese has exceeded the secondary drinking water standard in San Bruno and Daly City in the untreated groundwater, but the water is treated to meet secondary standards prior to use in the water supply.

Section 5.6.1.11, page 5.6-21: The last sentence of the third paragraph is revised as follows in response to a comment (see **Response L_DalyCty-41**):

> Chapter 13.20 of the Daly City Municipal Code specifies well permitting requirements for Daly City. ~~, but~~ Although this code does not include provisions related to overdraft of the Westside Groundwater Basin, Section 13.20.070 allows for denial of a permit when the request is judged not to be in the public interest.

Section 5.6.1.11, pages 5.6-21 to 5.6-22: The last partial paragraph that begins on page 5.6-21 and ends on page 5.6-22 is revised as follows in response to a comment (see **Response L_SBruno-09**):

> In accordance with Section 4.68.225 of the San Mateo County Code, the San Mateo County Environmental Health Division would not grant a well permit for a large well[12] ~~in a public park, cemetery, or golf course~~ that could potentially cause overdraft of the South Westside Groundwater Basin or be located in an area subject to a specific and localized groundwater problem. The Environmental Health Division could also deny, revoke, or suspend a permit for a large well to avoid pollution or contamination of water resources.

Section 5.6.2.2, page 5.6-25: The last sentence of the third full paragraph is revised as follows in response to a comment (see **Response L_DalyCty-42**).

> During drought conditions, the SFPUC would be able to reduce the quantity of SFPUC system water delivered to the participating pumpers, and the stored groundwater, or banked water, would be available for local use to supplement supplies from the regional water system.

Section 5.6.2.2, page 5.6-33: The following reference is added after (SFPUC, 2007) in response to a comment (see **Response SI_TRT-CWA-SierraC-27**).

> Schem, Clifford, U.S. Department of Veterans Affairs, National Cemetery Administration, personal communication with Greg Bartow, San Francisco Public Utilities Commission, September 7, 2007.

5.7 Cumulative Projects and Impacts Related to WSIP Water Supply and System Operations

Section 5.7.2.1, page 5.7-11: The first sentence of the third full paragraph under the heading "Expansion of MID Municipal Treatment Plant" is revised as follows to correct an editorial error:

> MID owns and operates a ~~30~~ 40-mgd municipal water treatment plan that obtains water from Modesto Reservoir.

Section 5.7.3.2, page 5.7-55, Figure 5.7-3: This figure is revised as shown on the following page in response to comments described in **Section 14.9, Master Response on Alameda Creek and Fishery Issues**.

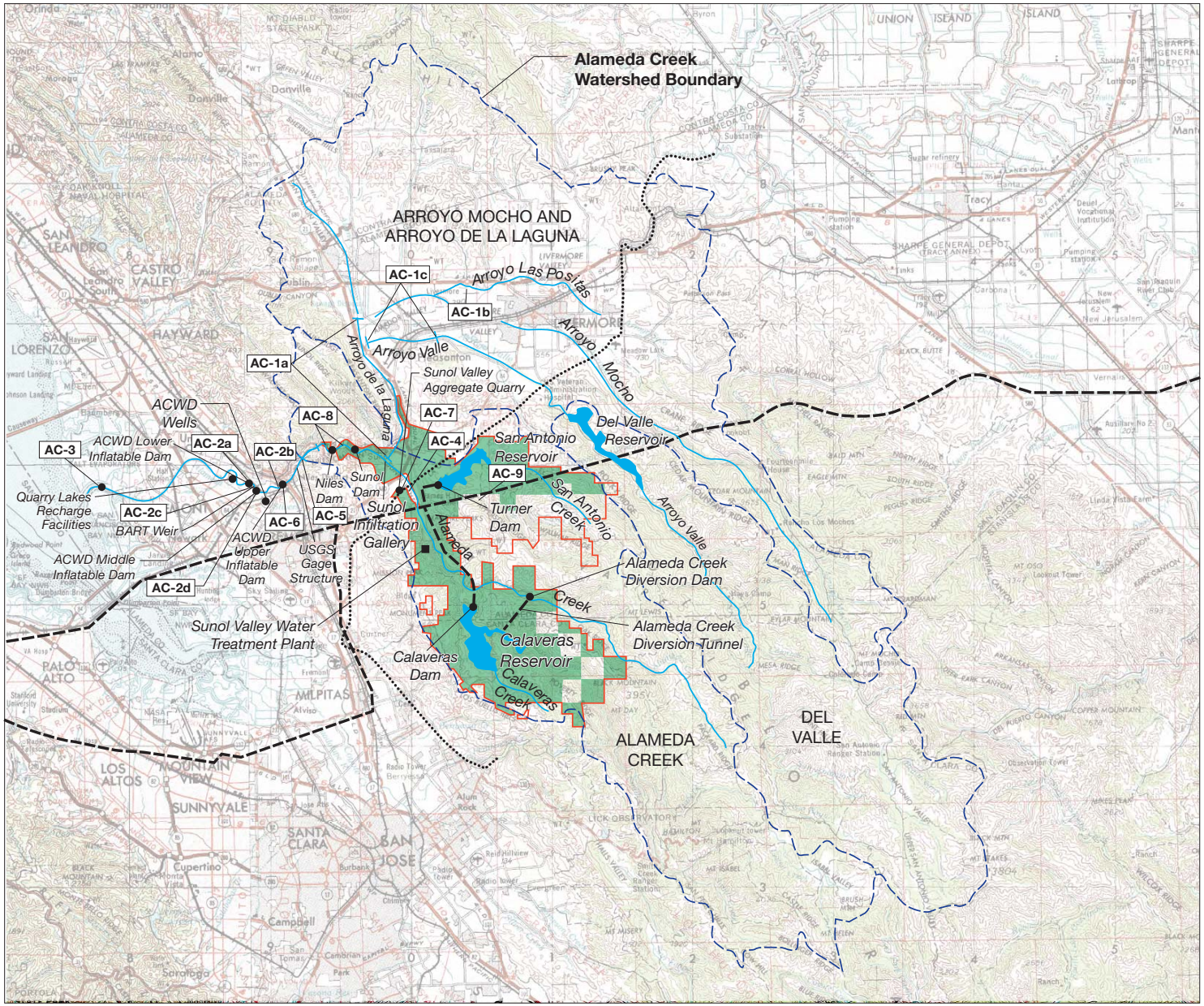
Section 5.7.3.2, page 5.7-65: The first full paragraph is revised as follows in response to comments described in **Section 14.9, Master Response on Alameda Creek and Fishery Issues.**

> **Cumulative Effects and WSIP Contribution**
>
> **Table 5.7-15** summarizes the effects of past and present projects, the impacts of the WSIP, the effects of probable future projects, and the combined impacts of the WSIP plus probable future projects on the Alameda Creek watershed. Past and present projects have substantially altered the hydrology, geomorphology, surface water quality, groundwater, fisheries, and terrestrial biology of this portion of the Alameda Creek watershed compared to pre-Euro-American settlement conditions. Visual and recreational resources have been moderately altered. The existing condition, which serves as the baseline for the analysis of the WSIP, reflects the substantial environmental changes that have occurred as a result of the past projects. Because past and present actions have drastically altered ~~this portion of~~ the Alameda Creek watershed, some of the environmental resources are more sensitive to small adverse changes than they would be if the ~~reach~~ watershed had remained relatively unaltered from pre-Euro-American settlement conditions.

Section 5.7.3.2, page 5.7-65, Table 5.7-15: The last row of Table 5.7-15 is revised as follows to reflect the change in project description of the Calaveras Dam (SV-2) project.

TABLE 5.7-15
CUMULATIVE EFFECTS ON THE ALAMEDA CREEK WATERSHED

Resource	Effects of Past and Present Projects	Impacts of WSIP (prior to mitigation/ after mitigation)	Effects of Other Future Projects	Cumulative Impact (WSIP after mitigation + Future Projects)	WSIP Contribution Cumulatively Considerable?
Hydrology	SA	SU/SU[a]	N/A	N/A	No
Geomorphology	SA	LS	LS	LS	No
Surface Water Quality	SA	LS	LSM	LS	No
Groundwater	SA	LS	LS	LS	No
Fisheries	SA	PSM/LS[a]	B	LS	No
Terrestrial Biology	SA	PSM/LS[a]	B	LS	No
Recreational/Visual Quality	MA	~~PSM/~~LS[a]	LS	LS	No



- Watershed Boundary
- Existing SFPUC System Corridor
- AP-1 Other SFPUC Project
- AC-1 Non-SFPUC Project
- CCSF Ownership (also project boundary for AP-1, AP-2, AP-3)
- HCP Study Area (also project boundary for AP-1a)
- DWR South Bay Aqueduct

See Draft PEIR Table 5.7-13 for names and descriptions of projects

Cumulative Project No.	Plan/Project Name
OTHER SFPUC PROJECTS (not shown on figure as watershed wide)	
AP-1	Alameda Watershed Management Plan (WMP)
AP-1a	Alameda Watershed Habitat Conservation Plan (sub-project of Alameda WMP)
AP-2	Watershed and Environmental Improvement Program (WSIP-related activity)
AP-3	Habitat Reserve Program (WSIP-related activity)
NON-SFPUC PROJECTS	
AC-1	Zone 7 Stream Management Master Plan (SMMP)
AC-1a	Arroyo de la Laguna Reach 10 Improvements (sub-project of Zone 7 SMMP)
AC-1b	Chain of Lakes (sub-project of Zone 7 SMMP)
AC-1c	Lower Arroyo del Valle Restoration and Enhancement (sub-project of Zone 7 SMMP)
AC-2	Alameda Creek Steelhead Restoration
AC-2a	Rubber Dam 2 Decommissioning and Foundation Modification Project (sub-project of Alameda Creek Steelhead Restoration)
AC-2b	Alameda Creek Pipeline No. 1 Fish Screen (sub-project of Alameda Creek Steelhead Restoration)
AC-2c	BART Weir (sub-project of Alameda Creek Steelhead Restoration Efforts)
AC-2d	Middle Inflatable Dam Modification
AC-3	Alameda Creek – Levee Reconfiguration
AC-4	PG&E Gas Line Crossing
AC-5	Stonybrook Creek Culvert Removal
AC-6	Upper Inflatable Dam Fish Passage Project
AC-7	Sunol Valley Aggregate Quarry – SMP 30
AC-8	Section 1135 Alameda Creek Flood Control Project Fish Passage Modifications
AC-9	Apperson Ridge Quarry

SOURCE: ESA + Orion

0 20 Miles

SFPUC Water System Improvement Program . 203287

Figure 5.7-3 (Revised)
Future Projects in the Alameda Creek Watershed Considered in the Cumulative Analysis

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Section 5.7.3.2, page 5.7-66: The third full paragraph on page 5.7-66 is revised as follows and the following paragraph is inserted after the third full paragraph on this page in response to comments described in **Section 14.9, Master Response on Alameda Creek Fishery Issues**.

> Implementation of the WSIP would substantially reduce flows in the reach of Alameda Creek from the diversion dam to below its confluence with Calaveras Creek compared to existing conditions (Impact 5.4.1-2). This impact was determined to be significant and unavoidable, even with implementation of Measure 5.4.1-2 (Diversion Tunnel Operation) and bypass flows included as part of the protective measures in the Calaveras Dam Replacement project (SV-2). However, no other past, present, or future projects were identified that would further reduce the stream flow in this reach of Alameda Creek, and some of the projects listed in Table 5.7-13 could enhance the flow. Thus, there would be no adverse cumulative impact on hydrology associated with past, present, and future projects, and the WSIP's contribution to the cumulative impact on hydrology is not applicable.
>
> Due to agreements and ongoing actions regarding the implementation of fish passage improvement projects in lower Alameda Creek (as described in Section 5.4.5 of the Draft PEIR), it is possible that steelhead will be restored to the Alameda Creek watershed reaches upstream of the BART weir by 2030. More specifically, steelhead may be restored during construction or operation of the Calaveras Dam Replacement project (SV-2) under the WSIP. In response to this scenario, the SFPUC has modified the WSIP program description—mainly that of the Alameda Creek Fishery Enhancement (SV-1) and Calaveras Dam Replacement (SV-2) projects—to incorporate protective measures for steelhead in the event that man-made barriers in Alameda Creek have been successfully removed and that steelhead migration, spawning, and rearing have been restored in Alameda Creek above the BART weir. The protective measures incorporated into the operations of the Calaveras Dam Replacement project would address future-occurring steelhead and would provide for a range of minimum bypass flows and releases at the Alameda Creek Diversion Dam and Calaveras Dam to support steelhead migration, spawning, and rearing. The program as revised, and with implementation of mitigation measures identified in the Draft PEIR, which together include minimum bypass flows to support the various life stages and habitat requirements for steelhead, would have a less-than-significant contribution to cumulative impacts on fishery resources in the Alameda Creek watershed. Please refer to Chapter 14, Section 14.9, of the Final PEIR for further discussion.

Section 5.7.4.1, page 5.7-71: The legend for Figure 5.7-4 is revised as follows in response to a comment (see **Response SI_CNPS-SCV1-09**) and to correct an editorial error. The revised figure is shown on page 16-89.

> PP-1a Peninsula Watershed Habitat Conservation Plan (sub-project of ~~Alameda~~ Peninsula WMP)

Section 5.7.5.1, page 5.7-87: The first bullet under the heading "Municipal Pumping" is revised as follows in response to a comment (see **Response L_DalyCty-44**).

- In its 2005 UWMP, the City of Daly City estimates that future municipal groundwater pumping under the WSIP conjunctive-use program (Regional Groundwater Projects, SF-2) would range from 1.34 mgd (1,501 afy) during a nondrought year when surface water is supplied by the SFPUC to 3.76 mgd (4,212 afy) during a drought year when the city is also allowed to pump its banked groundwater (City of Daly City, 2005). These projected pumping volumes are presented in Table 4-4 of the 2005 UWMP.

Section 5.7.5.1, page 5.7-87: The third bullet is revised as follows in response to two comments (see **Responses L_SBruno-12 and L_SBruno-17**).

- The 200~~6~~7 UWMP for the San Bruno does not yet reflect long-term participation in the SFPUC's proposed conjunctive-use program, but, if approved, participation in this program is expected to be included in the next revision of its UWMP. In its 200~~6~~7 UWMP, the City of San Bruno estimates that overall, groundwater usage will decrease from 2.5 mgd (2,800 afy) in 2010 to zero in 2030 through implementation of conservation measures and increased purchases from the SFPUC. In a drought year, groundwater use between 2010 and 2030 is projected to range from 0.80 mgd (896 afy) to a maximum of 2.5 mgd (2,800 afy) (City of San Bruno, 200~~6~~7).

Section 5.7.5.2, page 5.7-90: The first sentence of under Impact 5.7.5-2 is revised as follows in response to a comment (see **Response L_SBruno-13**).

Future and continuing projects identified in the northern portion of the South Westside Groundwater Basin include the WSIP conjunctive-use program (the regional component of SF-2), municipal pumping by the participating pumpers, and continued irrigation pumping at 2,600 afy.

Section 5.7.5.2, page 5.7-91: The second bullet is revised as follows in response to a comment (see **Response L_DalyCty-45**).

- Under the proposed conjunctive-use program, the participating pumpers collectively would not be allowed to pump more than the quantity of banked groundwater resulting from the in-lieu delivery of SFPUC system water.

Section 5.7.5.2, page 5.7-91: The first sentence of the last paragraph is revised as follows in response to a comment (see **Response L_SBruno-09**).

Furthermore, as discussed in Section 5.6, the San Mateo County Environmental Health Division would not grant a well permit for a large well ~~in a public park, cemetery, or golf course~~ that could potentially cause overdraft of the South Westside Groundwater Basin or be located in an area subject to a specific and localized groundwater problem.

PP-1 Other SFPUC Project

PC-1 Non-SFPUC Project

CCSF Ownership (also project boundary for PP-1, PP-2, PP-3)

Pilarcitos Creek Watershed Boundary (also project boundary for PC-2)

See Table 5.7-16 for names and descriptions of projects

Cumulative Project No.	Plan/Project Name
OTHER SFPUC PROJECTS	
PP-1	Peninsula Watershed Management Plan (WMP)
PP-1a	Peninsula Watershed Habitat Conservation Plan (sub-project of Peninsula WMP)
PP-2	Watershed and Environmental Improvement Program (WSIP-related activity)
PP-3	Habitat Reserve Program (WSIP-related activity)
NON-SFPUC PROJECTS	
PC-3	Lower Crystal Springs Dam Road Reconstruction
PC-2	Pilarcitos Creek Integrated Watershed Management Plan
PC-3	San Mateo Creek Mouth Improvements

0 2 Miles

SOURCE: ESA + Orion

SFPUC Water System Improvement Program . 203287

Figure 5.7-4
Future Projects in the Peninsula Watershed Considered in the Cumulative Analysis

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Section 5.7, page 5.7-100: The sixth reference under Westside Groundwater Basin Resources is revised as follows in response to a comment (see **Response L_SBruno-17**).

City of San Bruno, ~~*Public Draft*~~ *Final Urban Water Management Plan*. ~~December 2006~~ January 2007.

Attachment 5-A (End of Chapter 5)

Attachment 5-A, page 5-A-2, The revision is the same as that described below under Section 6.4, page 6-48.

Attachment 5-A, pages 5-A-2 and 5-A-3. Same revision as Section 6.4.2, pages 6-48 and 6-49.

Attachment 5-A, page 5-A-4. Same revision as Section 6.5.2, page 6-50.

Attachment 5-A, pages 5-A-6 and 5-A-7. Same revision as Section 6.4.3, pages 6-52 and 6-53 below.

Attachment 5-A, page 5-A-8. Same revision as Section 6.4.3, page 6-54 below.

Attachment 5-A, page 5-A-9. Same revision as Section 6.4.3, page 6-55.

Attachment 5-A, pages 5-A-10 and 5-A-11. Same as the multiple revisions to Section 6.4.4, pages 6-56 and 6-57 below.

Volume 4, Chapter 7

Section 7.1.2, page 7-7: The last complete dash is revised in response to two comments (see **Response L_Milpts-14** and **Response L_RdwdCty-08**).

– The population growth assumed in the demand projections for most (~~17~~15 of ~~20~~19) of the water customers for which comparable general plan projections are available is similar to the growth anticipated in the general plans of the cities served by them.

Section 7.2.1, page 7-10: This revision is the same as that described above under Vol. 1, Chapter 3, Section 3.3, page 3-6, Figure 3.2.

Section 7.3.1, page 7-21, Table 7.5: Table 7.5 is revised as shown on the following page to correct an editorial error.

TABLE 7.5
EMPLOYMENT AND POPULATION PROJECTIONS USED FOR WATER DEMAND ESTIMATES: SUMMARY BY COUNTY[a]

	Employment			Population		
	2001	2030	% change	2001	2030	% change
Wholesale Customers						
Alameda County	238,565	335,701	41%	456,962	542,688	19%
Santa Clara County	501,186	635,809	27%	466,452	580,391	24%
San Mateo County[b]	394,346	517,056	31%	703,185	814,904	16%
Total Wholesale Customers	1,134,097	1,488,566	31~~21~~%	1,626,599	1,937,983	19%
Retail Customers						
San Francisco (City and County)[c]	638,840	795,400	25%	760,075	849,942	12%
Total	1,772,937	2,283,966	29%	2,386,674	2,787,925	17%

Section 7.3.3, page 7-27: The second sentence of the first paragraph and the footnotes for that sentence are revised as follows in response to a comment (see **Response L_RdwdCty-08**).

The general plans of ~~22~~21 cities that are served in whole or part by SFPUC and its wholesale customers have population projections that are generally comparable to the water customer-selected population projections.[19, 20]

[19] ….The ~~22~~21 cities, served by ~~20~~19 water customers, represent approximately two-thirds of 32 cities served by the SFPUC regional system.

[20] The ~~22~~21 cities are served by ~~19~~18 wholesale customers and the SFPUC (for the retail service area), referred to collectively here as ~~20~~19 water customers.

Section 7.3.3, page 7-27: The first bullet item is revised as follows in response to a comment (see **Response L_Milpts-14**).

- The population projections used for ~~three~~ two of the wholesale customers (East Palo Alto~~,~~ ~~Milpitas,~~ and Sunnyvale) in the water demand studies are less than (from 2 to 6 percent less) the projections assumed in the general plans of the jurisdictions served by them.

Section 7.3.3, page 7-27: The second bullet item is revised as follows in response to a comment (see **Response L_RdwdCty-08**).

- The population projections assumed for ~~14~~13 of the water customers (ACWD, CWS-South San Francisco in combination with Westborough Water District, Daly City, Hayward, Hillsborough, Mid-Peninsula Water District, Millbrae, Mountain View, Palo Alto, ~~Redwood City,~~ San Bruno, San Francisco, and Santa Clara) are higher but within 1 to 10 percent of the projections presented in the respective general plans.

Section 7.3.3, page 7-28, Table 7.8: Table 7.8 is revised on the following page in response to two comments (see **Response L_Milpts-14** and **Response L_RdwdCty-08**). In addition, the table heading is revised to correct an editorial error.

Section 7.3.3, page 7-29: The first two bulleted items are revised in response to a comment (see **Response L_Milpts-14**).

- The population projections assumed by ~~three~~four of the water customers (Burlingame, Coastside County Water District, ~~and~~ Estero Municipal Improvement District, and Milpitas) appear to be more than 10 percent greater than the projections assumed in the respective general plans. The difference in these projections results from the longer 2030 planning horizon used for water planning and differences in the geographic area covered by the two sets of projections. Based on the difference in projections, however, the growth assumed in the demand models of these wholesale customers does not appear to be fully addressed in the general plans of the cities served by these customers.

- Two of the ~~three~~four customers assuming greater population growth than is reflected in the respective general plan also show somewhat greater growth than is forecasted in *Projections 2005*. Both of these customers (Burlingame and Estero MID) serve unincorporated areas outside the city's jurisdictional boundaries and ABAG subregional areas. In addition, Estero MID serves a non-segrable part of the city of San Mateo that is not included with the *Projections 2005* forecast for Foster City used in this comparison. The other customer (Coastside County Water District) assumes less growth than is forecasted in *Projections 2005* for 2030.

Section 7.3.6, page 7-50: The first full paragraph is revised as follows in response to a comment (see **Response L_Milpts-14**).

> The customer-selected population projection used for Milpitas in the demand study is ~~generally consistent with~~ approximately 15 percent greater than the growth identified in the city's general plan and is generally consistent with (about 3 percent less than) the growth projected by ABAG. ~~The 2030 Milpitas population presented in the demand study is~~

TABLE 7.8
COMPARISION OF WATER DEMAND POPULATION ESTIMATES AND GENERAL PLAN POPULATION ESTIMATES

Customer	UWMP Population in 2030	*Projections 2005* Population in 2030	Water Customer-Selected Population Projection for 2030	General Plan Population Projection for General Plan Projection Year[a]	General Plan Projection Year[a]	Difference: Water Customer Population and General Plan Population	% Difference (Water Customer Population and General Plan Population)
Customer-selected projection less than or equal to general plan projection							
City of East Palo Alto	32,712	43,600	32,712	34,600	2020	-1,888	-5.5%
~~City of Milpitas[b]~~	~~91,400~~	~~91,400~~	~~88,841~~	~~94,400~~	~~2020~~	~~5,559~~	~~-5.9%~~
City of Sunnyvale[c]	159,100	159,100	151,610	154,600	2020	-2,990	-1.9%
Customer-selected projection 1–10% greater than general plan projection							
Alameda County Water District	405,900	404,700	379,931	359,113		20,818	5.8%
Fremont	*257,100*	*257,200*		*229,213*	2020		
Newark	*53,500*	*53,400*		*49,800*	2020		
Union City	*95,300*	*94,100*		*80,100*	2020		
CWS–South San Francisco District and Westborough Water District[d,e]	83,450	73,660	73,884	68,685	2020	5,199	7.6%
City of Daly City	115,651	127,200	115,651	113,000	2020	2,651	2.3%
City of Hayward	162,800	171,500	162,757	160,300	2025	2,457	1.5%
Town of Hillsborough		11,800	12,708	11,800	2025	908	7.7%
Mid-Peninsula Water District[f]	28,930	28,800	27,997	27,800	2010	197	0.7%
City of Millbrae	24,200	24,500	25,174	24,860	2015	314	1.3%
City of Mountain View	81,700	89,600	81,670	75,200	2010	6,470	8.6%
City of Palo Alto	69,199	92,200	69,199	62,880	2010	6,319	10.0%
~~City of Redwood City~~	~~93,329~~	~~122,300~~	~~93,535~~	~~87,100~~	~~2020~~	~~6,435~~	~~7.4%~~
City of San Bruno	See note g	50,700	48,229	46,400	2020	1829	3.9%
City and County of San Francisco[h]	849,942	903,300	849,942	811,100	2020	38,842	4.8%
City of Santa Clara	140,698	142,100	140,698	129,900	2010	10,798	8.3%
Customer-selected projection more than 10% greater than general plan projection							
City of Burlingame[hi]	31,900	31,900	34,967	31,500	2010	3,467	11.0%
City of Milpitas[b]	91,400	91,400	88,841	94,400	2020	5,559	-5.9%
Coastside County Water District[j]	24,973	27,100	24,973	21,065	2020	3,908	18.6%
Estero Municipal Improvement District (MID)[j,k]	40,866	32,500	40,096	30,803	2010	9,293	30.2%

NOTE: Most wholesale customer service areas are not contiguous with city limits (or with the city and its planning area), and therefore the population projections from the jurisdictions' general plans and ABAG should be considered as general comparisons only. The following are not included, because the water service area and jurisdictional boundaries are not comparable or the general plan of the corresponding jurisdiction does not provide a comparable population projection: Brisbane, CWS–Bear Gulch, CWS–Mid-Peninsula, Menlo Park, North Coast County Water District, Purissima Hills Water District, Redwood City, San Jose North, Skyline County Water District, and Stanford University.

a The general plan population projection and projection year are the most distant population projection and the year of the most distant population projection available in the general plan or general plan element.

b The general plan population is based on the 2002 Milpitas General Plan, ~~population shown in the general plan (77,100) plus the additional population accommodated by the Milpitas Midtown Specific Plan, as advised by Milpitas Planning Department staff (Carrington, 2006), to account for 5,000 additional units with an assumed density of 3.46 persons per unit (i.e., an added population of 17,300). The City has amended to general plan to incorporate the specific plan.~~

c The service area of Sunnyvale's water district is contiguous with the city limits; however, another water utility (CWS) serves several small areas within the city.

d CWS = California Water Service Company.

e CWS–South San Francisco serves South San Francisco, Colma, a small portion of Daly City, and the unincorporated area of Broadmoor. The water customer estimate for the Westborough Water District is from the district's Urban Water Management Plan. The general plan figure is the combined total projected population in the South San Francisco and Colma general plans (67,400 and 1,285 respectively); the general plan projection year shown (2020) is for South San Francisco, the projection year for Colma is 2005. The *Projections 2005* figure is for South San Francisco and Colma (71,800 and 1,860, respectively).

f The Mid-Peninsula Water District serves Belmont, portions of San Carlos, and unincorporated areas of San Mateo County. The general plan figure is for the city of Belmont, from the 2002 housing element.

g The San Bruno UWMP (City of San Bruno, 2007) shows two population projections for 2030: 50,700, based on ABAG's *Projections 2005*, and 48,229, based on the City's Adjusted Draft General Plan.

h UWMP and *Projections 2005* figures are for household population, since the customer-selected figure is for household population.

i Burlingame's water system also serves portions of unincorporated Burlingame and a few properties in the city of San Mateo and town of Hillsborough.

j The general plan figure is for the city of Half Moon Bay only, from the 1993 Half Moon Bay Local Coastal Program Land Use Plan (Table 9.3, Chapter 9, page 189). In addition to incorporated Half Moon Bay, the Coastside County Water District serves unincorporated areas of Half Moon Bay and the unincorporated communities of El Granada, Miramar, and Princeton by the Sea.

k Estero MID serves Foster City and a portion of the city of San Mateo. The general plan figure is for Foster City.

SOURCES: ABAG, 2004; ACWD, 2005; CWS-South San Francisco, 2006; ~~Carrington, 2006;~~ City and County of San Francisco, 2004; City of Belmont, 2002a; City of Burlingame, 2002a; City of Burlingame, 2005; City of Daly City, 2004a; City of Daly City, 2005; City of East Palo Alto, 1999a; City of East Palo Alto, 2006; City of Foster City, 2001a; City of Fremont, 2003a; City of Half Moon Bay, 1993; City of Hayward, 2002a; City of Hayward, 2005; City of Millbrae, 1998a; City of Millbrae, 2005; City of Milpitas, 2002a; City of Milpitas, 2005; City of Mountain View, 2002a; City of Mountain View, 2005; City of Newark, 2002a; City of Palo Alto, 1998a; City of Palo Alto, 2005b; ~~City of Redwood City, 2005b; City of Redwood City, 2007a~~; City of San Bruno, 2003a; City of San Bruno, 2007; City of Santa Clara, 2002a; City of Santa Clara, 2005; City of South San Francisco, 2002a; City of Sunnyvale, 2002a; City of Sunnyvale, 2005; City of Union City, 2002a; Coastside County Water District, 2005; Estero MID, 2005; Hannaford and Hydroconsult, 2004; Mid-Peninsula Water District, 2006; SFPUC, 2005; Town of Colma, 1999a; Town of Hillsborough, 2002a; URS, 2004a, Westborough Water District, 2005.

~~approximately 6 percent less than that cited in the city's general plan, as amended by the Midtown Milpitas Specific Plan, and projected by ABAG.~~ The City of Milpitas is currently preparing a Transit Area Specific Plan that is expected, upon adoption, to result in a buildout population of 95,014, somewhat greater than the population projection used in the demand study (Williams, 2007).

Section 7.3.6, page 7-52: The third sentence of the fourth paragraph is revised as follows in response to a comment (see **Response L_PHWD1-09**).

In 2001, the Purissima Hills Water District served 6,032—or 64 percent—of the approximately ~~94,555~~ 9,455 residences estimated for the town and its sphere of influence in 2000.

Section 7.3.6, p. 7-53: The third full paragraph is revised as follows in response to a comment (see **Response L_RdwdCty-08**).

The customer-selected population projection used for Redwood City in the demand study is ~~generally consistent with the buildout population identified in the city's general plan (which has a 2020 planning horizon), and~~ 24 percent lower than ABAG's 2030 population projection of 122,300 for the city and its sphere of influence. The 2030 Redwood City population used in the demand study is approximately 7 percent more than the 2020 projection shown in the city's Downtown Precise Plan ~~(a recent amendment of the general plan)~~, which cites ABAG's *Projections 2005* forecast for 2020 for the city within its jurisdictional boundary. The city's water service area includes only a portion of the city's sphere of influence (Bonte, 2006), which probably accounts for the difference between the ABAG projection for the city and its sphere of influence and that assumed in the demand study. ABAG's 2030 projection of 94,300 for Redwood City within the city limits only is within 1 percent of the demand study projection. Because the population projection included in the city's 1990 general plan is for 2000 (earlier than 2005), it is not considered comparable to the 2030 WSIP population projection for this analysis. According to the city, the 2003 UWMP was selected for use in the demand study because the UWMP contained the most current population and employment projections at the time.

Section 7.4.1, page 7-62: The second to the last bullet is revised as follows in response to a comment (see **Response L_PHWD1-11**).

- Town of Los Altos Hills General Plan (1975), General Plan Path Element (1996), 2002 Housing Element (2002), Circulation Element (1999), Land Use Element (n.d.) and Open Space~~,~~ and Recreation Element~~s (n.d.)~~ (2007).

Section 7.4, page 7-90: The fourth to the last reference is revised as follows in response to a comment (see **Response L_PHWD1-11**).

Town of Los Altos Hills Land Use, Open Space, and Recreation Elements, http://www.osaltoshills.ca.gov/government/town-documents.html (website accessed March 15, 2006), 2007.

Section 7.4, page 7-91: The following reference is added after (URS, 2006) in response to a comment (see **Response L_Milpts-14**).

Williams, Thomas, Comment letter from the City Manager of Milpitas to the SFPUC on the Draft PEIR for the SFPUC's Water System Improvement Program, September 27, 2007.

Chapter 7 references, pages 7-85, 7-89 and 7-90: The following corrections are made:

Popp, Ron, Director of Public Works, City of Millbrae, email communication, June 4, 2007.

San Francisco Public Utilities Commission (SFPUC), SFPUC Capital Improvement Program Wholesale Customer Best Estimate of Water Purchases from the SFPUC [submitted by the SFPUC and each wholesale customer], November 2004.

City of Redwood City, *Downtown Precise Plan Draft Environmental Impact Report* (October 2006) and *Final Environmental Impact Report,* State Clearinghouse #200650~~5~~52027, certified March 2007a.

Town of Colma, Ordinance No. 557 of the City Council of the Town of Colma: An Ordinance Amending the Colma Municipal Code To Provide for Amendments to the "Town of Colma Zoning Map," July 14, 1999d.

Town of Hillsborough, *Town of Hillsborough Housing Element, 1999-2006,* adopted July 8, 2002a.

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Section 9.2.1, page 9-19: Table 9.8 is revised as shown on page 16-111 to reflect the change in project description of the Calaveras Dam (SV-2) project.

Section 9.2.1, page 9-21, Table 9.9: The impact descriptions for Impacts 5.5.3-2, 5.5.5-4, and 5.5.6-4 as well as the impact conclusions for Impact 5.5.6-5, Sensitive habitats, are revised as shown on page 16-112 to refine the biological resources analysis in the Pilarcitos Watershed as determined from the updated modeling results conducted in 2008, as discussed in Chapter 13, Section 13.3.

Section 9.2.8, page 9-78: The following footnote is added to the first sentence of the first paragraph under the heading "9.2.8 Modified WSIP Alternative" in response to comments described in **Section 14.10, Master Response on Modified WSIP Alternative.**

> The Modified WSIP Alternative incorporates changes in the proposed WSIP primarily to modify the proposed water supply and system operations so as to minimize environmental effects.[11]
>
> [11] The description and analysis of the Modified WSIP Alternative has been updated in the Comment and Responses document. Please see Section **14.10, Master Response on the Modified WSIP Alternative** (Vol. 7, Chapter 14) for detailed information.

Section 9.3.1, page 9-90: The fourth sentence of the second paragraph is revised as follows in response to a comment (see **Response L_CoastsideCWD-27**).

> The SFPUC currently serves Coastside CWD ~~primarily~~ with about equal quantities of water from ~~the~~ Pilarcitos ~~Reservoir~~ Creek and Crystal Springs Reservoir.

TABLE 8.6 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITIONS – ALAMEDA WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desal for Drought	Variant 3 – 10% Rationing
Impact 5.4.7-1: Effects on recreation facilities and/or activities	Under both existing and future conditions, water recreation is prohibited in SFPUC reservoirs. Thus, changes in reservoir water levels would not adversely affect recreation. Operations under the WSIP would substantially reduced flows along Alameda Creek in the Sunol Regional Wilderness during winter and early spring months and adversely affect the recreational experience of hikers; however, with the changes in project description for the Calaveras Dam Replacement (SV-2) project, bypass flows would be reduced from the diversion dam when flows are present. (~~PSM~~ LS)	Same as proposed program (~~PSM~~ LS)	Same as proposed program (~~PSM~~ LS)	Same as proposed program (~~PSM~~ LS)
Impact 5.4.7-2: Visual effects on scenic resources or visual character of water bodies	Apart from raised water levels in Calaveras Reservoir and substantial reductions in flows along Alameda Creek in the Sunol Regional Wilderness area during winter and spring months, changes in stream flow and reservoir elevations in the Alameda watershed would not be apparent to most recreational users. WSIP-induced reductions in stream flows along Alameda Creek would substantially change quality of visual resources in the Sunol Regional Wilderness area; however, with the changes in project description for the Calaveras Dam Replacement (SV-2) project, bypass flows would be reduced from the diversion dam when flows are present. (~~PSM~~ LS)	Same as proposed program (~~PSM~~ LS)	Same as proposed program (~~PSM~~ LS)	Same as proposed program (~~PSM~~ LS)

TABLE 8.7
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION – PENINSULA WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Impact 5.5.3-2: Effects on water quality in Pilarcitos Reservoir and along Pilarcitos Creek	~~Operations under the WSIP would increase summer drawdown of Pilarcitos Reservoir and could cause the reservoir to destratify earlier in the season, which may improve water quality. However, the ability of the reservoir to support cold freshwater habitat could be reduced due to a reduced volume of cool water below thermocline.~~ Proposed operations would generally be within the same range as existing conditions although replacement Measure 5.5.3-2a would cause Pilarcitos Reservoir to be drawn down earlier in the summer compared to existing conditions. Water temperature could increase and dissolved oxygen content could be reduced. During dry years summertime releases from Pilarcitos Reservoir to Pilarcitos Creek would be eliminated or reduced to a low level for a longer period of time with the WSIP, which would increase the temperature of instream flows between Pilarcitos Creek and Stone Dam and reduce the creek's ability to support designated cold freshwater habitat along this reach. Slight reductions in spill over Stone Dam would be minor and would not adversely affect water quality along Pilarcitos Creek. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)
Impact 5.5.5-4: Effects on fisheries resources in Pilarcitos Reservoir	~~Reduction in average monthly storage~~ Proposed operations would be within the same range as existing conditions although replacement Measure 5.5.3-2a would cause Pilarcitos Reservoir to be drawn down earlier in the summer compared to existing conditions. This would reduce the volume and quality of coldwater habitat available for resident fish species. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)
Impact 5.5.6-4: Impacts on biological resources in Pilarcitos Reservoir				
• Sensitive Habitats	Reduced water elevations could slightly reduce the extent of areas supporting sensitive freshwater marsh habitat. (LS)	Similar to proposed program (LS)	Same as proposed program (LS)	Similar to proposed program (LS)

TABLE 8.7 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION – PENINSULA WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
• Key Special Status Species	Proposed operations would be within the same range as existing conditions, although replacement Measure 5.5.3-2a would cause Pilarcitos Reservoir to be drawn down earlier in the summer compared to existing conditions. This ~~e~~would reduce the extent of suitable habitat for California red-legged frog and San Francisco garter snake. Special status species that utilize adjacent upland vegetation would not be affected. (PSM)	Similar to proposed program (PSM)	Similar to proposed program (PSM)	Similar to proposed program (PSM)
Impact 5.5.6-5: Impacts on biological resources along Pilarcitos Creek below Pilarcitos Reservoir				
• Sensitive Habitats	~~In summer months of dry years, an extended period of no or little flow would stress or kill riparian vegetation.~~ Proposed operations would result in flows within the range of historical conditions, to which sensitive habitats have adapted. (~~PSM~~ LS)	Similar to proposed program (~~PSM~~ LS)	Similar to proposed program (~~PSM~~ LS)	Similar to proposed program (~~PSM~~ LS)

TABLE 9.8
SUMMARY OF SIGNIFICANT WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR CEQA ALTERNATIVES – ALAMEDA WATERSHED

Impact	Proposed Program	No Program Alternative	No Purchase Request Increase Alternative	Aggressive Conservation/Water Recycling and Local Groundwater Alternative		Lower Tuolumne River Diversion Alternative	Year-round Desalination at Oceanside Alternative	Regional Desalination for Drought Alternative	Modified WSIP Alternative
				No Supplemental Tuolumne River Water	With Supplemental Tuolumne River Water				
Section 5.4.7, Recreational and Visual Resources									
Impact 5.4.7-1: Effects on recreation									
	Operations under the WSIP would substantially reduce flows along Alameda Creek in the Sunol Regional Wilderness during winter and early spring months and adversely affect the recreational experience of hikers; however, with the changes in project description for the Calaveras Dam Replacement (SV-2) project, bypass flows would be reduced from the diversion dam when flows are present. (~~PSM~~ LS)	Same as proposed program. (~~PSM~~ LS)	Same as proposed program. (~~PSM~~ LS)	Same as proposed program. (~~PSM~~ LS	Same as proposed program. (~~PSM~~ LS)	Same as proposed program. (~~PSM~~ LS)	Same as proposed program. (~~PSM~~ LS)	Same as proposed program (~~PSM~~ LS)	~~Much less than~~ Same as proposed program (LS)
Impact 5.4.7-2: Visual effects									
	WSIP-induced reductions in stream flows along Alameda Creek would substantially change the quality of visual resources in the Sunol Regional Wilderness; however, with the changes in project description for the Calaveras Dam Replacement (SV-2) project, bypass flows would be reduced from the diversion dam when flows are present. (~~PSM~~ LS)	Same as proposed program. (~~PSM~~ LS)	Same as proposed program. (~~PSM~~ LS)	Same as proposed program. (~~PSM~~ LS)	Same as proposed program. (~~PSM~~ LS)	Same as proposed program. (~~PSM~~ LS)	Same as proposed program. (~~PSM~~ LS)	Same as proposed program (~~PSM~~ LS)	~~Much less than~~ Same as proposed program (LS)

LS = Less than Significant, no mitigation required
SM or PSM = Significant or Potentially Significant, can be Mitigated to less than significant
SU or PSU = Significant Unavoidable or Potentially Significant Unavoidable, cannot be mitigated to less than significant

TABLE 9.9
SUMMARY OF SIGNIFICANT WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR CEQA ALTERNATIVES – PENINSULA WATERSHED

Impact	Proposed Program	No Program Alternative	No Purchase Request Increase Alternative	Aggressive Conservation/Water Recycling and Local Groundwater Alternative		Lower Tuolumne River Diversion Alternative	Year-round Desalination at Oceanside Alternative	Regional Desalination for Drought Alternative	Modified WSIP Alternative
				No Supplemental Tuolumne River Water	With Supplemental Tuolumne River Water				
Section 5.5.3, Surface Water Quality									
Impact 5.5.3-2: Water quality in Pilarcitos Reservoir									
	~~Operations under the WSIP would increase summer drawdown of Pilarcitos Reservoir and could cause the reservoir to destratify earlier in the season, which may improve water quality. However, the ability of the reservoir to support cold freshwater habitat could be reduced due to a reduced volume of cool water below thermocline.~~ Proposed operations would generally be within the same range as existing conditions although replacement Measure 5.5.3-2a would cause Pilarcitos Reservoir to be drawn down earlier in the summer compared to existing conditions. Water temperature could increase and dissolved oxygen content could be reduced. During dry years, summertime releases from Pilarcitos Reservoir to Pilarcitos Creek would be eliminated or reduced to a low level for a longer period of time with the WSIP, which would increase the temperature of instream flows between Pilarcitos Creek and Stone Dam and reduce the creek's ability to support designated cold freshwater habitat along this reach. (PSM)	Similar to proposed program. (PSM)	Similar to but much less than proposed program. (LS)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program (PSM)	Similar to ~~existing condition~~ but much less than proposed program (LS)
Impact 5.5.5-4: Effects on fisheries resources in Pilarcitos Reservoir									
	~~Reduction in average monthly storage in Pilarcitos Reservoir~~ Proposed operations would be within the same range as existing conditions although replacement Measure 5.5.3-2a would cause Pilarcitos Reservoir to be drawn down earlier in the summer compared to existing conditions. This would reduce the volume and quality of coldwater habitat available for resident fish species. (PSM)	Similar to proposed program. (PSM)	Similar to but much less than proposed program. (LS)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program (PSM)	Similar to existing condition (LS)
Impact 5.5.6-4: Impacts on biological resources in Pilarcitos Reservoir									
▪ Key special status species	Proposed operations would be within the same range as existing conditions, although replacement Measure 5.5.3-2a would cause Pilarcitos Reservoir to be drawn down earlier in the summer compared to existing conditions. This would reduce the extent of suitable habitat for California red-legged frog and San Francisco garter snake. Special-status species that utilize adjacent upland vegetation would not be affected. (PSM)	Similar to proposed program. (PSM)	Similar to but much less than proposed program. (LS)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program (PSM)	Similar to existing condition (LS)
Impact 5.5.6-5: Impacts on biological resources along Pilarcitos Creek									
▪ Sensitive habitats	~~In summer months of dry years, an extended period of no or little flow would stress or kill riparian vegetation.~~ Proposed operations would result in flows within the range of historical conditions, to which sensitive habitats have adapted. (~~PSM~~ LS)	Similar to proposed program. (~~PSM~~ LS)	Similar to ~~but much less than~~ proposed program. (LS)	Similar to proposed program. (~~PSM~~ LS)	Similar to proposed program. (~~PSM~~ LS)	Similar to proposed program. (~~PSM~~ LS)	Similar to proposed program. (~~PSM~~ LS)	Similar to proposed program (~~PSM~~ LS)	Similar to ~~existing condition~~ proposed program (LS)

O. Hydrologic Modeling – Additional Supporting Information

APPENDIX O

Hydrologic Modeling – Additional Supporting Information

O1 – Updated HH/LSM Assumptions and Results—Proposed WSIP

O2 – Updated HH/LSM Assumptions and Results—Modified WSIP Alt.

O3 – Updated HH/LSM Assumptions and Results—Phased WSIP Variant

O4 – Analysis of WSIP upon the San Joaquin River and the Sacramento-San Joaquin Delta

APPENDIX O1

Memorandum

Subject: **Updated HH/LSM Assumptions and Results – Proposed WSIP**
From: **Daniel B. Steiner**
Date: **March 20, 2008**

1. Introduction

This memorandum summarizes assumptions for, and discusses the interpretation of, the Hetch Hetchy/Local Simulation Model (HH/LSM) results for the simulation of the Water System Improvement Program (WSIP or the proposed program). Table 1-1 and Table 1-2 summarize the program/setting characteristics and modeling assumptions, and the performance and hydrologic results, respectively, for the WSIP as they compare to the modeled existing setting (2005, with Calaveras Reservoir constrained by the California Division of Safety of Dams [DSOD] restrictions).

The hydrology under the proposed program is primarily discussed in terms of a comparison to the baseline condition presented in the Draft Program Environmental Impact Report, i.e., the simulated current (2005) operation of the San Francisco Public Utilities Commission (SFPUC) regional water system, assuming that the operation of Calaveras and Crystal Springs Reservoirs is constrained by DSOD restrictions. Primary hydrologic parameters such as projected water deliveries, reservoir storage, and stream flows are compared, and additional parameters that assist in identifying the causes of hydrologic changes are also described as needed.

APPENDIX O1

Table 1-1
Setting Characteristics and Modeling Assumptions (Part 1/3)

Assumptions and Characteristics of Setting and/or Program	Units	Baseline Baseline Conditions[1] - Calaveras Constrained	Proposed WSIP
Time Horizon for Setting of Analysis / Date[4]		2005	2030
HH/LSM Simulation Study Name[5]		Base1LT	WSIP1LT
System Wide Parameters			
Customer Purchase Request (Demand Level)[6]	MGD	265	300
Demand Level Supplied from Other Sources[7]			
Regional Recycled Water/Conservation/Groundwater in SF	MGD	0	10
Other Regional Recycled Water/Conservation/Groundwater	MGD	0	0
Demand Level Supplied from Tuolumne + Local Watersheds[8]	MGD	265	290
Average Annual Deliveries and Supplies[9]			
Deliveries from Tuolume + Local Watersheds (Average Annual)	MGD	258	287
Supply or Deliveries from Other Sources - Regional Recl/Cons/GW	MGD	0	10
Total Deliveries and Supply for Demand Level (Average Annual)	MGD	258	297
Features and Facilities[10]			
Regional Reclaimed Water/Conservation/Groundwater - SF			●
Regional Reclaimed Water/Conservation/Groundwater - Other			
Calaveras Reservoir - 12.4 BG (Constrained)		●	
Calaveras Reservoir - 31.6 BG (Restored/Unconstrained)			●
Calaveras Reseroivr Release for Fish			●
Calaveras Reservoir Release for Fish & Flow Recapture			●
Alameda Creek Diversion Dam Bypass Flow & Recapture			
Pilarcitos Reservoir Pump for Creek Summer Release			
Crystal Springs Reservoir - 18.52 BG (Constrained)		●	
Crystal Springs Reservoir - 20.28 BG (Restricted)			
Crystal Springs Reservoir - 22.15 BG (Restored/Unconstrained)			●
Sunol Valley Water Treatment Plant Expansion			●
Sunol Valley Water Treatment Plant Feed from SJPL			●
Harry Tracy Water Treatment Plant Expansion			●
Bay Division Pipeline Increased Conveyance			●
San Joaquin Pipeline Increased Conveyance			●
Desalination Project			
Westside Groundwater Project			●
Tuolumne River Transfer			**29,350 (From Storage)**
Water Supply Reliability[11]			
Action	Level	Rationing %	Rationing %
Implement Drought Water Supply Action (Westside GW or Desal)	1	NA	GW
Rationing (Level 1)	2	10	10
Rationing (Level 2)	3	20	20
Rationing (Level 3)	4	25	25
	Years	Action Level	Action Level
	1921		
	1924	2	1
	1925		1
	1926		1
	1929		1
	1930		1
	1931	3	2
	1932		
	1933		
	1934	2	1
	1935		
	1939		
	1944		
	1946		
	1947		
	1948		1
	1949		
	1950		1
	1953		
	1954		
	1955		1
	1957		
	1959		
	1960	2	1
	1961	3	2
	1962		
	1964		1
	1966		
	1968		
	1971		
	1972		1
	1976	2	1
	1977	3	2
	1979		
	1981		
	1984		
	1985		1
	1987	2	1
	1988	3	2
	1989	3	2
	1990	3	3
	1991	3	2
	1992	3	3
	1994	2	1
	DD1993	4	3
	DD1994	4	3
Max Drought Rationing - Policy Cap[12]	DD	Incidental 25%	20%
	Historical	Incidental 20%	20%

APPENDIX O1

Table 1-1
Setting Characteristics and Modeling Assumptions (Part 2/3)

Assumptions and Characteristics of Setting and/or Program	Units	Baseline Baseline Conditions[1] - Calaveras Constrained	Proposed WSIP
System Wide Parameters			
Incremental Supply - Average[13]			
System Customer Purchase Request Level	MGD	265	300
Demand Level Supplied from Other Sources	MGD	0	10
Demand Level Supplied from Tuolumne + Local Watersheds	MGD	265	290
System Deliveries	MGD	258	287
Regional Desalination	MGD	0	0
San Joaquin Pipelines (Tuolumne Diversion)	MGD	221	245
Inferred Local Watershed Production	MGD	37	41
Addt'l Tuolumne Diversion (Compared to Calaveras Constrained)	MGD	*221*	24
Incremental Design Drought Supply[14]			
From Other Sources - Regional Recl/Cons/GW (Every Year)	MGD	0	10
Restoration of Calaveras Reservoir Capacity (w/ flow recapture)	MGD	0	7
Restoration of Crystal Springs Capacity		0	1
MID/TID Transfer to SFPUC (Results in additional diversion from TR)	MGD	0	25
Westside Basin Conjunctive Use (8,100 acre-feet Storage)	MGD	0	6
Regional Desalination (26 mgd)	MGD	0	0
Sum of Incremental Supplies	MGD	0	48
Yield - Without Other Sources Added (Compared to Calaveras Constrained)	MGD	219	257
Yield - With Other Sources Added (Compared to Calaveras Constrained)	MGD	219	267
Design Drought Delivery Calculator[15]		2	3
	MGD		
Average Annual Delivery During	Year 1	265	290
Average Annual Delivery During	Year 2	239	290
Average Annual Delivery During	Year 3	212	261
Average Annual Delivery During	Year 4	212	261
Average Annual Delivery During	Year 5	212	232
Average Annual Delivery During	Year 6	212	261
Average Annual Delivery During	Year 7	212	232
Average Annual Delivery During	Year 8	199	232
Average Annual Delivery During	Last 6 Mo	99	116
	DD Ave	219	256
Firm Yield (Nominal) Not Including Other Sources	MGD	219	256
Local System Operational Parmeters			
Crystal Springs Reservoir Operation			
Storage - Minimum/Maximum	BG	5.4 - 18.52	5.4 - 22.15
	TAF	16.6 - 56.8	16.6 - 68.0
Fall/Winter Operation Storage		16.52 BG (50.7 TAF)	18.55 BG (56.9 TAF)
Stream Release		Up to 250 cfs to not exceed 18.52 BG	Up to 250 cfs to not exceed 21 BG
Calaveras Reservoir Operation			
Storage - Minimum/Maximum	BG	8.4 - 12.4	8.4 - 31.5
	TAF	25.7 - 38.0	25.7 - 96.8
Fall/Winter Operation Storage		10.3 BG (31.6 TAF)	27.0 BG (82.9 TAF)
Alameda Creek Release/Recapture[16]	AFY	0	Up to 6,300
San Andreas Reservoir Operation			
Storage - Minimum/Maximum	BG	3.0 - 6.2	3.0 - 6.2
	TAF	9.2 - 19.0	9.2 - 19.0
Fall/Winter Operation Storage		5.6 BG (17.2 TAF)	5.6 BG (17.2 TAF)
San Antonio Reservoir Operation			
Storage - Minimum/Maximum	BG	1.0 - 16.5	1.0 - 16.5
	TAF	3.1 - 50.5	3.1 - 50.5
Fall/Winter Operation Storage		15.9 BG (48.8 TAF)	15.9 BG (48.8 TAF)
Pilarcitos Reservoir Operation			
Storage - Minimum/Maximum	BG	0.66 - 0.97	0.66 - 0.97
	TAF	2.0 - 3.0	2.0 - 3.0
Fall/Winter Operation Storage		0.72 BG (2.2 TAF)	0.72 BG (2.2 TAF)
Water Treatment Plants			
Sunol Valley Water Treatment Plant Maximum	MGD	120	160
		90 MGD from Calaveras	90 MGD from Calaveras + Recapture
Sunol Valley Water Treatment Plant Minimum	MGD	20	20
		From Calavers & San Antonio & SJPL	From Calavers & San Antonio & SJPL
Harry Tracy Water Treatment Plant Maximum	MGD	120	140
Harry Tracy Water Treatment Plant Minimum	MGD	20	20
Conveyance			
Bay Division Pipeline Maximum		340 MGD Jun - Sep 320 MGD Apr, May & Oct 290 MGD Nov - Mar	380 MGD Apr - Oct 320 MGD Nov - Mar
Bay Division Pipeline Maintenance		Cycle one pipeline out Nov - Mar each year (average remaining capacity rotation) maximum 230 MGD	Same as Baselines, except maximum 320 MGD

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Table 1-1
Setting Characteristics and Modeling Assumptions (Part 3/3)

Assumptions and Characteristics of Setting and/or Program	Units	Baseline Baseline Conditions[1] - Calaveras Constrained	Proposed WSIP
Tuolumne River System Operational Parameters			
Hetch Hetchy Reservoir Operation			
Storage - Minimum/Maximum	TAF	26.1 - 360.4	26.1 - 360.4
Fall/Winter Operation Storage		30 TAF winter buffer	30 TAF winter buffer
1987 Stipulation Minimum Release Flows		Yes	Yes
1987 Stipulation Supplemental Release Flows		No	No
Cherry Reservoir Operation			
Storage - Minimum/Maximum	TAF	1.0 - 273.3	1.0 - 273.3
Fall/Winter Operation Storage		25.3 TAF winter buffer	25.3 TAF winter buffer
Eleanor Reservoir Operation			
Storage - Minimum/Maximum	TAF	0.0 - 27.1	0.0 - 27.1
Fall/Winter Operation Storage		Required Minimum Storage	Reqrd Minimum Stor
New Don Pedro Water Bank Account			
Storage - Minimum/Maximum	TAF	0.0 - 570.0 Temporary storage up to 740 TAF during Apr - Sep	0.0 - 570.0 Temp stor up to 740 TAF during Apr - Sep
Conveyance			
San Joaquin Pipelines Maximum	MGD	290	313
San Joaquin Pipelines Minimum	MGD	70	70
San Joaquin Pipelines Flow Rate Changes		11 Stepwise	17 Stepwise
		Surrogate minimum changes by allowing only 7 changes in a year	Allow up to 7 changes in a year (surrogate)
San Joaquin Pipelines Maintenance		Cycle one pipeline out Nov - Mar each year (average remaining capacity rotation) maximum 210 MGD	Cyclic 5-year mantenance (see note)
TID/MID Operational Parameters			Note: Cyclic 5-year maintenance, maximum 271 MGD available all other months exc and 135.5 MGD available
Districts' Tuolumne Diversion[17]		Varies annually based on land use and water availability Annual average 875 TAF	Set equal to baseline conditions. SFPUC effects measured by the result of reducing inflow to DP and its effect upon La Grange releases to the TR
Tuolumne River La Grange Flow Releases			
Don Pedro, 1996 FERC		X	X
VAMP - considered but not modeled[18]		X	X

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Table 1-2
Summary of Modeling Results (Part 1/2)

HH/LSM Simulation Results	Units	Baseline Baseline Conditions[1] - Calaveras Constrained	Proposed WSIP
Design Drought Production & Disposition[19]			
San Joaquin Pipeline Diversion	MGD	208.7	235.0
Bay-Area Deliveries	MGD	218.3	248.9
Added Groveland & Coastside Delivery	MGD	2.6	3.6
Local Reservoir Evaporation	MGD	10.7	12.5
Inflow from ACDD	MGD	1.3	1.6
Flow Recapture	MGD	0	5.3
Local Reservoir Stream Release	MGD	0.6	5.4
Desalination	MGD	0	0
Westside Basin	MGD	0	5.6
District Transfer to NDP Water Bank	MGD	0	24.7
Local Storage - Begin	MG	53,854	77,310
Local Storage - End	MG	18,403	18,495
Study Average Production & Disposition (1921-02)[20]			
Tuolumne River System			
Reservoirs			
Hetch Hetchy			
Inflow	AF	749,605	749,605
River	AF	275,255	267,021
Stream Minimum Release	AF	65,728	65,593
Tunnel	AF	470,709	478,932
Evaporation	AF	3,893	3,869
Reservoir	AF	281,938	275,235
Cherry			
Inflow	AF	279,293	279,293
Eleanor Gravity	AF	289	289
Eleanor Pump	AF	118,251	118,274
River	AF	41,636	41,439
Stream Minimum Release	AF		
Tunnel	AF	352,692	352,915
Evaporation	AF	3,505	3,501
Reservoir	AF	239,971	239,309
Eleanor			
Inflow	AF	169,617	169,617
Eleanor Gravity	AF	289	289
Eleanor Pump	AF	118,251	118,274
River	AF	49,171	49,148
Stream Minimum Release	AF		
Evaporation	AF	1,906	1,906
Reservoir	AF	22,191	22,191
Don Pedro Reservoir			
Inflow	AF	1,587,517	1,560,828
MID Diversion	AF	302,054	302,055
TID Diversion	AF	573,164	573,168
LaGrange Total Stream	AF	668,876	644,009
LaGrange Minimum Stream Release	AF	221,477	221,477
Total Evaporation	AF	43,493	42,604
Reservoir	AF	1,472,337	1,434,872
Water Bank Account			
Balance	AF	514,299	516,733
Transfer	AF	0	29,350
San Joaquin Pipelines			
Volume (AF)	AF	247,763	274,450
Volume (MG)	MG	80,734	89,429
Rate (MGD)	MGD	221	245
Max Rate (MGD)	MGD	290	313
Min Rate (MGD)	MGD	70	0
East Bay System			
Reservoirs			
Calaveras			
Inflow	MG	12,368	12,368
From ACDD	MG	1,316	1,730
Stream	MG	3,660	4,167
Stream Flow Recapture	MG	0	1,538
To SVWTP	MG	9,013	8,244
To San Antonio	MG	0	0
Evaporation	MG	1,023	1,704
Resevoir	MG	10,969	28,170
San Antonio			
Inflow	MG	2,468	2,468
From Calaveras/SJPL	MG	1,173	1,734
Stream	MG	991	613
To SVWTP	MG	1,693	2,628
Evaporation	MG	1,012	973
Resevoir	MG	15,323	14,490
Alameda Creek Diversion Dam			
Inflow	MG	4,197	4,197
To Calaveras Reservoir	MG	1,316	1,730
Spill	MG	2,881	2,467
Alameda Creek Confluence			
Accretion	MG	625	625
From ACDD	MG	2,881	2,467
From Calaveras Dam	MG	3,660	4,167
At Confluence	MG	7,167	7,259
Treatment Plants			
SVWTP Total	MG	13,662	15,738
From Calaveras	MG	9,013	8,244
From San Antonio	MG	1,693	2,628
From SJPL	MG	2,956	3,329
From Recapture	MG	0	1,538
SVWTP Total MGD	MGD	37	43
SVWTP Max MGD	MGD	120	158
SVWTP Min MGD	MGD	20	20

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Table 1-2
Summary of Modeling Results (Part 2/2)

HH/LSM Simulation Results	Units	Baseline Baseline Conditions[1] - Calaveras Constrained	Proposed WSIP
Peninsula System			
Reservoirs			
Crystal Springs			
Inflow	MG	3,722	3,722
From San Andreas	MG	0	0
From Pilarcitos and SJPL	MG	8,045	7,643
Stream	MG	773	325
Pump to San Andreas	MG	9,438	9,005
Pump to Coastside	MG	247	591
Evaporation	MG	1,323	1,490
Reservoir	MG	16,360	18,621
San Andreas			
Inflow	MG	1,428	1,428
From other Streams	MG	9,954	9,590
Stream	MG	0	0
To HTWTP	MG	10,851	10,487
Evaporation	MG	530	531
Reservoir	MG	5,892	5,882
Pilarcitos			
Inflow		1,297	1,297
To San Andreas	MG	516	584
For Stone Diversion	MG	262	280
Stream other than Diversion	MG	417	332
Evaporation	MG	103	102
Reservoir	MG	776	767
Stone Dam			
Accretion blw Pilarcitos	MG	167	211
Pilarcitos non-diversion Release	MG	417	332
Pilarcitos Release for Diversions	MG	584	543
Diversion to Coastside	MG	167	211
Diversion to Crystal Springs	MG	142	180
Spill past Stone	MG	860	695
Treatment Plants			
HTWTP Total	MG	10,851	10,487
HTWTP Total MGD	MGD	30	29
HTWTP Max MGD	MGD	149	106
HTWTP Min MGD	MGD	20	20
Other Facilites			
Westside Basin Net	MG	0	11
Desalination Input	MG	0	0
Additional Information			
Total Local Reservoir Stream Release	MG	5,842	5,437
Total Local Reservoir Stream Evaporation	MG	3,991	4,800
Deliveries			
In-City	MG	29,589	26,686
South Bay	MG	43,106	52,906
Crystal Springs	MG	15,120	16,931
San Andreas	MG	5,400	6,604
Coastside	MG	675	1,082
Groveland	MG	365	365
Total Deliveries	MG	94,255	104,574
Total Deliveries	MGD	258	287
Storage			
Total Local Storage Begin	MG	49,849	71,363
Total Local Storage End	MG	43,129	65,197
Residual Difference during 82-year Simulation	MGD	0.22	0.21
Westside Storage Begin	MG	0	23,474
Westside Storage End	MG	0	24,363
Residual Difference during 82-year Simulation	MGD	0.00	-0.03

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Notes for Table 1-1 and Table 1-2

1. Baseline condition represents the existing conditions at the time of Notice of Preparation publication in September 2006. This is the baseline used to assess WSIP program impacts and impact significance. This setting is indicative of DSOD restrictions on Calaveras and Crystal Springs Reservoirs.

2. N/A

3. N/A

4. The time horizon for the setting of the scenario. The baseline condition scenario is depicted for recent conditions, while the proposed WSIP, variants, and alternatives are depicted for the future at full buildout and implementation (i.e., conditions in the year 2030).

5. HH/LSM simulation study name.

6. The customer purchase request (demand) information is based on the demand and request studies prepared by the SFPUC in coordination with the wholesale customers. This demand on the regional water system includes both the SFPUC retail customers and wholesale customers. The current (2005) average annual demand is 265 mgd and the projected 2030 average annual demand is 300 mgd, assuming the SFPUC adopts the updated wholesale customer purchase requests as part of renewing the Master Sales Agreement with these customers (due in 2009).

7. Certain scenarios include development of additional water supply from a combination of recycled water projects, groundwater projects, and conservation, utilized every year and not subject to reduction during drought.

8. The average annual demand for supplies from the combination of SFPUC local watershed, Tuolumne River, and programs not included in the regional water conservation, recycling, and groundwater programs shown.

9. Modeled results for SFPUC deliveries, with supplies added for regional water conservation, recycling, and groundwater programs. Total deliveries and supply will be less than full customer purchase requests due to rationing in some years.

10. Shows only the features that affect hydrologic results of the system operation simulations. Additional projects are included in the WSIP.

11. Illustrates the frequency and severity of water supply action or the severity of systemwide rationing. Only years when a variable water supply component is implemented or rationing occurs are shown. "DD" illustrates the shortage results for years included in the prospective drought period of the SFPUC design drought. These years contribute to establishing system operation protocols but are not included in the hydrologic assessment analyses.

12. Rationing policy cap: The SFPUC WSIP level of service goal is to maintain rationing on the regional system at no more than 20% during any one year of the drought. Some alternatives do not achieve this level of service goal. Performance is indicated for the Design Drought ("DD") sequence and for the "Historical" hydrologic sequence.

13. Water supply elements develop water in different amounts from year-to-year, and in some instances only develop water during dry years. This information is provided to illustrate a comparison between local watershed supplies, Tuolumne River supplies, and other identifiable water supplies used to meet system purchase requests. Values are stated in units of average annual quantities during the simulated historical sequence.

14. Results from HH/LSM analysis of each scenario. Values represent the average annual production of each element of supply during the design drought period.

15. Simplified calculation of system deliveries during the SFPUC design drought. The value represents the application of systemwide shortages to the demand level being met with SFPUC local watershed, Tuolumne River, and other developed supplies, and does not include supplies from regional water conservation, recycled water, or groundwater projects. Average value may be slightly misstated (up to 3 mgd) due to metric of analysis that does not account for differences in residual storage between studies. "Nominal" Firm Yield represents the yield of each scenario after adjustment for minor residual storage differences.

16. Supplemental releases from Calaveras Reservoir for fisheries (1997 CDFG MOU) of up to 6,300 acre-feet per year and the Alameda Creek recapture facility project are tied to implementation of the Calaveras Dam Replacement project (SV-2). When the dam is replaced and capacity restored, the flow release and recapture will both occur. The release requirement is based on supplementing other occurring flows below Calaveras Reservoir, sometimes not requiring the full 6,300 acre-feet.

17. SFPUC actions are assumed to not change MID/TID diversions so as to isolate and possibly overstate the WSIP's effects on the Tuolumne River below La Grange Dam. The Districts' diversions are assumed to be constant among the scenarios to provide comparable results of WSIP-alone effects. The exception is for the Modified WSIP Alternative, in which the MID/TID diversion is reduced by the amount of SFPUC transfer.

18. Participation in the San Joaquin River Agreement is assumed. Although the agreement expires after 2010, it is assumed that a subsequent similar agreement or requirement of the Districts will occur. HH/LSM does not explicitly model the Districts' participation in the agreement; however, their participation if modeled would result in only minor differences in results and would not change impact conclusions.

19. From HH/LSM results for modeling the SFPUC design drought period.

20. From HH/LSM results for modeling the system operations for the historical hydrologic period 1921-2002. Values indicate average annual quantities during simulated historical period.

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2. Proposed WSIP

The SFPUC proposes to adopt and implement the WSIP to increase the reliability of the regional water system. The WSIP is a program to implement the service goals and system performance objectives established by the SFPUC for the regional water system in the areas of water quality, seismic reliability, delivery reliability, and water supply through the year 2030.

The WSIP level of service objectives for water supply are to: (1) fully meet customer purchase requests in nondrought years through planning year 2030, estimated at 300 million gallons per day (mgd) average annual delivery; and (2) provide drought-year delivery with a maximum systemwide delivery reduction (rationing) of 20 percent in any one year of a drought. These objectives correspond to a required system firm yield of 256 mgd in 2030. System firm yield is defined as the average annual water delivery that can be sustained throughout an extended drought. The current firm yield of the system is 219 mgd under the current restricted operating conditions that limit storage levels in Calaveras and Crystal Springs Reservoirs.

During nondrought years, the SFPUC would serve the increased 35 mgd in purchase requests through a combination of conservation, water recycling, groundwater supply programs, increased diversions from the Tuolumne River, and greater utilization of Bay Area watershed supplies associated with the restoration of operational storage capacity (primarily in Calaveras Reservoir). The SFPUC would implement conservation, water recycling, and groundwater supply programs in the SFPUC retail service area to achieve the equivalent of 10 mgd of supply per year, in all years. These programs would be in addition to demand management and conservation measures already accounted for in the 2030 purchase requests for the retail service area.

In most years, the SFPUC could serve the projected 2030 water purchases of 300 mgd with its existing sources of water supply; however, these sources alone have not allowed for full water deliveries during past droughts, and they would be insufficient during future droughts as purchase requests increase. The SFPUC proposes to serve this 2030 need for increased system firm yield (i.e., water supply during a drought scenario) with a combination of conservation, water recycling, and groundwater programs in the SFPUC retail service area; water transfers (29,350 acre-feet per year) from the Turlock Irrigation District (TID) and Modesto Irrigation District (MID); a groundwater conjunctive-use program, incorporating the Westside Basin Groundwater Program; and restoration of reservoir operating capacity at Crystal Springs and Calaveras Reservoirs. Systemwide rationing is limited to no more than 20 percent in any year, with a firm yield of 256 mgd throughout an extended drought.

2.1 Water Deliveries and Drought Response Actions

With a current systemwide purchase request of approximately 265 mgd, the regional water system cannot provide full deliveries during all anticipated drought sequences. Drought response actions (delivery shortages) are necessary at the onset of a drought to provide a viable, albeit reduced, supply throughout the duration of a drought. Because the regional water system has limited current resources, rationing of the SFPUC supply by more than 20 percent may be required during an extended drought. With the proposed program, the purchase requests would increase from 265 mgd to 300 mgd, with 10 mgd of these requests satisfied by conservation, recycling, and groundwater programs in the city of San Francisco. In the future, the system would experience a net demand of 290 mgd. The additional net demand and increase in the water supply reliability of the regional water system would be served by the water supply programs described above. Table 1-1 compares the drought response actions for the proposed program and base (Calaveras constrained) settings. Figure 2.1-1 illustrates the drought response actions for the simulated 82-year historical period (1921-2002).

In Figure 2.1-1, years with bars showing a “1” or greater level of action indicate periods when a supplemental water supply action is initiated. In the WSIP setting, the action is the use of the Westside Basin Groundwater Program to supplement SFPUC water deliveries. The water transfer from MID/TID is also occurring during these periods. Action levels greater than “1” indicate the imposition of delivery shortages (rationing) to SFPUC customers.

Figure 2.1-1

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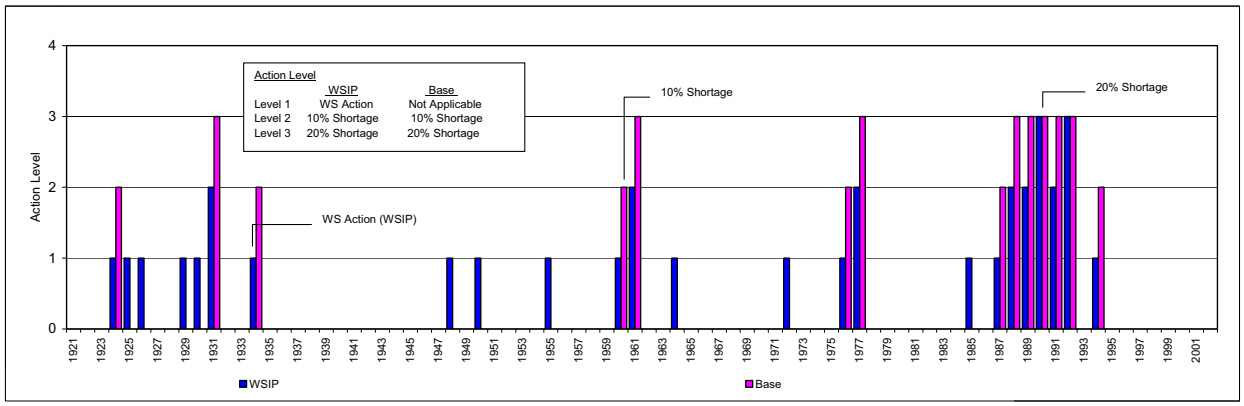
Drought Response Actions – WSIP and Base



In modeling parlance, there is no level 1 action in the base setting. Without supplemental resources, the existing system only has the delivery shortage measure available to cope with drought. This shortage measure is imposed during level 2 (10 percent) and level 3 (20 percent). These percentages of shortage are applied to both the WSIP and the base settings for these action levels. As evidenced in Figure 2.1-1, rationing would be required more frequently and with greater severity (level 2 and level 3 actions) in the base setting.

Figure 2.1-1 illustrates that, when compared to the base setting, the WSIP setting triggers the supplemental resource (Westside Basin Groundwater Program) at an early indication of drought, and during periods when in the base setting there were no supplemental resources available to the system. The utilization of the supplemental resource during these times results in the elimination or reduction, or at least a non-increase in the severity, of delivery shortage.

Although not illustrated in Figure 2.1-1, Table 1-1 shows the delivery shortages anticipated during the entire SFPUC design drought. Shortages during the design drought with the WSIP are maintained within the objective to limit the severity of shortage to no more than 20 percent. With the existing system (Calaveras and Crystal Springs Reservoirs constrained), the 20-percent-limitation (cap) objective cannot be achieved during the last 18 months of the design drought, and a 25-percent shortage is applied. The system's yield in the base setting is 219 mgd.

The difference in water deliveries between the proposed program and the base settings is shown chronologically for the 82-year simulation in Table 2.1-1. The differences all indicate an increase in deliveries due to an increase in the level of purchase requests, and an increase in the reliability of delivery. The annual (fiscal-year-based) increase of approximately 9.1 million gallons represents the basic increase in delivery associated with an increase in purchase requests from 265 mgd to 290 mgd. The years that show other levels of additional deliveries illustrate the increase in purchase requests and represent years when shortages are reduced in the WSIP setting compared to the base setting.

2.2 Diversions from Tuolumne River

The metric for illustrating the SFPUC diversions from the Tuolumne River Basin is the flow through the San Joaquin Pipeline (SJPL). Table 2.2-1 illustrates the difference in diversions to the SJPL between the proposed program and the base settings. Evident in the operation is the increase in summer diversions associated with an increase in the conveyance capacity of the SJPL. Regardless of an increase in purchase requests, the availability of increased conveyance capacity would increase diversions during the summer to retain storage in the Bay Area reservoirs, typically exercising the SJPL at its maximum capacity. The increase in purchase requests would require the utilization of the maximum capacity for a longer period into the fall. Generally, fewer diversions would occur during the late fall and early winter because of the lesser drawdown of the Bay Area reservoirs (requiring less replenishment), and because systematic maintenance within Hetch Hetchy facilities (lessening available conveyance capacity) would impair diversions in the WSIP setting. The increase in diversions during the winter and spring would

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Table 2.1-1

Difference in Total System-wide Delivery (MG) WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
1921	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1922	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1923	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1924	810	611	461	374	437	609	727	907	1,008	2,347	2,262	1,909	12,462	9,124
1925	1,627	1,198	894	695	869	1,278	1,584	1,935	1,008	1,145	1,095	940	14,269	17,607
1926	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,125	9,125
1927	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,125
1928	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1929	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1930	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,125	9,125
1931	810	611	461	374	437	609	727	907	1,008	2,009	1,947	1,710	11,610	9,125
1932	1,547	1,259	1,075	947	1,006	1,309	1,479	1,721	1,847	1,145	1,095	940	15,370	17,856
1933	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1934	810	611	461	374	437	609	727	907	1,008	2,347	2,262	1,909	12,462	9,124
1935	1,627	1,198	894	695	869	1,278	1,584	1,935	1,008	1,145	1,095	940	14,268	17,607
1936	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1937	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1938	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1939	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1940	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1941	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1942	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1943	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1944	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1945	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1946	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1947	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1948	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1949	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,125
1950	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1951	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,125
1952	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1953	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1954	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1955	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1956	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,125
1957	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1958	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1959	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1960	810	611	461	374	437	609	727	907	1,008	2,347	2,262	1,909	12,462	9,124
1961	1,627	1,198	894	695	869	1,278	1,584	1,935	2,150	2,009	1,947	1,710	17,896	18,749
1962	1,547	1,259	1,075	947	1,006	1,309	1,479	1,721	1,847	1,145	1,095	940	15,370	17,856
1963	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1964	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1965	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,125
1966	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1967	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1968	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1969	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1970	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1971	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1972	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1973	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,125
1974	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1975	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1976	810	611	461	374	437	609	727	907	1,008	2,347	2,262	1,909	12,462	9,124
1977	1,627	1,198	894	695	869	1,278	1,584	1,935	2,150	2,009	1,947	1,710	17,896	18,749
1978	1,547	1,259	1,075	947	1,006	1,309	1,479	1,721	-263	1,145	1,095	940	13,260	15,746
1979	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1980	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1981	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1982	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1983	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1984	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1985	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1986	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,125
1987	810	611	461	374	437	609	727	907	1,008	2,347	2,262	1,909	12,462	9,124
1988	1,627	1,198	894	695	869	1,278	1,584	1,935	2,150	2,009	1,947	1,710	17,896	18,749
1989	1,547	1,259	1,075	947	1,006	1,309	1,479	1,721	1,847	2,009	1,947	1,710	17,856	17,856
1990	1,547	1,259	1,075	947	1,006	1,309	1,479	1,721	1,847	885	845	733	14,654	17,856
1991	646	509	403	337	381	503	586	709	775	2,009	1,947	1,710	10,513	7,311
1992	1,547	1,259	1,075	947	1,006	1,309	1,479	1,721	1,847	885	845	733	14,654	17,856
1993	646	509	403	337	381	503	586	709	-1,335	1,145	1,095	940	5,917	5,201
1994	810	611	461	374	437	609	727	907	1,008	2,347	2,262	1,909	12,462	9,124
1995	1,627	1,198	894	695	869	1,278	727	907	1,008	1,145	1,095	940	12,383	15,721
1996	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1997	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1998	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1999	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
2000	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
2001	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
2002	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
Avg (21-02)	920	699	536	439	509	707	831	1,024	1,054	1,290	1,237	1,062	10,307	10,307

APPENDIX O1

Table 2.2-1

Difference in Total San Joaquin Pipeline (Acre-feet) WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
1921	0	-921	0	0	0	12,368	2,118	2,189	2,118	2,189	2,189	2,118	24,368	27,130
1922	952	1,841	-1,902	952	0	0	7,365	5,043	4,880	2,189	2,189	2,118	25,627	25,627
1923	0	-2,762	0	0	0	15,317	2,118	2,189	2,118	2,189	2,189	2,118	25,476	25,476
1924	-951	0	1,902	-952	-859	5,803	2,118	2,189	2,118	2,189	2,189	2,118	17,864	17,864
1925	2,189	-19,334	-19,979	5,803	17,272	11,512	2,118	2,189	2,118	2,189	2,189	2,118	10,384	10,384
1926	5,043	5,616	-7,088	5,803	9,452	15,317	4,880	2,189	2,118	2,189	2,189	2,118	49,826	49,826
1927	1,903	-921	0	4,757	0	6,659	2,762	2,189	2,118	2,189	2,189	2,118	25,963	25,963
1928	2,949	0	-2,331	3,805	4,297	5,708	4,603	2,189	2,118	2,189	2,189	2,118	29,834	29,834
1929	4,756	1,841	1,902	1,902	1,718	5,803	2,118	2,189	2,118	2,189	2,189	2,118	30,843	30,843
1930	2,189	-19,334	-19,979	5,803	9,538	11,512	2,118	2,189	2,118	2,189	2,189	2,118	2,650	2,650
1931	2,189	5,616	-7,088	5,803	5,242	5,803	2,118	2,189	2,118	2,189	2,189	6,721	35,089	30,486
1932	8,562	2,762	5,708	5,708	0	15,412	4,880	6,945	6,721	2,189	2,189	2,118	63,194	67,797
1933	-951	0	-7,088	7,611	6,875	5,803	2,118	2,189	2,118	2,189	2,189	2,118	25,171	25,171
1934	2,189	5,616	5,803	6,659	6,015	5,803	2,118	2,189	2,118	2,189	2,189	2,118	45,006	45,006
1935	5,043	-19,334	-19,979	19,122	17,272	10,560	9,483	7,897	7,642	2,189	2,189	2,118	44,202	44,202
1936	2,189	4,603	-7,088	7,611	0	15,317	2,118	2,189	2,118	2,189	2,189	2,118	35,553	35,553
1937	3,806	1,841	1,902	3,805	0	951	6,445	5,043	4,880	2,189	2,189	2,118	35,169	35,169
1938	1,903	0	0	5,708	0	0	5,524	5,043	4,880	2,189	2,189	2,118	29,554	29,554
1939	-1,902	-921	-2,855	2,854	2,578	5,803	2,118	2,189	2,118	2,189	2,189	2,118	18,478	18,478
1940	2,189	-19,334	-19,979	15,317	7,734	13,319	8,286	5,043	4,880	2,189	2,189	2,118	23,951	23,951
1941	-1,902	-921	0	0	0	0	0	952	921	2,189	2,189	2,118	5,546	5,546
1942	2,379	0	-1,142	0	0	2,663	5,524	2,854	2,762	2,189	2,189	2,118	21,536	21,536
1943	1,903	-921	-7,088	0	0	3,805	6,721	2,189	2,118	2,189	2,189	2,118	15,223	15,223
1944	1,902	-921	0	1,902	7,046	15,317	2,118	2,189	2,118	2,189	2,189	2,118	38,167	38,167
1945	-475	-19,334	-19,979	5,803	13,749	15,317	2,118	2,189	2,118	2,189	2,189	2,118	8,002	8,002
1946	5,043	1,841	0	0	0	10,560	2,118	2,189	2,118	2,189	2,189	2,118	30,365	30,365
1947	952	1,841	0	-952	3,437	10,560	2,118	2,189	2,118	2,189	2,189	2,118	28,759	28,759
1948	2,189	5,616	-7,088	4,756	2,578	5,803	2,118	2,189	2,118	2,189	2,189	2,118	26,775	26,775
1949	2,189	5,616	2,854	-952	-859	1,902	2,118	2,189	2,118	2,189	2,189	2,118	23,671	23,671
1950	3,805	-19,334	-19,979	16,459	16,413	5,803	2,118	2,189	2,118	2,189	2,189	2,118	16,088	16,088
1951	2,189	7,365	0	0	0	8,562	2,118	2,189	2,118	2,189	2,189	2,118	31,037	31,037
1952	2,949	0	1,712	0	0	0	9,206	2,189	2,118	2,189	2,189	2,118	24,670	24,670
1953	1,902	-921	0	0	0	15,317	2,118	2,189	2,118	2,189	2,189	2,118	29,219	29,219
1954	-1,807	0	0	2,854	5,328	10,560	2,118	2,189	2,118	2,189	2,189	2,118	29,856	29,856
1955	-951	-19,334	-15,222	16,459	14,866	5,803	2,118	2,189	2,118	2,189	2,189	2,118	14,542	14,542
1956	2,189	5,616	0	0	0	2,663	2,118	2,189	2,118	2,189	2,189	2,118	23,389	23,389
1957	2,949	0	1,902	3,805	7,046	10,560	2,118	2,189	2,118	2,189	2,189	2,118	39,183	39,183
1958	952	2,762	-7,088	9,514	0	0	0	1,047	1,013	2,189	2,189	2,118	14,696	14,696
1959	0	0	0	2,854	0	15,317	2,118	2,189	2,118	2,189	2,189	2,118	31,092	31,092
1960	2,189	-19,334	-19,979	5,803	10,398	5,803	2,118	2,189	2,118	2,189	2,189	2,118	-2,199	-2,199
1961	2,189	5,616	-7,088	5,803	9,538	5,803	2,118	2,189	2,118	2,189	5,043	9,483	45,001	34,782
1962	9,799	10,219	4,757	3,805	3,437	18,075	7,642	7,897	7,642	2,189	2,189	2,118	79,769	89,988
1963	2,949	1,841	-7,088	0	0	7,610	5,524	1,902	1,841	2,189	2,189	2,118	21,075	21,075
1964	2,189	0	0	7,611	6,875	5,803	2,118	2,189	2,118	2,189	2,189	2,118	35,399	35,399
1965	2,189	-19,334	-14,270	5,708	5,156	11,512	12,889	952	921	2,189	2,189	2,118	12,219	12,219
1966	2,949	-2,762	-1,379	9,704	8,765	5,803	2,118	2,189	2,118	2,189	2,189	2,118	36,001	36,001
1967	2,189	5,616	-2,855	0	0	0	6,445	0	0	2,189	2,189	2,118	17,891	17,891
1968	2,189	0	-7,088	8,562	7,734	5,803	2,118	2,189	2,118	2,189	2,189	2,118	30,121	30,121
1969	2,189	4,603	-952	0	0	951	7,642	2,189	2,118	2,189	2,189	2,118	25,236	25,236
1970	0	-19,334	-19,979	12,367	11,171	19,122	2,118	2,189	2,118	2,189	2,189	2,118	16,268	16,268
1971	2,379	-921	0	0	0	10,560	2,118	2,189	2,118	2,189	2,189	2,118	24,939	24,939
1972	2,189	5,616	0	-952	3,437	5,803	2,118	2,189	2,118	2,189	2,189	2,118	29,014	29,014
1973	2,189	5,616	-7,088	0	0	0	6,721	2,189	2,118	2,189	2,189	2,118	18,241	18,241
1974	1,902	0	0	0	0	10,464	4,603	5,043	4,880	2,189	2,189	2,118	33,388	33,388
1975	-1,902	-19,334	-19,979	11,512	5,156	3,805	8,286	5,043	4,880	2,189	2,189	2,118	3,963	3,963
1976	-1,902	-921	-7,088	0	0	5,803	2,118	2,189	2,118	2,189	2,189	2,118	8,813	8,813
1977	5,043	5,616	4,756	0	0	5,803	2,118	2,189	2,118	-4,756	-1,902	7,365	28,350	34,139
1978	7,611	-921	-2,854	5,708	5,156	10,464	12,152	5,803	5,616	2,189	2,189	2,118	55,231	49,442
1979	-2,854	0	1,902	2,854	0	11,416	2,118	2,189	2,118	2,189	2,189	2,118	26,239	26,239
1980	5,043	-19,334	-15,222	13,319	0	7,610	4,880	2,189	2,118	2,189	2,189	2,118	7,099	7,099
1981	1,902	0	-7,088	7,610	6,874	11,512	2,118	2,189	2,118	2,189	2,189	2,118	33,731	33,731
1982	2,189	-921	0	0	0	0	0	1,902	1,841	2,189	2,189	2,118	11,507	11,507
1983	1,047	-2,762	951	0	0	0	4,787	4,757	4,603	2,189	2,189	2,118	19,879	19,879
1984	952	-4,603	0	0	0	5,803	2,118	2,189	2,118	2,189	2,189	2,118	15,073	15,073
1985	2,189	-19,334	-19,979	10,560	9,538	5,803	2,118	2,189	2,118	2,189	2,189	2,118	1,698	1,698
1986	2,189	5,616	-7,088	5,803	3,437	7,610	7,365	5,043	4,880	2,189	2,189	2,118	41,351	41,351
1987	0	0	1,902	-952	-859	5,803	2,118	2,189	2,118	2,189	2,189	2,118	18,815	18,815
1988	5,043	5,616	-7,088	10,465	7,734	5,803	2,118	2,189	2,118	2,189	2,189	9,483	47,859	40,494
1989	4,756	1,841	4,757	2,854	2,578	5,803	2,118	5,043	4,880	5,043	3,806	7,365	50,844	48,491
1990	6,659	-19,334	-15,222	10,560	9,538	5,803	2,118	2,189	2,118	5,043	4,756	6,444	20,672	20,643
1991	3,805	-921	-2,331	0	0	10,465	4,880	2,854	2,762	2,189	3,805	1,841	29,349	37,757
1992	0	4,603	3,805	952	2,406	18,075	6,721	6,945	6,721	1,047	-1,902	1,841	51,214	58,063
1993	1,902	-921	-1,379	0	0	0	4,603	2,854	2,762	2,189	2,189	2,118	16,317	10,807
1994	-2,854	0	0	-952	10,312	5,803	2,118	2,189	2,118	2,189	2,189	2,118	25,230	25,230
1995	5,043	-19,334	-19,979	7,610	6,874	0	9,206	1,903	1,842	2,189	2,189	2,118	-339	-339
1996	1,902	0	-2,331	0	0	0	4,880	5,043	4,880	2,189	2,189	2,118	20,870	20,870
1997	1,903	0	0	0	0	10,465	2,118	2,189	2,118	2,189	2,189	2,118	25,289	25,289
1998	2,189	2,762	-7,088	0	0	951	11,048	3,901	3,775	2,189	2,189	4,880	26,796	24,034
1999	1,902	-921	0	6,659	0	8,562	9,206	2,189	2,118	2,189	2,189	2,118	36,211	38,973
2000	1,902	-19,334	-19,979	15,317	7,734	16,173	2,118	2,189	2,118	2,189	2,189	2,118	14,734	14,734
2001	3,806	2,762	-7,088	7,611	8,593	15,317	2,118	2,189	2,118	2,189	2,189	2,118	43,922	43,922
2002	952	0	-1,902	6,659	6,015	10,560	2,118	2,189	2,118	2,189	2,189	2,118	35,205	35,205
Avg (21-02)	2,106	-2,522	-4,852	4,307	3,833	7,532	3,864	2,797	2,706	2,160	2,195	2,561	26,687	26,720

result from the need to replenish Bay Area reservoir storage after the maintenance period, serve increased purchase requests, and top off Bay Area reservoir storage prior to summer. The difference in SJPL diversions between the WSIP setting and the base setting is illustrated in Figure 2.2-1. The difference in average monthly diversions through the SJPL is shown by year type for the 82-year simulation period.

Table 2.2-2 illustrates the average monthly diversions through the SJPL, by year type, for the 82-year simulation period for the proposed program and the base settings. The table illustrates a trend of diverting less water from the Tuolumne River Basin in wetter years (as Bay Area reservoir watersheds provide more supply during those years) than in drier years.

Figure 2.2-1
SJPL Diversions – WSIP and Base-Calaveras Constrained

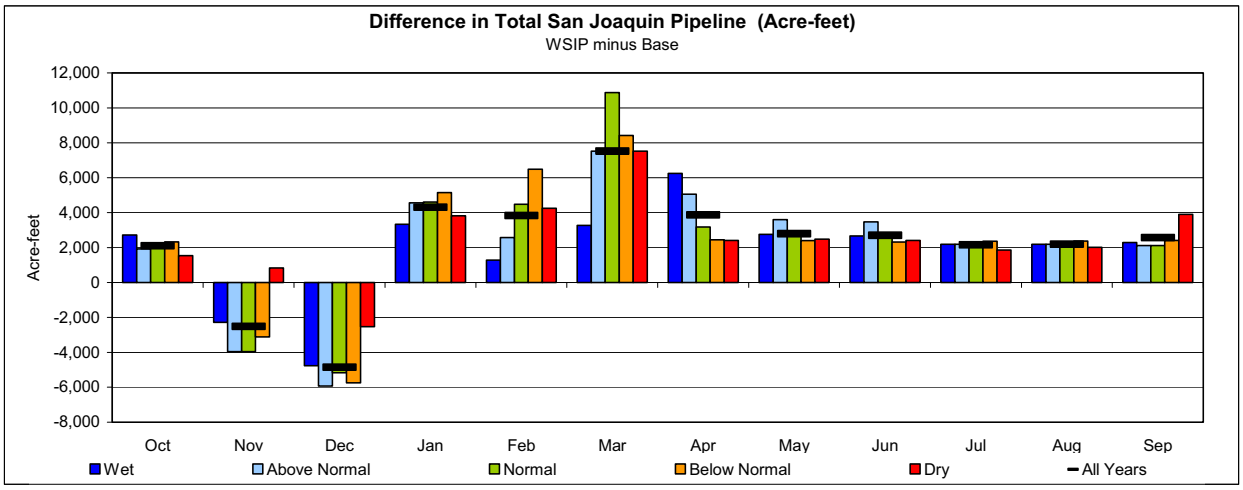


Table 2.2-2

Total San Joaquin Pipeline (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)
WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	27,584	16,762	9,692	11,066	7,304	10,875	21,647	26,722	25,859	29,778	29,778	28,817	245,884	243,146
Above Normal	26,935	14,568	8,898	13,901	8,598	16,352	24,176	28,608	27,685	29,778	29,778	28,817	258,095	258,095
Normal	26,632	15,087	9,698	15,299	11,343	21,935	28,322	29,778	28,817	29,778	29,778	28,817	275,285	275,285
Below Normal	27,567	16,214	13,000	21,070	18,065	25,211	28,817	29,481	28,530	29,778	29,521	27,972	295,227	295,751
Dry	26,210	19,881	16,554	19,818	16,869	25,717	28,817	29,778	28,817	29,094	28,773	27,154	297,481	299,662
All Years	26,992	16,475	11,553	16,261	12,458	20,037	26,359	28,878	27,946	29,645	29,529	28,317	274,450	274,450

Total San Joaquin Pipeline (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)
Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	24,854	19,046	14,449	7,730	6,015	7,611	15,398	23,962	23,189	27,589	27,589	26,526	223,960	222,101
Above Normal	25,015	18,522	14,830	9,346	6,015	8,831	19,117	25,015	24,208	27,589	27,589	26,699	232,776	232,343
Normal	24,616	19,046	14,865	10,691	6,864	11,060	25,145	27,054	26,181	27,589	27,589	26,699	247,400	246,589
Below Normal	25,239	19,334	18,748	15,927	11,585	16,789	26,374	27,085	26,212	27,421	27,141	25,562	267,417	267,585
Dry	24,676	19,046	19,087	15,995	12,621	18,195	26,411	27,292	26,411	27,232	26,757	23,247	266,970	269,749
All Years	24,886	18,997	16,405	11,955	8,624	12,505	22,496	26,081	25,239	27,485	27,334	25,756	247,763	247,729

Difference in Total San Joaquin Pipeline (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)
WSIP minus Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	2,730	-2,285	-4,757	3,336	1,289	3,264	6,249	2,759	2,670	2,189	2,189	2,291	21,924	21,045
Above Normal	1,920	-3,954	-5,932	4,555	2,583	7,521	5,058	3,593	3,477	2,189	2,189	2,118	25,318	25,752
Normal	2,016	-3,959	-5,167	4,608	4,479	10,875	3,177	2,724	2,636	2,189	2,189	2,118	27,885	28,696
Below Normal	2,328	-3,120	-5,748	5,143	6,480	8,422	2,443	2,396	2,318	2,357	2,379	2,410	27,810	28,166
Dry	1,534	834	-2,533	3,823	4,248	7,521	2,406	2,486	2,406	1,862	2,016	3,907	30,511	29,913
All Years	2,106	-2,522	-4,852	4,307	3,833	7,532	3,864	2,797	2,706	2,160	2,195	2,561	26,687	26,720

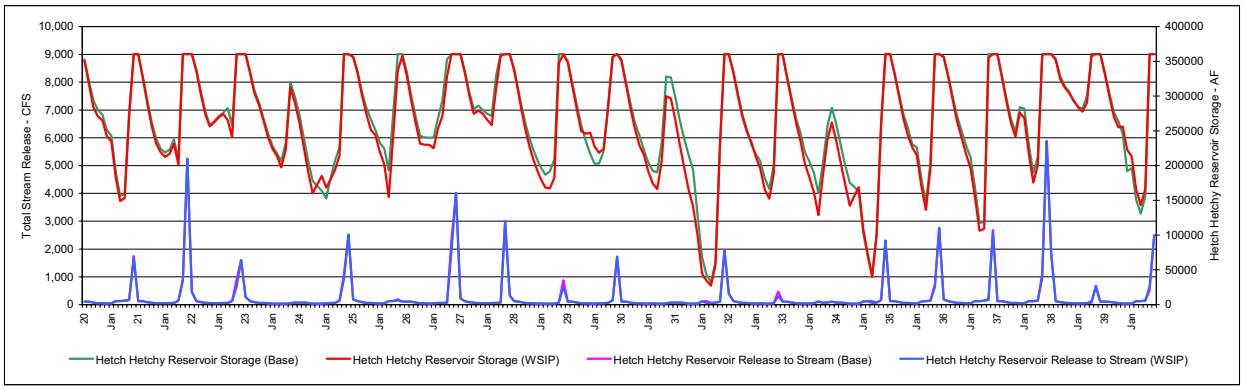
2.3 Hetch Hetchy Reservoir and Releases

The additional draw of water for the additional deliveries occurring under the WSIP would generally result in an increase in draw from Hetch Hetchy Reservoir. Figure 2.3-1 illustrates a chronological trace of the simulation of Hetch Hetchy Reservoir storage and stream releases. Shown in Figure 2.3-1 are the results for the WSIP and base settings. Supplementing the Figure 2.3-1 representation of Hetch Hetchy Reservoir storage are Table 2.3-1, Hetch Hetchy Reservoir Storage (WSIP); Table 2.3-2, Hetch Hetchy Reservoir Storage (Base); and Table 2.3-3, Difference in Hetch Hetchy Reservoir Storage (WSIP minus Base).

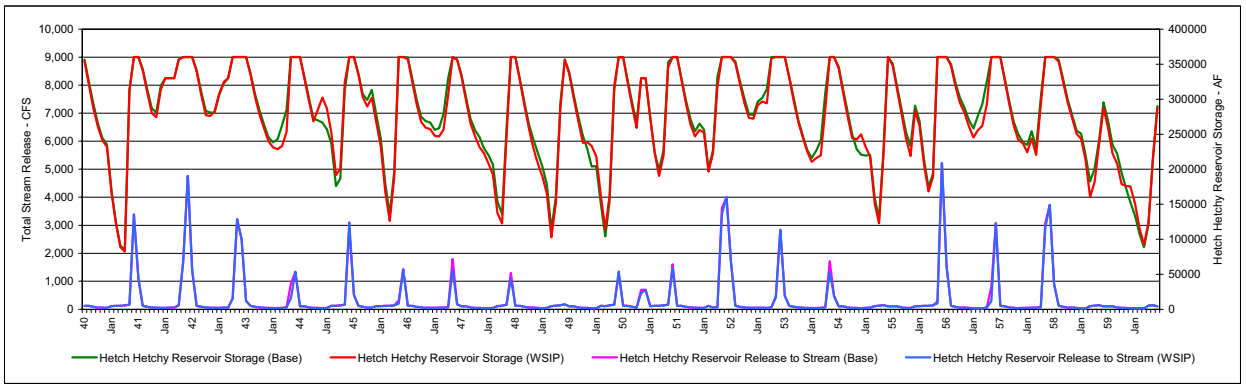
APPENDIX O1

Figure 2.3-1
Hetch Hetchy Reservoir Storage and Stream Release

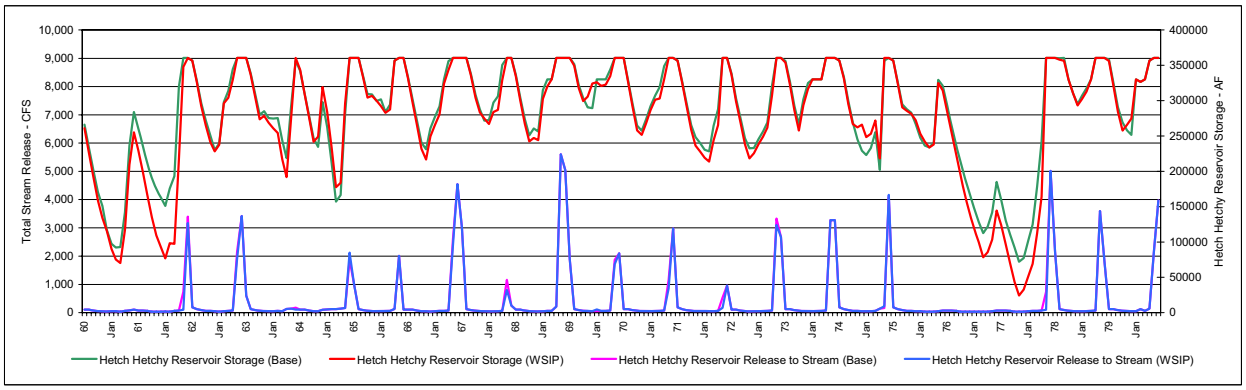
1920 - 1939



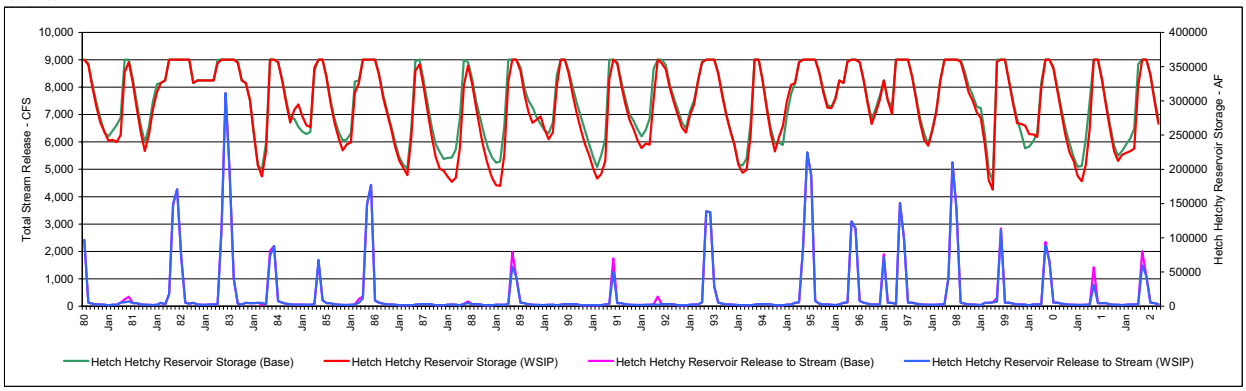
1940 - 1959



1960 - 1979



1980 - 2002



APPENDIX O1

Table 2.3-1

Hetch Hetchy Reservoir Storage (Acre-feet) WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	271,165	264,808	242,632	234,683	182,084	149,183	153,305	270,347	360,400	360,400	326,811	291,828
1922	258,301	232,379	219,552	212,511	216,970	231,546	201,859	360,400	360,400	360,400	336,082	302,853
1923	273,916	256,464	262,541	269,252	274,392	265,677	241,032	360,400	360,400	360,400	333,186	304,241
1924	287,239	264,605	241,219	224,237	213,989	197,420	222,900	312,177	290,436	262,497	227,241	191,379
1925	160,353	172,388	185,426	168,354	179,977	193,968	214,415	360,400	360,400	356,465	334,210	301,427
1926	274,085	251,427	243,883	219,916	201,778	154,687	243,705	336,096	357,554	330,389	294,965	261,018
1927	231,614	230,204	229,890	225,094	252,663	271,751	328,434	360,400	360,400	360,400	333,718	301,231
1928	274,488	279,141	274,500	265,521	258,520	310,981	357,818	360,400	360,400	337,096	302,689	269,444
1929	238,756	214,109	197,101	180,226	168,280	167,248	182,805	347,340	360,400	348,102	314,426	281,237
1930	249,493	245,923	247,253	227,747	218,315	224,793	286,156	356,465	360,400	350,768	316,726	283,424
1931	252,998	228,677	214,984	191,409	174,118	166,236	207,521	299,800	296,541	266,646	231,402	197,210
1932	165,286	141,000	99,154	44,357	34,477	27,305	58,254	229,673	360,400	360,400	333,089	299,918
1933	270,157	248,649	233,883	213,269	196,104	165,553	152,529	188,275	360,400	360,400	326,593	293,382
1934	260,961	234,344	202,598	182,895	161,604	129,002	185,456	237,968	261,776	235,550	203,546	172,300
1935	142,314	156,037	168,825	108,936	73,089	39,750	100,334	259,346	360,400	360,400	331,788	299,322
1936	267,086	242,699	226,345	214,884	170,029	136,212	195,836	360,400	360,400	356,465	327,853	294,110
1937	262,493	239,158	216,925	195,925	154,023	106,324	109,133	355,146	360,400	360,400	327,212	292,471
1938	261,919	241,518	276,115	268,301	217,388	175,924	200,166	360,400	360,400	360,400	352,029	324,714
1939	312,466	304,668	294,282	283,636	277,502	290,985	360,400	360,400	360,400	332,157	299,492	270,327
1940	255,209	256,245	222,760	213,012	165,616	143,200	166,203	360,400	360,400	354,451	320,313	286,310
1941	260,678	241,118	232,444	166,634	122,924	89,103	82,492	312,086	360,400	360,400	341,291	309,048
1942	280,245	274,466	313,690	330,000	330,000	330,000	356,592	360,400	360,400	360,400	339,529	306,962
1943	277,164	275,780	282,691	307,119	324,209	330,000	360,400	360,400	360,400	360,400	334,820	303,090
1944	277,241	258,445	240,206	231,387	228,604	233,279	253,354	360,400	360,400	360,400	329,290	297,445
1945	268,450	285,342	302,246	287,091	252,554	191,770	200,884	324,552	360,400	360,400	334,928	303,168
1946	289,579	302,009	266,576	232,638	168,168	125,876	188,823	360,400	360,400	357,267	325,581	293,235
1947	267,584	259,488	257,238	247,959	246,704	256,512	305,459	360,400	356,592	332,847	297,991	265,329
1948	247,258	231,519	222,630	208,209	191,894	137,570	122,657	247,597	360,400	360,400	325,774	291,062
1949	257,437	230,325	207,779	189,698	165,102	102,768	150,930	285,781	356,592	336,040	301,328	268,173
1950	237,728	238,697	233,120	217,888	163,294	114,244	162,551	319,659	360,400	359,600	323,849	289,929
1951	259,038	330,000	330,000	273,739	223,537	190,502	219,413	345,379	360,400	360,400	326,780	293,203
1952	263,719	247,031	256,244	252,090	196,649	222,356	318,163	360,400	360,400	360,400	351,651	322,211
1953	294,426	273,225	272,304	291,357	296,819	294,144	358,469	360,400	360,400	360,400	330,136	297,172
1954	267,018	245,088	225,346	210,648	216,124	219,810	285,610	360,400	360,400	343,956	308,827	274,943
1955	244,584	242,635	249,852	232,018	218,294	150,980	122,826	222,121	360,400	348,498	313,738	278,863
1956	244,816	218,801	283,964	261,892	207,063	168,360	188,550	360,400	360,400	360,400	347,791	319,290
1957	295,080	281,251	261,004	245,354	255,623	261,924	293,186	360,400	360,400	360,400	326,823	292,697
1958	262,298	242,214	237,194	224,344	243,852	220,345	292,148	360,400	360,400	360,400	353,900	323,910
1959	295,427	273,019	250,518	243,597	212,867	160,299	181,528	235,211	287,682	259,237	222,655	207,831
1960	178,623	176,466	175,310	150,905	115,966	92,114	123,900	215,531	287,296	261,055	225,853	191,635
1961	158,801	133,990	115,379	89,989	75,248	70,132	117,173	209,414	255,120	229,047	199,072	166,120
1962	135,106	109,472	92,419	76,863	98,093	97,377	215,903	347,784	360,400	356,465	326,379	292,131
1963	265,044	241,281	228,162	237,510	296,137	304,290	329,586	360,400	360,400	360,400	336,396	305,026
1964	273,668	278,495	268,855	260,703	254,291	217,069	191,863	276,888	360,400	343,750	309,409	275,896
1965	241,813	249,120	319,261	283,925	232,964	177,623	183,699	296,108	360,400	360,400	360,400	333,188
1966	304,353	306,716	299,942	292,395	282,814	287,628	356,592	360,400	360,400	331,450	297,972	265,321
1967	231,906	216,758	249,252	265,475	280,406	324,014	343,546	360,400	360,400	360,400	360,400	335,768
1968	304,053	283,496	274,527	266,857	283,817	286,873	329,080	360,400	360,400	334,325	299,837	267,451
1969	242,147	247,245	244,063	302,446	320,114	330,000	360,400	360,400	360,400	360,400	349,426	317,777
1970	299,296	305,659	324,435	326,065	320,846	322,797	334,670	360,400	360,400	360,400	326,016	290,760
1971	257,964	251,563	267,786	286,658	301,378	302,930	330,322	360,400	360,400	356,465	325,764	292,446
1972	258,839	236,370	228,162	219,353	213,819	244,031	265,495	360,400	360,400	336,426	299,001	267,965
1973	238,190	218,208	225,626	238,473	249,151	261,799	307,249	360,400	360,400	353,990	322,828	286,127
1974	257,794	293,500	316,503	330,000	330,000	330,000	360,400	360,400	360,400	356,465	331,550	295,187
1975	266,912	262,126	266,128	248,443	253,233	271,955	218,363	360,400	360,400	356,465	324,162	290,479
1976	285,385	281,517	272,478	253,215	242,054	233,754	238,104	324,938	314,385	284,316	252,614	222,717
1977	193,779	167,282	139,742	117,657	99,799	78,202	85,462	103,210	144,346	124,287	96,380	69,868
1978	43,507	24,382	32,503	50,915	68,975	112,212	164,152	360,400	360,400	360,400	357,869	356,406
1979	329,957	310,280	293,137	302,038	312,919	330,000	360,400	360,400	360,400	356,097	320,734	284,314
1980	257,725	265,877	274,536	330,000	326,446	330,000	356,592	360,400	360,400	360,400	352,729	320,413
1981	290,796	267,741	254,865	241,410	243,092	239,594	250,218	341,900	356,592	326,381	288,829	253,955
1982	226,746	250,781	287,735	312,861	326,446	330,000	360,400	360,400	360,400	360,400	360,400	360,400
1983	326,065	330,000	330,000	330,000	330,000	330,000	355,110	360,400	360,400	360,400	360,400	355,970
1984	330,000	326,192	301,515	251,330	205,725	189,676	227,004	360,400	360,400	356,465	328,962	296,457
1985	268,372	286,904	294,977	277,357	264,474	261,687	348,828	360,400	360,400	333,535	296,865	266,723
1986	245,402	227,652	236,474	239,341	311,791	326,065	360,400	360,400	360,400	360,400	337,490	304,597
1987	281,194	258,749	232,710	212,948	201,794	191,486	247,637	343,806	353,248	321,619	285,112	249,916
1988	218,130	201,193	197,937	189,208	181,835	187,927	230,788	322,288	351,731	325,880	291,107	257,476
1989	228,478	205,142	187,290	176,843	175,880	221,901	328,424	360,400	360,400	343,974	309,341	284,242
1990	267,935	272,656	277,435	258,063	244,079	253,888	321,588	360,400	360,400	339,162	307,130	280,640
1991	257,447	236,752	220,773	201,620	186,608	192,958	212,319	331,748	360,400	354,429	321,715	294,880
1992	272,636	259,154	242,411	230,916	237,549	235,995	302,519	360,400	355,022	346,244	319,447	297,703
1993	278,750	261,161	253,660	279,592	294,907	330,000	356,592	360,400	360,400	360,400	339,684	305,994
1994	278,714	255,699	235,580	206,856	194,993	199,287	248,143	360,400	360,400	328,106	288,504	253,299
1995	226,108	246,696	263,295	299,588	323,326	326,065	356,592	360,400	360,400	360,400	360,400	341,235
1996	313,102	290,180	289,399	302,383	330,000	326,065	357,776	360,400	360,400	356,465	329,269	295,808
1997	266,385	283,200	301,776	330,000	300,695	281,114	360,400	360,400	360,400	360,400	334,509	301,549
1998	267,747	243,111	234,508	256,700	283,939	330,000	360,400	360,400	360,400	360,400	357,575	336,363
1999	312,379	300,546	283,189	274,898	237,089	183,904	170,253	357,615	360,400	360,400	328,523	295,405
2000	267,514	266,427	263,903	251,200	251,088	247,384	318,690	360,400	360,400	347,257	314,429	280,432
2001	248,366	224,815	212,272	190,495	182,549	206,184	260,155	360,400	360,186	330,828	293,698	259,268
2002	226,907	212,332	221,154	223,929	226,634	230,337	322,554	360,400	360,400	337,536	300,566	266,784
Avg (21-02)	255,904	246,607	243,366	234,942	226,197	219,194	254,171	333,374	350,872	341,109	313,888	283,193

APPENDIX O1

Table 2.3-2

Hetch Hetchy Reservoir Storage (Acre-feet) Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	280,411	273,133	250,957	243,012	190,418	156,484	159,470	275,503	360,400	360,400	328,999	296,132
1922	263,554	239,474	224,744	218,657	223,120	237,696	208,009	360,400	360,400	360,400	338,270	307,157
1923	278,219	258,004	264,081	270,793	275,934	282,536	257,891	360,400	360,400	360,400	335,374	308,545
1924	290,590	267,956	246,473	228,542	217,437	206,672	232,567	319,193	299,564	273,802	240,713	206,954
1925	178,108	170,809	163,868	152,585	181,467	206,969	225,842	360,400	360,400	356,465	336,398	305,731
1926	283,429	266,388	251,261	233,101	224,226	193,028	276,699	360,400	360,400	335,420	302,178	270,343
1927	242,836	240,506	240,191	240,158	267,736	293,484	352,928	360,400	360,400	360,400	335,906	305,535
1928	281,739	286,393	279,420	274,249	271,550	329,719	360,400	360,400	360,400	339,284	307,062	275,931
1929	249,997	227,192	212,086	197,122	186,905	191,676	209,350	360,400	360,400	350,290	318,800	287,725
1930	258,166	235,262	216,614	202,893	202,985	220,974	284,455	356,465	360,400	352,956	321,099	289,912
1931	261,671	242,966	222,186	204,418	192,376	190,297	233,699	328,151	326,987	299,243	266,140	238,628
1932	215,243	193,719	128,322	67,999	42,831	32,420	61,085	231,720	360,400	360,400	335,277	304,222
1933	273,508	252,000	230,146	217,141	206,853	182,105	166,743	200,181	360,400	360,400	328,781	297,686
1934	267,451	246,451	218,992	205,761	189,607	160,228	202,741	257,431	283,334	259,261	229,404	200,246
1935	175,286	169,675	162,484	104,010	69,201	43,091	102,489	260,984	360,400	360,400	333,976	303,626
1936	273,576	253,792	230,244	226,479	181,301	145,902	204,009	360,400	360,400	356,465	330,041	298,414
1937	270,601	249,107	228,767	211,579	167,908	117,966	118,707	360,400	360,400	360,400	329,400	296,775
1938	268,124	247,723	284,031	281,929	231,023	189,521	212,145	360,400	360,400	360,400	354,217	329,018
1939	314,865	306,147	292,907	285,114	281,559	300,846	356,592	360,400	360,400	334,345	303,865	276,815
1940	263,881	245,583	192,045	196,568	151,034	130,959	155,867	360,400	360,400	356,639	324,687	292,798
1941	265,260	244,779	235,495	169,687	125,534	91,292	84,162	313,335	360,400	360,400	343,479	313,352
1942	286,926	281,147	319,229	330,000	330,000	330,000	356,592	360,400	360,400	360,400	341,717	311,266
1943	283,369	281,064	280,888	305,315	322,404	330,000	360,400	360,400	360,400	360,400	337,008	307,394
1944	283,446	263,729	245,490	238,577	242,844	262,836	285,029	360,400	360,400	360,400	331,478	301,749
1945	272,276	269,834	266,760	257,391	236,587	175,803	186,832	312,263	360,400	360,400	337,116	307,472
1946	298,923	313,194	277,762	243,830	179,367	135,427	196,880	360,400	360,400	359,455	329,955	299,722
1947	275,020	268,766	266,516	256,291	258,478	278,846	329,910	360,400	356,592	335,035	302,365	271,816
1948	255,930	245,807	229,831	220,170	206,440	153,592	136,183	258,923	360,400	360,400	327,962	295,366
1949	263,928	242,431	222,739	203,721	178,274	113,920	159,848	293,245	356,592	338,228	305,702	274,661
1950	248,017	229,653	203,967	204,416	151,359	104,230	154,484	312,900	360,400	360,400	326,837	295,032
1951	266,327	330,000	330,000	273,739	223,537	199,065	226,940	352,902	360,400	360,400	328,968	297,507
1952	270,971	254,282	265,208	256,577	201,139	226,846	331,859	360,400	360,400	360,400	353,839	326,515
1953	300,631	278,509	277,588	296,644	302,108	314,750	360,400	360,400	360,400	360,400	332,324	301,476
1954	269,513	247,582	227,840	215,998	226,805	241,051	308,969	360,400	360,400	346,144	313,200	281,430
1955	250,117	228,834	220,830	219,437	220,572	159,061	129,641	227,821	360,400	350,686	318,112	285,351
1956	253,489	233,090	290,850	268,782	213,957	174,362	193,602	360,400	360,400	360,400	349,979	323,594
1957	302,332	288,502	270,158	258,319	275,642	292,503	325,882	360,400	360,400	360,400	329,011	297,001
1958	267,551	250,230	238,122	234,786	254,300	230,793	302,596	360,400	360,400	360,400	356,088	328,214
1959	299,729	277,321	254,820	250,756	220,030	182,778	200,788	240,985	295,567	269,299	234,888	222,167
1960	195,138	173,648	152,513	133,893	107,807	88,465	121,115	216,331	290,212	266,155	233,132	201,024
1961	170,373	151,178	116,885	97,300	92,106	92,793	141,951	236,348	284,141	260,208	235,221	211,711
1962	190,469	175,055	162,758	151,091	175,846	193,205	319,373	360,400	360,400	356,465	328,567	296,435
1963	272,296	250,374	230,167	239,516	298,144	313,908	344,728	360,400	360,400	360,400	338,584	309,330
1964	280,158	284,985	275,345	274,808	275,278	243,860	218,576	293,373	356,592	342,134	309,983	278,588
1965	246,691	234,664	297,938	262,593	211,621	157,081	166,277	281,195	360,400	360,400	360,400	335,306
1966	309,419	309,020	299,715	301,871	283,891	294,508	356,592	360,400	360,400	333,638	302,345	271,809
1967	240,578	231,046	260,686	276,916	291,853	330,000	355,978	360,400	360,400	360,400	360,400	337,886
1968	308,358	287,801	271,744	272,635	297,331	306,191	350,516	360,400	360,400	336,513	304,211	273,939
1969	250,819	260,520	256,387	314,777	330,000	330,000	360,400	360,400	360,400	360,400	351,614	322,081
1970	303,598	290,627	289,425	330,000	330,000	330,000	343,990	360,400	360,400	360,400	328,204	295,064
1971	264,645	257,322	273,546	292,421	307,143	319,256	348,766	360,400	360,400	356,465	327,952	296,750
1972	265,329	248,476	240,268	230,515	228,425	264,440	288,021	360,400	360,400	338,614	303,374	274,452
1973	246,861	232,496	232,826	245,678	256,360	269,008	321,179	360,400	360,400	356,178	327,202	292,614
1974	266,182	301,887	324,891	330,000	330,000	330,000	360,400	360,400	360,400	356,465	333,738	299,491
1975	269,312	245,191	229,214	223,020	232,950	255,478	201,886	356,465	360,400	356,465	326,350	294,783
1976	287,784	282,995	266,869	247,602	236,438	233,942	240,409	329,430	320,991	293,102	263,576	235,784
1977	211,881	191,000	168,216	146,157	128,335	112,542	121,920	141,809	184,960	160,051	130,121	110,883
1978	92,092	72,046	77,314	101,462	124,716	178,418	242,510	360,400	360,400	360,400	360,057	360,400
1979	330,000	310,323	295,083	306,838	317,722	330,000	360,400	360,400	360,400	358,285	325,107	290,802
1980	269,252	258,070	251,507	330,000	326,446	330,000	356,592	360,400	360,400	360,400	354,917	324,717
1981	297,001	273,946	253,982	248,138	256,698	264,712	275,335	360,400	360,400	332,373	297,002	264,239
1982	239,211	262,326	299,280	324,411	326,446	330,000	360,400	360,400	360,400	360,400	360,400	360,400
1983	326,065	330,000	330,000	330,000	330,000	330,000	359,897	360,400	360,400	360,400	360,400	358,088
1984	330,000	326,192	301,515	251,330	205,725	199,414	238,663	360,400	360,400	356,465	331,150	300,761
1985	274,862	274,060	262,155	255,078	251,721	254,736	343,995	360,400	360,400	335,723	301,239	273,210
1986	254,074	241,940	243,674	252,349	328,243	330,000	360,400	360,400	360,400	360,400	339,678	308,901
1987	285,496	263,052	238,915	218,205	206,195	201,690	259,958	358,308	360,400	330,951	296,621	263,532
1988	236,781	225,459	215,116	216,862	217,237	229,133	274,112	360,400	356,592	332,923	300,330	276,174
1989	251,922	230,428	217,332	209,757	211,390	263,214	360,400	360,400	360,400	349,016	318,183	300,442
1990	290,787	276,174	265,731	256,913	252,466	268,079	337,897	360,400	360,400	344,204	316,923	296,870
1991	277,475	255,860	237,549	218,406	203,404	220,219	244,459	360,400	360,400	356,617	327,706	302,708
1992	280,460	271,581	258,644	248,110	257,159	273,680	346,925	360,400	360,400	352,662	323,955	304,049
1993	286,996	268,486	259,605	285,541	300,859	330,000	356,592	360,400	360,400	360,400	341,872	310,298
1994	280,162	257,147	237,028	207,354	205,802	215,899	266,874	360,400	360,400	330,294	292,878	259,786
1995	237,634	238,887	235,508	279,395	309,999	326,065	356,592	360,400	360,400	360,400	360,400	343,353
1996	317,122	294,200	291,087	304,073	330,000	326,065	357,776	360,400	360,400	356,465	331,457	300,112
1997	272,590	289,404	307,981	330,000	300,695	291,579	360,400	360,400	360,400	360,400	336,697	305,853
1998	274,237	252,363	236,673	258,866	286,106	330,000	360,400	360,400	360,400	360,400	359,763	343,429
1999	321,345	308,591	291,234	289,606	251,804	198,620	183,193	360,400	360,400	360,400	330,711	299,709
2000	273,719	253,298	230,795	233,390	241,001	253,471	326,894	360,400	360,400	349,445	318,802	286,920
2001	258,656	237,867	218,236	204,074	204,728	243,680	299,768	360,400	360,400	333,230	298,285	265,969
2002	234,555	219,980	226,900	236,337	245,064	259,327	353,663	360,400	360,400	339,724	304,940	273,272
Avg (21-02)	265,578	253,671	245,075	240,657	234,512	232,346	267,303	337,298	352,928	344,130	318,964	290,795

APPENDIX O1

Table 2.3-3

Difference in Hetch Hetchy Reservoir Storage (Acre-feet) WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	-9,246	-8,325	-8,325	-8,329	-8,334	-7,301	-6,165	-5,156	0	0	-2,188	-4,304
1922	-5,253	-7,095	-5,192	-6,146	-6,150	-6,150	-6,150	0	0	0	-2,188	-4,304
1923	-4,303	-1,540	-1,540	-1,541	-1,542	-16,859	-16,859	0	0	0	-2,188	-4,304
1924	-3,351	-3,351	-5,254	-4,305	-3,448	-9,252	-9,667	-7,016	-9,128	-11,305	-13,472	-15,575
1925	-17,755	1,579	21,558	15,769	-1,490	-13,001	-11,427	0	0	0	-2,188	-4,304
1926	-9,344	-14,961	-7,378	-13,185	-22,448	-38,341	-32,994	-24,304	-2,846	-5,031	-7,213	-9,325
1927	-11,222	-10,302	-10,301	-15,064	-15,073	-21,733	-24,494	0	0	0	-2,188	-4,304
1928	-7,251	-7,252	-4,920	-8,728	-13,030	-18,738	-2,582	0	0	-2,188	-4,373	-6,487
1929	-11,241	-13,083	-14,985	-16,896	-18,625	-24,428	-26,545	-13,060	0	-2,188	-4,374	-6,488
1930	-8,673	10,661	30,639	24,854	15,330	3,819	1,701	0	0	-2,188	-4,373	-6,488
1931	-8,673	-14,289	-7,202	-13,009	-18,258	-24,061	-26,178	-28,351	-30,446	-32,597	-34,738	-41,418
1932	-49,957	-52,719	-29,168	-23,642	-8,354	-5,115	-2,831	-2,047	0	0	-2,188	-4,304
1933	-3,351	-3,351	3,737	-3,872	-10,749	-16,552	-14,214	-11,906	0	0	-2,188	-4,304
1934	-6,490	-12,107	-16,394	-22,866	-28,003	-31,226	-17,285	-19,463	-21,558	-23,711	-25,858	-27,946
1935	-32,972	-13,638	6,341	4,926	3,888	-3,341	-2,155	-1,638	0	0	-2,188	-4,304
1936	-6,490	-11,093	-3,899	-11,595	-11,272	-9,690	-8,173	0	0	0	-2,188	-4,304
1937	-8,108	-9,949	-11,842	-15,654	-13,885	-11,642	-9,574	-5,254	0	0	-2,188	-4,304
1938	-6,205	-6,205	-7,916	-13,628	-13,635	-13,597	-11,979	0	0	0	-2,188	-4,304
1939	-2,399	-1,479	1,375	-1,478	-4,057	-9,861	3,808	0	0	-2,188	-4,373	-6,488
1940	-8,672	10,662	30,715	16,444	14,582	12,241	10,336	0	0	-2,188	-4,374	-6,488
1941	-4,582	-3,661	-3,051	-3,053	-2,610	-2,189	-1,670	-1,249	0	0	-2,188	-4,304
1942	-6,681	-6,681	-5,539	0	0	0	0	0	0	0	-2,188	-4,304
1943	-6,205	-5,284	1,803	1,804	1,805	0	0	0	0	0	-2,188	-4,304
1944	-6,205	-5,284	-5,284	-7,190	-14,240	-29,557	-31,675	0	0	0	-2,188	-4,304
1945	-3,826	15,508	35,486	29,700	15,967	15,967	14,052	12,289	0	0	-2,188	-4,304
1946	-9,344	-11,185	-11,186	-11,192	-11,199	-9,551	-8,057	0	0	-2,188	-4,374	-6,487
1947	-7,436	-9,278	-9,278	-8,332	-11,774	-22,334	-24,451	0	0	-2,188	-4,374	-6,487
1948	-8,672	-14,288	-7,201	-11,961	-14,546	-16,022	-13,526	-11,326	0	0	-2,188	-4,304
1949	-6,491	-12,106	-14,960	-14,023	-13,172	-11,152	-8,918	-7,464	0	-2,188	-4,374	-6,488
1950	-10,289	9,044	29,153	13,472	11,935	10,014	8,067	6,759	0	-800	-2,988	-5,103
1951	-7,289	0	0	0	0	-8,563	-7,527	-7,523	0	0	-2,188	-4,304
1952	-7,252	-7,251	-8,964	-4,487	-4,490	-4,490	-13,696	0	0	0	-2,188	-4,304
1953	-6,205	-5,284	-5,284	-5,287	-5,289	-20,606	-1,931	0	0	0	-2,188	-4,304
1954	-2,495	-2,494	-2,494	-5,350	-10,681	-21,241	-23,359	0	0	-2,188	-4,373	-6,487
1955	-5,533	13,801	29,022	12,581	-2,278	-8,081	-6,815	-5,700	0	-2,188	-4,374	-6,488
1956	-8,673	-14,289	-6,886	-6,890	-6,894	-6,002	-5,052	0	0	0	-2,188	-4,304
1957	-7,252	-7,251	-9,154	-12,965	-20,019	-30,579	-32,696	0	0	0	-2,188	-4,304
1958	-5,253	-8,016	-928	-10,442	-10,448	-10,448	-10,448	0	0	0	-2,188	-4,304
1959	-4,302	-4,302	-4,302	-7,159	-7,163	-22,479	-19,260	-5,774	-7,885	-10,062	-12,233	-14,336
1960	-16,515	2,818	22,797	17,012	8,159	3,649	2,785	-800	-2,916	-5,100	-7,279	-9,389
1961	-11,572	-17,188	-1,506	-7,311	-16,858	-22,661	-24,778	-26,934	-29,021	-31,161	-36,149	-45,591
1962	-55,363	-65,583	-70,339	-74,228	-77,753	-95,828	-103,470	-12,616	0	0	-2,188	-4,304
1963	-7,252	-9,093	-2,005	-2,006	-2,007	-9,618	-15,142	0	0	0	-2,188	-4,304
1964	-6,490	-6,490	-6,490	-14,105	-20,987	-26,791	-26,713	-16,485	3,808	1,616	-574	-2,692
1965	-4,878	14,456	21,323	21,332	21,343	20,542	17,422	14,913	0	0	0	-2,118
1966	-5,066	-2,304	227	-9,476	-1,077	-6,880	0	0	0	-2,188	-4,373	-6,488
1967	-8,672	-14,288	-11,434	-11,441	-11,447	-5,986	-12,432	0	0	0	0	-2,118
1968	-4,305	-4,305	2,783	-5,778	-13,514	-19,318	-21,436	0	0	-2,188	-4,374	-6,488
1969	-8,672	-13,275	-12,324	-12,331	-9,886	0	0	0	0	0	-2,188	-4,304
1970	-4,302	15,032	35,010	-3,935	-9,154	-7,203	-9,320	0	0	0	-2,188	-4,304
1971	-6,681	-5,759	-5,760	-5,763	-5,765	-16,326	-18,444	0	0	0	-2,188	-4,304
1972	-6,490	-12,106	-12,106	-11,162	-14,606	-20,409	-22,526	0	0	-2,188	-4,373	-6,487
1973	-8,671	-14,288	-7,200	-7,205	-7,209	-7,209	-13,930	0	0	-2,188	-4,374	-6,487
1974	-8,388	-8,387	-8,388	0	0	0	0	0	0	0	-2,188	-4,304
1975	-2,400	16,935	36,914	25,423	20,283	16,477	16,477	3,935	0	0	-2,188	-4,304
1976	-2,399	-1,478	5,609	5,613	5,616	-188	-2,305	-4,492	-6,606	-8,786	-10,962	-13,067
1977	-18,102	-23,718	-28,474	-28,500	-28,536	-34,340	-36,458	-38,599	-40,614	-35,764	-33,741	-41,015
1978	-48,585	-47,664	-44,811	-50,547	-55,741	-66,206	-78,358	0	0	0	-2,188	-3,994
1979	-43	-43	-1,946	-4,800	-4,803	0	0	0	0	-2,188	-4,373	-6,488
1980	-11,527	7,807	23,029	0	0	0	0	0	0	0	-2,188	-4,304
1981	-6,205	-6,205	883	-6,728	-13,606	-25,118	-25,117	-18,500	-3,808	-5,992	-8,173	-10,284
1982	-12,465	-11,545	-11,545	-11,550	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	-4,787	0	0	0	0	-2,118
1984	0	0	0	0	0	-9,738	-11,659	0	0	0	-2,188	-4,304
1985	-6,490	12,844	32,822	22,279	12,753	6,951	4,833	0	0	-2,188	-4,374	-6,487
1986	-8,672	-14,288	-7,200	-13,008	-16,452	-3,935	0	0	0	0	-2,188	-4,304
1987	-4,302	-4,303	-6,205	-5,257	-4,401	-10,204	-12,321	-14,502	-7,152	-9,332	-11,509	-13,616
1988	-18,651	-24,266	-17,179	-27,654	-35,402	-41,206	-43,324	-38,112	-4,861	-7,043	-9,223	-18,698
1989	-23,444	-25,286	-30,042	-32,914	-35,510	-41,313	-31,976	0	0	-5,042	-8,842	-16,200
1990	-22,852	-3,518	11,704	1,150	-8,387	-14,191	-16,309	0	0	-5,042	-9,793	-16,230
1991	-20,028	-19,108	-16,776	-16,786	-16,796	-27,261	-32,140	-28,652	0	-2,188	-5,991	-7,828
1992	-7,824	-12,427	-16,233	-17,194	-19,610	-37,685	-44,406	0	-5,378	-6,418	-4,508	-6,346
1993	-8,246	-7,325	-5,945	-5,949	-5,952	0	0	0	0	0	-2,188	-4,304
1994	-1,448	-1,448	-1,448	-498	-10,809	-16,612	-18,731	0	0	-2,188	-4,374	-6,487
1995	-11,526	7,809	27,787	20,193	13,327	0	0	0	0	0	0	-2,118
1996	-4,020	-4,020	-1,688	-1,690	0	0	0	0	0	0	-2,188	-4,304
1997	-6,205	-6,204	-6,205	0	0	-10,465	0	0	0	0	-2,188	-4,304
1998	-6,490	-9,252	-2,165	-2,166	-2,167	0	0	0	0	0	-2,188	-7,066
1999	-8,966	-8,045	-8,045	-14,708	-14,715	-14,716	-12,940	-2,785	0	0	-2,188	-4,304
2000	-6,205	13,129	33,108	17,810	10,087	-6,087	-8,204	0	0	-2,188	-4,373	-6,488
2001	-10,290	-13,052	-5,964	-13,579	-22,179	-37,496	-39,613	0	-214	-2,402	-4,587	-6,701
2002	-7,648	-7,648	-5,746	-12,408	-18,430	-28,990	-31,109	0	0	-2,188	-4,374	-6,488
Avg (21-02)	-9,674	-7,064	-1,709	-5,714	-8,315	-13,152	-13,132	-3,925	-2,056	-3,021	-5,076	-7,602

APPENDIX O1

Table 2.3-3 illustrates the difference in Hetch Hetchy Reservoir storage between the WSIP and base settings. Immediately after Hetch Hetchy Reservoir is filled (May or June, and then continuing through July), occasional differences in storage would occur, typically during a multi-year drought sequence or during an occasional single year when the reservoir does not fill. No reduction in yearly storage during that period would indicate that the same amount of water is being passed through the reservoir, regardless of the size of the conveyance capacity of the SJPL or the purchase requests. Water not diverted to the SJPL would return to the Tuolumne River at Kirkwood Powerhouse or Moccasin Reservoir and flow to Don Pedro Reservoir. In the late summer and early fall, storage levels would consistently be slightly different (lower) between the two settings, as additional diversions to the SJPL would retain Bay Area reservoir storage. The additional storage depletion would be somewhat ameliorated later in the fall and into winter as SJPL diversions are reduced because of lower Bay Area reservoir replenishment needs and conveyance system maintenance. The storage difference would become almost neutral in December with the WSIP setting because of the additional conveyance maintenance that would occur under the WSIP (which does not occur in the base setting). The maintenance impairs diversions to the SJPL. After December, storage in the reservoir associated with the WSIP setting again would be affected as replenishment of Bay Area reservoir storage resumes following the maintenance period and because of increased purchase requests. During drier years, there is a difference in storage between the WSIP and base settings; the WSIP setting results in a lower amount of storage in the reservoir by the end of April. Figure 2.3-2 illustrates the reservoir storage, averaged by year type, for the WSIP setting. Figure 2.3-3 illustrates the average difference in storage, averaged by year type, for the two settings. Figure 2.3-4 illustrates the average monthly storage in Hetch Hetchy Reservoir for the 82-year simulation, and the range in storage for each month for the WSIP and base settings.

Figure 2.3-2

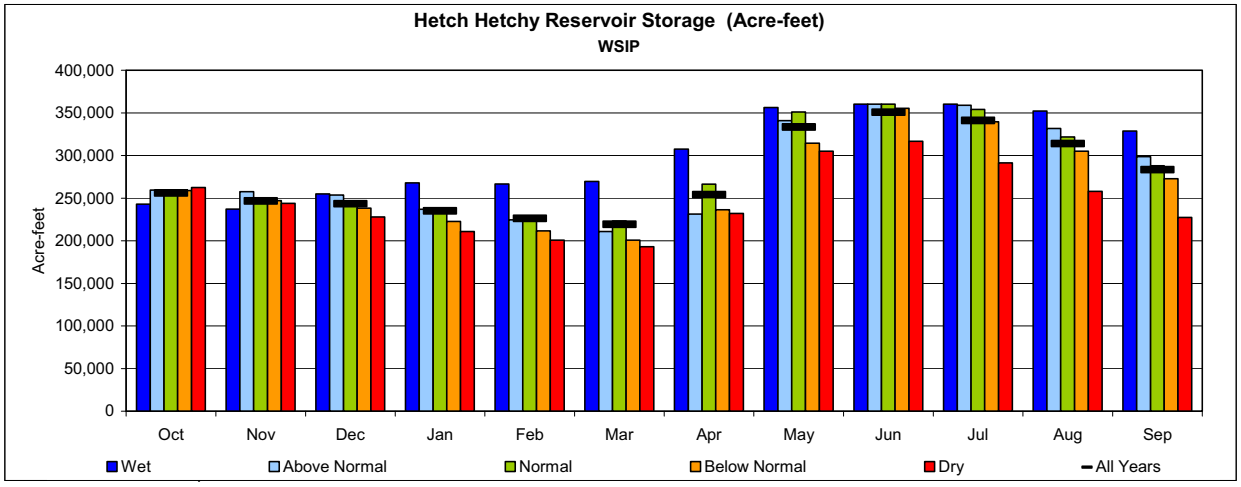


Figure 2.3-3

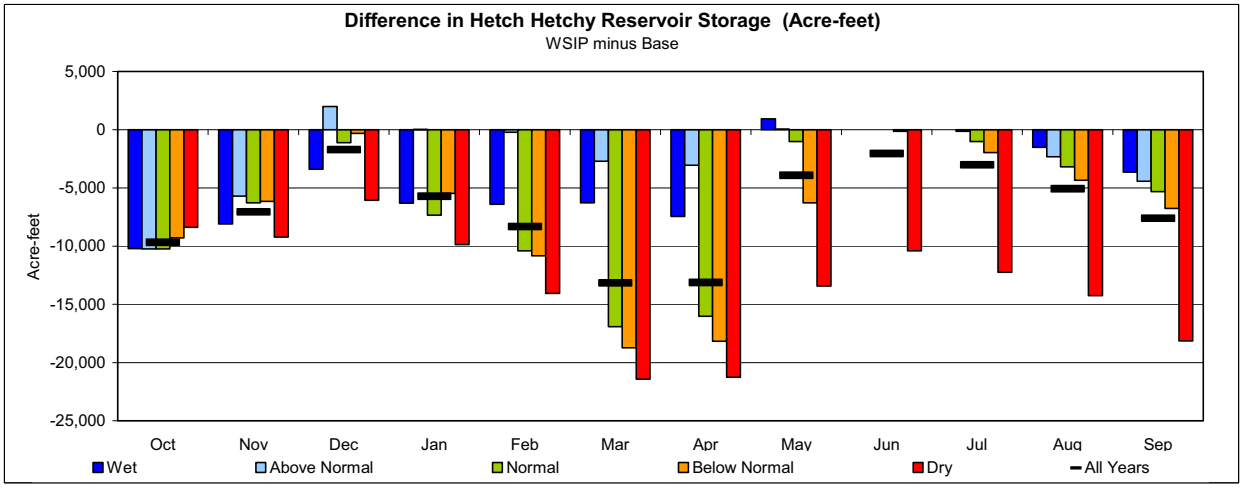
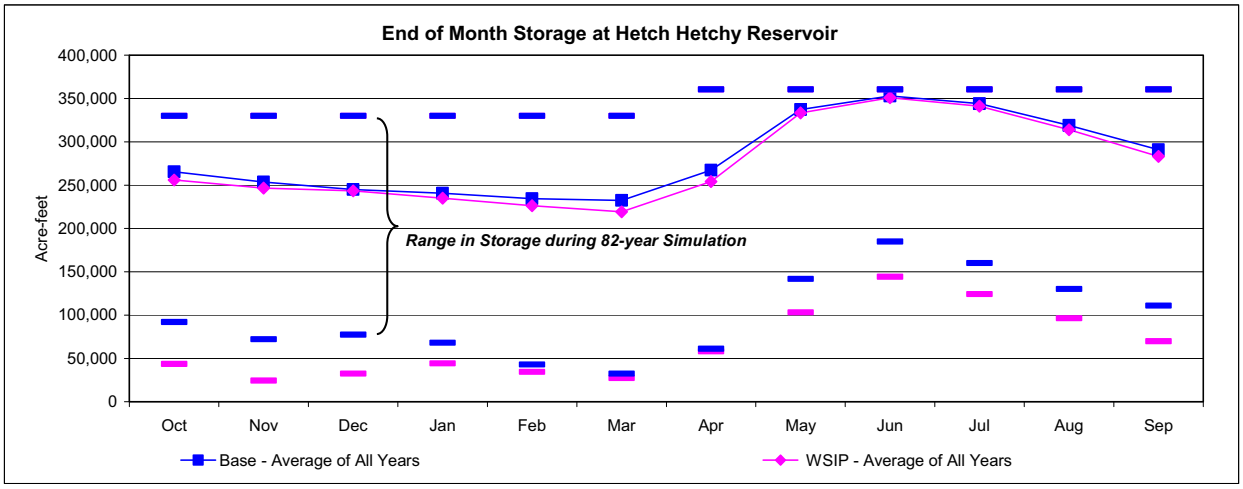


Figure 2.3-4



The difference in storage in Hetch Hetchy Reservoir attributed to the diversion effects of the WSIP would manifest in differences in releases from O'Shaughnessy Dam to the stream. A different amount of available reservoir space in the winter and spring due to the WSIP would lead to a different ability to regulate inflow, thus potentially changing the amount of water released to the stream (the amount which is above minimum release requirements). Figure 2.3-1 illustrates the stream releases from O'Shaughnessy Dam for the WSIP and base settings. Supplementing Figure 2.3-1 are Table 2.3-4 and Table 2.3-5, which show the stream releases from O'Shaughnessy Dam for the WSIP and base settings. Table 2.3-6 illustrates the difference in stream releases between the WSIP and base settings. Compared to the base setting, the WSIP setting typically results in a lesser stream release, predominantly during May or June, which reflects the months when releases to the stream above minimum release requirements are made in anticipation of the reservoir being filled. In a few exceptions to this circumstance, an increase in releases to the stream occurs. Several of these exceptions are considered anomalous within modeling, the result of only shifting releases from one month to another. The other exceptions occur due to the balancing of reservoir storage among the Hetch Hetchy system and the Bay Area reservoirs. The decrease in releases is the result of a more depleted reservoir, which is the result of greater demands between the settings.

Table 2.3-6 illustrates the difference in stream releases between the WSIP and base settings, expressed in terms of a monthly volume (acre-feet) of flow. The difference in monthly flow below O'Shaughnessy Dam indicates a potential change in releases between the WSIP and base settings, ranging from a decrease of approximately 40,000 acre-feet to an increase of approximately 14,900 acre-feet. Considering the manner in which releases are determined and made to the stream, quantifying the effect of these changes in terms of average monthly flow (in cubic feet per second [cfs]) is not always meaningful.[1] Assuming that a change in release volume equates to a delay or earlier initiation of releasing 6,000 acre-feet per day, the difference in stream releases from O'Shaughnessy Dam between the WSIP and base settings would range from delayed releases of up to 7 days to an addition of up to 2 days of release. Normally, the effect of a delay in release would not affect the year's peak stream release rate during a year.

[1] See "Estimated Effect of WSIP on Daily Releases below Hetch Hetchy Reservoir," Memorandum by Daniel B. Steiner, December 31, 2006.

APPENDIX O1

Table 2.3-4

Hetch Hetchy Reservoir Release to Stream (Acre-feet) WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	3,074	2,975	2,460	3,074	6,916	7,624	8,271	10,084	98,913	7,686	7,686	5,316	164,079
1922	3,689	3,570	3,074	3,074	3,362	3,689	8,271	52,095	312,197	28,813	7,686	5,316	434,836
1923	3,689	3,570	3,074	3,074	3,362	3,689	7,676	39,054	95,231	16,928	7,686	5,316	192,349
1924	3,689	3,570	3,074	2,152	1,961	2,152	2,083	3,074	4,463	4,612	4,612	3,669	39,111
1925	2,152	2,083	2,152	3,074	3,362	3,689	8,271	56,758	149,864	11,621	7,686	5,316	256,028
1926	3,689	3,570	3,074	2,460	2,802	7,624	7,676	8,854	6,545	6,764	6,764	4,284	64,106
1927	3,074	2,975	2,460	3,074	3,362	3,689	4,463	118,928	238,640	13,543	7,686	5,316	407,210
1928	3,689	3,570	3,074	3,074	3,362	3,689	4,463	181,693	19,601	7,686	6,764	4,284	244,949
1929	3,074	2,975	2,460	2,460	1,961	2,152	2,083	4,919	38,258	6,764	6,764	4,284	78,154
1930	3,074	2,975	2,460	2,152	2,802	3,074	3,868	8,854	102,907	6,764	6,764	4,284	149,978
1931	3,074	2,975	2,460	2,152	2,802	2,152	2,083	3,074	4,463	4,612	4,612	3,669	38,128
1932	2,152	2,083	2,152	7,009	3,362	3,689	4,463	6,149	114,929	24,366	7,686	5,316	183,356
1933	3,689	3,570	3,074	2,152	2,802	2,152	2,083	3,074	17,729	6,764	6,764	4,284	58,137
1934	3,074	2,975	2,460	2,460	2,802	7,009	3,868	4,919	6,545	4,612	4,612	3,669	49,005
1935	2,152	2,083	2,152	7,009	6,916	7,624	4,463	10,084	136,065	7,686	7,686	5,316	199,236
1936	3,689	3,570	3,074	2,460	6,356	7,624	8,271	38,045	164,181	11,621	7,686	5,316	261,893
1937	3,689	3,570	3,074	3,074	6,916	7,624	8,271	10,084	154,062	7,686	7,686	5,316	221,052
1938	3,689	3,570	3,074	3,074	6,916	7,624	8,271	58,406	350,036	112,643	7,686	5,316	570,305
1939	3,689	3,570	3,074	2,460	2,802	3,074	3,868	41,832	6,545	6,764	6,764	4,284	88,726
1940	3,074	2,975	2,460	2,460	6,916	7,624	8,271	40,199	145,292	7,686	7,686	5,316	239,959
1941	3,689	3,570	3,074	7,009	6,916	7,624	8,271	10,084	200,571	67,763	7,686	5,316	331,573
1942	3,689	3,570	3,074	3,074	3,362	3,689	8,271	105,473	283,373	86,094	7,686	5,316	516,671
1943	3,689	3,570	3,074	3,074	3,362	3,689	23,247	197,709	148,920	18,174	7,686	5,316	421,510
1944	3,689	3,570	3,074	2,460	2,802	3,074	3,868	24,276	79,627	6,764	6,764	4,284	144,252
1945	3,074	2,975	2,460	3,074	6,916	7,624	8,271	10,084	184,630	31,926	7,686	5,316	274,036
1946	3,689	3,570	7,009	7,009	6,916	7,624	8,271	12,189	85,083	7,686	7,686	5,316	162,048
1947	3,689	3,570	3,074	3,074	3,362	3,689	4,463	86,043	10,353	6,764	6,764	4,284	139,129
1948	3,074	2,975	2,460	2,460	2,802	7,009	7,676	10,084	65,929	7,686	7,686	5,316	125,157
1949	3,689	3,570	3,074	2,460	2,802	7,009	7,676	8,854	10,353	6,764	6,764	4,284	67,299
1950	3,074	2,975	2,460	2,460	6,916	7,009	8,271	10,084	80,211	7,686	7,686	5,316	144,148
1951	3,689	34,010	42,960	7,009	6,916	7,624	8,271	10,084	87,710	7,686	7,686	5,316	228,961
1952	3,689	3,570	3,074	3,074	6,916	3,689	4,463	209,387	238,065	106,256	7,686	5,316	595,185
1953	3,689	3,570	3,074	3,074	3,362	3,074	3,868	26,262	168,768	29,365	7,686	5,316	261,108
1954	3,689	3,570	3,074	2,460	2,802	3,074	4,463	82,272	27,809	6,764	6,764	4,284	151,025
1955	3,074	2,975	2,460	3,074	3,362	7,009	7,676	8,854	6,545	6,764	6,764	4,284	62,841
1956	3,074	2,975	6,395	7,009	6,916	7,624	8,271	12,723	310,301	94,682	7,686	5,316	472,972
1957	3,689	3,570	3,074	2,152	1,961	2,152	3,868	17,650	183,319	7,686	6,764	4,284	240,169
1958	3,074	2,975	2,460	3,074	3,362	3,689	4,463	178,371	221,860	55,443	7,686	5,316	491,773
1959	3,689	3,570	3,074	2,152	1,961	7,009	7,676	8,854	6,545	6,764	6,764	4,284	62,342
1960	3,074	2,975	2,460	2,152	1,961	2,152	7,676	8,854	6,545	6,764	6,764	4,284	55,661
1961	3,074	2,975	2,460	3,074	2,802	2,152	3,868	4,919	6,545	4,612	4,612	3,669	44,762
1962	2,152	2,083	2,152	2,460	1,961	3,689	4,463	6,149	188,681	11,621	7,686	5,316	238,413
1963	3,689	3,570	3,074	2,152	2,802	3,689	4,463	118,067	203,340	36,602	7,686	5,316	394,450
1964	3,689	3,570	3,074	3,074	3,362	3,074	7,676	8,854	6,545	6,764	6,764	4,284	60,730
1965	3,074	2,975	6,395	7,009	6,916	7,624	8,271	10,084	126,387	61,519	7,686	5,316	253,256
1966	3,689	3,570	3,074	3,074	3,362	3,689	7,676	123,555	6,545	6,764	6,764	4,284	176,046
1967	3,074	2,975	2,460	3,074	3,362	3,689	4,463	146,692	270,669	185,208	7,686	5,316	638,668
1968	3,689	3,570	3,074	2,460	2,802	3,074	3,868	49,547	14,833	6,764	6,764	4,284	104,729
1969	3,074	2,975	2,460	3,074	3,362	3,689	12,681	344,502	300,076	115,876	7,686	5,316	804,771
1970	3,689	3,570	3,074	7,009	3,362	3,689	4,463	105,428	124,926	7,686	7,686	5,316	279,898
1971	3,689	3,570	3,074	3,074	3,362	3,689	4,463	52,458	177,149	11,621	7,686	5,316	279,151
1972	3,689	3,570	3,074	3,074	3,362	3,074	3,868	10,254	57,109	6,764	6,764	4,284	108,886
1973	3,074	2,975	2,460	3,074	3,362	3,689	4,463	190,830	159,403	7,686	7,686	5,316	394,018
1974	3,689	3,570	3,074	3,074	3,362	3,689	4,463	201,034	194,704	11,621	7,686	5,316	445,282
1975	3,689	3,570	3,074	3,074	2,802	3,689	8,271	14,107	247,984	11,621	7,686	5,316	314,883
1976	3,689	3,570	3,074	3,074	1,961	2,152	2,083	3,074	4,463	4,612	4,612	3,669	40,033
1977	2,152	2,083	2,152	2,152	1,961	2,152	2,083	3,074	4,463	4,612	4,612	3,669	35,165
1978	2,152	2,083	2,152	3,074	3,362	3,689	4,463	6,149	298,570	132,949	7,686	5,316	471,645
1979	3,689	3,570	3,074	2,460	3,362	3,689	4,463	220,976	107,368	7,686	7,686	5,316	373,339
1980	3,689	3,570	3,074	3,074	6,916	3,689	8,271	133,323	235,879	148,920	7,686	5,316	563,407
1981	3,689	3,570	3,074	2,152	2,802	3,074	7,676	8,854	10,353	6,764	6,764	4,284	63,056
1982	3,074	2,975	2,460	3,074	6,916	3,689	26,103	228,913	254,131	108,434	7,686	5,316	652,771
1983	7,624	3,570	3,074	3,074	3,362	3,689	4,463	175,217	463,488	302,677	61,509	5,316	1,037,063
1984	3,689	7,378	7,009	7,009	6,916	7,624	4,463	113,013	130,916	11,621	7,686	5,316	312,640
1985	3,689	3,570	3,074	3,074	3,362	3,074	4,463	104,203	12,733	6,764	6,764	4,284	159,054
1986	3,074	2,975	2,460	3,074	3,362	7,624	17,050	228,842	263,786	12,678	7,686	5,316	557,927
1987	3,689	3,570	3,074	2,152	1,961	2,152	2,083	3,074	4,463	4,612	4,612	3,669	39,111
1988	2,152	2,083	2,152	3,074	3,362	3,074	2,083	4,919	6,545	4,612	4,612	3,669	42,337
1989	2,152	2,083	2,152	3,074	2,802	3,074	4,463	89,012	62,889	7,686	6,764	4,284	190,435
1990	3,074	2,975	2,460	2,460	2,802	3,074	2,083	3,074	4,463	4,612	4,612	3,669	39,358
1991	2,152	2,083	2,152	2,152	1,961	2,152	3,868	4,919	74,555	6,764	6,764	4,284	113,806
1992	3,074	2,975	2,460	2,460	2,802	3,074	3,868	3,074	4,463	4,612	4,612	3,669	41,143
1993	2,152	2,083	2,152	3,074	3,362	3,689	8,271	213,205	204,082	44,068	7,686	5,316	499,140
1994	3,689	3,570	3,074	2,460	1,961	2,152	2,083	3,074	4,463	4,612	4,612	3,669	39,419
1995	2,152	2,083	2,152	3,074	3,362	7,624	8,271	131,296	334,396	294,086	11,843	5,316	805,655
1996	3,689	3,570	3,074	2,460	3,362	7,624	8,271	190,622	169,121	11,621	7,686	5,316	416,416
1997	3,689	3,570	3,074	110,603	6,916	7,624	4,463	231,648	146,890	7,686	7,686	5,316	539,165
1998	3,689	3,570	3,074	2,460	3,362	3,689	4,463	64,194	312,909	217,820	7,686	5,316	632,232
1999	3,689	3,570	3,074	2,460	6,916	7,624	8,271	10,084	166,036	7,686	7,686	5,316	232,412
2000	3,689	3,570	3,074	2,152	3,362	3,689	4,463	136,496	97,677	7,686	7,686	5,316	278,860
2001	3,689	3,570	3,074	2,460	2,802	3,074	3,868	48,240	6,545	6,764	6,764	4,284	95,134
2002	3,074	2,975	2,460	3,074	3,362	3,689	4,463	91,804	64,932	7,686	6,764	4,284	198,567
Avg (21-02)	3,351	3,614	3,449	4,514	3,861	4,506	6,199	68,039	123,274	33,709	7,711	4,793	267,021

APPENDIX O1

Table 2.3-5

Hetch Hetchy Reservoir Release to Stream (Acre-feet)

Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	3,074	2,975	2,460	3,074	6,916	7,624	8,271	10,084	104,064	7,686	7,686	5,316	169,230
1922	3,689	3,570	3,074	3,074	3,362	3,689	8,271	57,465	312,197	28,813	7,686	5,316	440,206
1923	3,689	3,570	3,074	3,074	3,362	3,689	7,676	55,903	95,231	16,928	7,686	5,316	209,198
1924	3,689	3,570	3,074	2,152	1,961	2,152	2,083	3,074	4,463	4,612	4,612	3,669	39,111
1925	2,152	2,083	2,152	3,074	3,362	3,689	8,271	67,753	149,864	11,621	7,686	5,316	267,023
1926	3,689	3,570	3,074	2,460	2,802	7,624	7,676	11,767	6,545	6,764	6,764	4,284	67,019
1927	3,074	2,975	2,460	3,074	3,362	3,689	4,463	144,018	238,640	13,543	7,686	5,316	432,300
1928	3,689	3,570	3,074	3,074	3,362	3,689	4,463	184,434	19,601	7,686	6,764	4,284	247,690
1929	3,074	2,975	2,460	2,460	1,961	2,152	2,083	4,919	52,130	6,764	6,764	4,284	92,026
1930	3,074	2,975	2,460	2,152	2,802	3,074	3,868	8,854	102,907	6,764	6,764	4,284	149,978
1931	3,074	2,975	2,460	2,152	2,802	2,152	2,083	3,074	4,463	4,612	4,612	3,669	38,128
1932	2,152	2,083	2,152	7,009	6,916	3,689	4,463	6,149	116,974	24,366	7,686	5,316	188,955
1933	3,689	3,570	3,074	2,152	2,802	2,152	2,083	3,074	28,182	6,764	6,764	4,284	68,590
1934	3,074	2,975	2,460	2,460	2,802	7,009	3,868	4,919	6,545	4,612	4,612	3,669	49,005
1935	2,152	2,083	2,152	7,009	6,916	3,689	4,463	10,084	137,701	7,686	7,686	5,316	196,937
1936	3,689	3,570	3,074	2,460	6,356	7,624	8,271	45,190	164,181	11,621	7,686	5,316	269,038
1937	3,689	3,570	3,074	3,074	6,916	7,624	8,271	12,743	159,632	7,686	7,686	5,316	229,281
1938	3,689	3,570	3,074	3,074	6,916	7,624	8,271	68,866	350,036	112,643	7,686	5,316	580,765
1939	3,689	3,570	3,074	2,460	2,802	3,074	7,676	37,787	6,545	6,764	6,764	4,284	88,489
1940	3,074	2,975	2,460	2,460	6,916	7,624	8,271	31,527	145,292	7,686	7,686	5,316	231,287
1941	3,689	3,570	3,074	7,009	6,916	7,624	8,271	10,084	201,819	67,763	7,686	5,316	332,821
1942	3,689	3,570	3,074	3,074	3,362	3,689	8,271	105,473	283,373	86,094	7,686	5,316	516,671
1943	3,689	3,570	3,074	3,074	3,362	3,689	23,247	197,709	148,920	18,174	7,686	5,316	421,510
1944	3,689	3,570	3,074	2,460	2,802	3,074	3,868	55,934	79,627	6,764	6,764	4,284	175,910
1945	3,074	2,975	2,460	3,074	6,916	7,624	8,271	10,084	172,351	31,926	7,686	5,316	261,757
1946	3,689	3,570	7,009	7,009	6,916	7,624	8,271	19,234	85,083	7,686	7,686	5,316	169,093
1947	3,689	3,570	3,074	3,074	3,362	3,689	4,463	110,484	10,353	6,764	6,764	4,284	163,570
1948	3,074	2,975	2,460	2,460	2,802	7,009	7,676	10,084	77,241	7,686	7,686	5,316	136,469
1949	3,689	3,570	3,074	2,460	2,802	7,009	7,676	8,854	10,353	6,764	6,764	4,284	67,299
1950	3,074	2,975	2,460	2,460	6,916	7,009	8,271	10,084	73,459	7,686	7,686	5,316	137,396
1951	3,689	41,299	42,960	7,009	6,916	7,624	8,271	10,084	95,720	7,686	7,686	5,316	244,260
1952	3,689	3,570	3,074	3,074	6,916	3,689	4,463	223,078	238,065	106,256	7,686	5,316	608,876
1953	3,689	3,570	3,074	3,074	3,362	3,074	3,868	28,311	168,768	29,365	7,686	5,316	263,157
1954	3,689	3,570	3,074	2,460	2,802	3,074	4,463	105,620	27,809	6,764	6,764	4,284	174,373
1955	3,074	2,975	2,460	3,074	3,362	7,009	7,676	8,854	6,545	6,764	6,764	4,284	62,841
1956	3,074	2,975	6,395	7,009	6,916	7,624	8,271	17,135	310,301	94,682	7,686	5,316	477,384
1957	3,689	3,570	3,074	2,152	1,961	2,152	3,868	50,333	183,319	7,686	6,764	4,284	272,852
1958	3,074	2,975	2,460	3,074	3,362	3,689	4,463	188,814	221,860	55,443	7,686	5,316	502,216
1959	3,689	3,570	3,074	2,152	1,961	7,009	7,676	8,854	6,545	6,764	6,764	4,284	62,342
1960	3,074	2,975	2,460	2,152	1,961	2,152	7,676	8,854	6,545	6,764	6,764	4,284	55,661
1961	3,074	2,975	2,460	3,074	2,802	2,152	3,868	4,919	6,545	4,612	4,612	3,669	44,762
1962	2,152	2,083	2,152	2,460	1,961	3,689	4,463	45,687	202,079	11,621	7,686	5,316	291,349
1963	3,689	3,570	3,074	2,152	2,802	3,689	4,463	133,252	203,340	36,602	7,686	5,316	409,635
1964	3,689	3,570	3,074	3,074	3,362	3,074	7,676	8,854	10,353	6,764	6,764	4,284	64,538
1965	3,074	2,975	6,395	7,009	6,916	7,624	8,271	10,084	111,487	61,519	7,686	5,316	238,356
1966	3,689	3,570	3,074	3,074	3,362	3,689	7,676	123,555	6,545	6,764	6,764	4,284	176,046
1967	3,074	2,975	2,460	3,074	3,362	3,689	4,463	159,921	270,669	185,208	7,686	5,316	651,897
1968	3,689	3,570	3,074	2,460	2,802	3,074	3,868	71,420	14,833	6,764	6,764	4,284	126,602
1969	3,074	2,975	2,460	3,074	3,362	3,689	12,681	344,502	300,076	115,876	7,686	5,316	804,771
1970	3,689	3,570	3,074	3,074	3,362	3,689	4,463	114,745	124,926	7,686	7,686	5,316	285,280
1971	3,689	3,570	3,074	3,074	3,362	3,689	4,463	71,223	177,149	11,621	7,686	5,316	297,916
1972	3,689	3,570	3,074	3,074	3,362	3,074	3,868	32,769	57,109	6,764	6,764	4,284	131,401
1973	3,074	2,975	2,460	3,074	3,362	3,689	4,463	204,754	159,403	7,686	7,686	5,316	407,942
1974	3,689	3,570	3,074	3,074	3,362	3,689	4,463	201,034	194,704	11,621	7,686	5,316	445,282
1975	3,689	3,570	3,074	3,074	2,802	3,689	8,271	10,084	243,813	11,621	7,686	5,316	306,689
1976	3,689	3,570	3,074	3,074	1,961	2,152	2,083	3,074	4,463	4,612	4,612	3,669	40,033
1977	2,152	2,083	2,152	2,152	1,961	2,152	2,083	3,074	4,463	4,612	4,612	3,669	35,165
1978	2,152	2,083	2,152	3,074	3,362	3,689	4,463	45,254	298,570	132,949	7,686	5,626	511,060
1979	3,689	3,570	3,074	2,460	3,362	3,689	4,463	220,976	107,368	7,686	7,686	5,316	373,339
1980	3,689	3,570	3,074	3,074	6,916	3,689	8,271	133,323	235,879	148,920	7,686	5,316	563,407
1981	3,689	3,570	3,074	2,152	2,802	3,074	7,676	15,457	20,663	6,764	6,764	4,284	79,969
1982	3,074	2,975	2,460	3,074	6,916	3,689	26,103	228,913	254,131	108,434	7,686	5,316	652,771
1983	7,624	3,570	3,074	3,074	3,362	3,689	4,463	180,307	463,488	302,677	61,509	5,316	1,042,153
1984	3,689	7,378	7,009	7,009	6,916	3,689	4,463	124,666	130,916	11,621	7,686	5,316	320,358
1985	3,689	3,570	3,074	3,074	3,362	3,074	4,463	99,040	12,733	6,764	6,764	4,284	153,891
1986	3,074	2,975	2,460	3,074	3,362	16,102	20,985	228,842	263,786	12,678	7,686	5,316	570,340
1987	3,689	3,570	3,074	2,152	1,961	2,152	2,083	3,074	4,463	4,612	4,612	3,669	39,111
1988	2,152	2,083	2,152	3,074	3,362	3,074	2,083	4,919	10,353	4,612	4,612	3,669	46,145
1989	2,152	2,083	2,152	3,074	2,802	3,074	4,463	122,056	62,889	7,686	6,764	4,284	223,479
1990	3,074	2,975	2,460	2,460	2,802	3,074	2,083	3,074	4,463	4,612	4,612	3,669	39,358
1991	2,152	2,083	2,152	2,152	1,961	2,152	3,868	4,919	104,230	6,764	6,764	4,284	143,481
1992	3,074	2,975	2,460	2,460	2,802	3,074	3,868	21,507	4,463	4,612	4,612	3,669	59,576
1993	2,152	2,083	2,152	3,074	3,362	3,689	8,271	213,205	204,082	44,068	7,686	5,316	499,140
1994	3,689	3,570	3,074	2,460	1,961	2,152	2,083	3,074	4,463	4,612	4,612	3,669	39,419
1995	2,152	2,083	2,152	3,074	3,362	7,624	8,271	131,296	334,396	294,086	11,843	5,316	805,655
1996	3,689	3,570	3,074	2,460	3,362	7,624	8,271	190,622	169,121	11,621	7,686	5,316	416,416
1997	3,689	3,570	3,074	116,811	6,916	7,624	4,463	231,648	146,890	7,686	7,686	5,316	545,373
1998	3,689	3,570	3,074	2,460	3,362	3,689	4,463	64,194	312,909	217,820	7,686	5,316	632,232
1999	3,689	3,570	3,074	2,460	6,916	7,624	8,271	18,453	168,986	7,686	7,686	5,316	243,731
2000	3,689	3,570	3,074	2,152	3,362	3,689	4,463	144,697	97,677	7,686	7,686	5,316	287,061
2001	3,689	3,570	3,074	2,460	2,802	3,074	3,868	87,834	6,545	6,764	6,764	4,284	134,728
2002	3,074	2,975	2,460	3,074	3,362	3,689	4,463	123,552	64,932	7,686	6,764	4,284	230,315
Avg (21-02)	3,351	3,703	3,449	4,542	3,904	4,514	6,294	74,969	124,312	33,709	7,711	4,797	275,255

APPENDIX O1

Table 2.3-6

Difference in Hetch Hetchy Reservoir Release to Stream (Acre-feet) WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	-5,151	0	0	0	-5,151
1922	0	0	0	0	0	0	0	-5,370	0	0	0	0	-5,370
1923	0	0	0	0	0	0	0	-16,849	0	0	0	0	-16,849
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	-10,995	0	0	0	0	-10,995
1926	0	0	0	0	0	0	0	-2,913	0	0	0	0	-2,913
1927	0	0	0	0	0	0	0	-25,090	0	0	0	0	-25,090
1928	0	0	0	0	0	0	0	-2,741	0	0	0	0	-2,741
1929	0	0	0	0	0	0	0	0	-13,872	0	0	0	-13,872
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	-3,554	0	0	0	-2,045	0	0	0	-5,599
1933	0	0	0	0	0	0	0	0	-10,453	0	0	0	-10,453
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	3,935	0	0	-1,636	0	0	0	2,299
1936	0	0	0	0	0	0	0	-7,145	0	0	0	0	-7,145
1937	0	0	0	0	0	0	0	-2,659	-5,570	0	0	0	-8,229
1938	0	0	0	0	0	0	0	-10,460	0	0	0	0	-10,460
1939	0	0	0	0	0	0	-3,808	4,045	0	0	0	0	237
1940	0	0	0	0	0	0	0	8,672	0	0	0	0	8,672
1941	0	0	0	0	0	0	0	0	-1,248	0	0	0	-1,248
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	-31,658	0	0	0	0	-31,658
1945	0	0	0	0	0	0	0	0	12,279	0	0	0	12,279
1946	0	0	0	0	0	0	0	-7,045	0	0	0	0	-7,045
1947	0	0	0	0	0	0	0	-24,441	0	0	0	0	-24,441
1948	0	0	0	0	0	0	0	0	-11,312	0	0	0	-11,312
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	6,752	0	0	0	6,752
1951	0	-7,289	0	0	0	0	0	0	-8,010	0	0	0	-15,299
1952	0	0	0	0	0	0	0	-13,691	0	0	0	0	-13,691
1953	0	0	0	0	0	0	0	-2,049	0	0	0	0	-2,049
1954	0	0	0	0	0	0	0	-23,348	0	0	0	0	-23,348
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	-4,412	0	0	0	0	-4,412
1957	0	0	0	0	0	0	0	-32,683	0	0	0	0	-32,683
1958	0	0	0	0	0	0	0	-10,443	0	0	0	0	-10,443
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	-39,538	-13,398	0	0	0	-52,936
1963	0	0	0	0	0	0	0	-15,185	0	0	0	0	-15,185
1964	0	0	0	0	0	0	0	0	-3,808	0	0	0	-3,808
1965	0	0	0	0	0	0	0	0	14,900	0	0	0	14,900
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	-13,229	0	0	0	0	-13,229
1968	0	0	0	0	0	0	0	-21,873	0	0	0	0	-21,873
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	3,935	0	0	0	-9,317	0	0	0	0	-5,382
1971	0	0	0	0	0	0	0	-18,765	0	0	0	0	-18,765
1972	0	0	0	0	0	0	0	-22,515	0	0	0	0	-22,515
1973	0	0	0	0	0	0	0	-13,924	0	0	0	0	-13,924
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	4,023	4,171	0	0	0	8,194
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	-39,105	0	0	0	-310	-39,415
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	-6,603	-10,310	0	0	0	-16,913
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	-5,090	0	0	0	0	-5,090
1984	0	0	0	0	0	3,935	0	-11,653	0	0	0	0	-7,718
1985	0	0	0	0	0	0	0	5,163	0	0	0	0	5,163
1986	0	0	0	0	0	-8,478	-3,935	0	0	0	0	0	-12,413
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	-3,808	0	0	0	-3,808
1989	0	0	0	0	0	0	0	-33,044	0	0	0	0	-33,044
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	-29,675	0	0	0	-29,675
1992	0	0	0	0	0	0	0	-18,433	0	0	0	0	-18,433
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	-6,208	0	0	0	0	0	0	0	0	-6,208
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	-8,369	-2,950	0	0	0	-11,319
2000	0	0	0	0	0	0	0	-8,201	0	0	0	0	-8,201
2001	0	0	0	0	0	0	0	-39,594	0	0	0	0	-39,594
2002	0	0	0	0	0	0	0	-31,748	0	0	0	0	-31,748
Avg (21-02)	0	-89	0	-28	-43	-7	-94	-6,930	-1,038	0	0	-4	-8,234

2.4 Lake Lloyd and Lake Eleanor

Compared to the operation in the base setting, the operation of Lake Lloyd and Lake Eleanor are simulated to be only slightly different in the WSIP setting. Figure 2.4-1 illustrates a chronological trace of the simulation of Lake Lloyd storage and stream releases. Figure 2.4-1 shows the results for the WSIP and base settings. The operation resulting for the WSIP setting is essentially the same as for the base setting, except during the prolonged drought of 1987-1992. During this drought period, there is a greater draw from Hetch Hetchy Reservoir in the WSIP setting compared to the base setting. The additional draw of water reduces the amount of water released from Hetch Hetchy Reservoir to Don Pedro Reservoir in the WSIP setting, which, to satisfy MID/TID entitlements to inflow, is met with additional releases from Lake Lloyd.

Figure 2.4-2 illustrates an almost identical operation of Lake Eleanor between the WSIP and base settings. Any difference that occurs in the Lake Eleanor operation would be caused by a small change in operation at Lake Lloyd that would affect the operation of the Cherry-Eleanor Tunnel between the two watersheds. Any difference that occurs in the simulations is associated more with modeling discretion than with any substantive likely difference in operation.

Supplementing the Figure 2.4-1 representation of Lake Lloyd stream releases is Table 2.4-1, which illustrates the differences in stream releases between the WSIP and base settings. The one notable difference in operation for the 82-year simulation occurs during the year following the rare 1987-1992 drought sequence, when the additional draw from Lake Lloyd storage described above would require replenishment. In this one occurrence, the releases to the stream above the minimum release requirement that would occur in the base setting would not occur in the WSIP setting. Table 2.4-2 illustrates average releases by year type for the WSIP and base settings, and shows almost no difference in releases between the two settings.

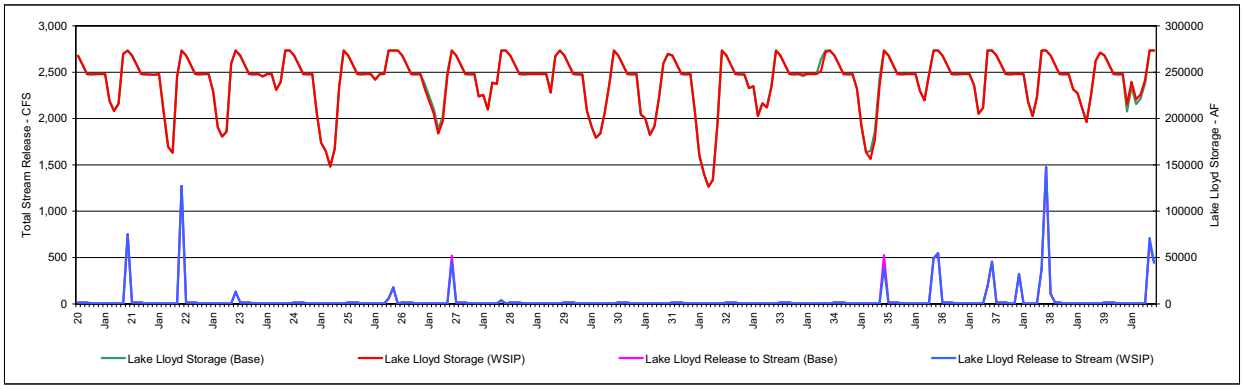
2.5 Flow below the Tuolumne River and Cherry River Confluence

The flow that occurs below the confluence of the Tuolumne River and Cherry River is considered important to recreational activity (whitewater rafting) during the May-through-September period. To estimate the effect of the WSIP on the occurrence of flow at this location, HH/LSM monthly volumetric flow results were post-processed to reflect the daily and hourly shaping potential currently exercised by Hetch Hetchy operators to satisfy water and power objectives while accommodating the desires of recreational interests. Figure 2.5-1 and Figure 2.5-2 illustrate the controlled flow below Hetch Hetchy facilities below the confluence of the Tuolumne and Cherry Rivers, averaged by year type, for the WSIP and base settings. Illustrated are the combined flow elements of: (1) stream releases from O'Shaughnessy Dam, Lake Lloyd, and Lake Eleanor; (2) the return of Canyon Tunnel diversions through Kirkwood Powerhouse that exceed the Mountain Tunnel diversion; and (3) diversions through Holm Powerhouse. For this analysis, the monthly volumes of diversion through Holm Powerhouse have been shaped into a release of 4 hours per day for 6 days a week. The other flow elements represent the average daily flow rate associated with the monthly volume of flow. Figure 2.5-1 and Figure 2.5-2 illustrate that the HH/LSM operation protocols for reservoir operation incidentally result in approximately 1,000 cfs of flow below the confluence if Holm Powerhouse releases are shaped. This opportunity occurs in both the WSIP and base settings. The flow rates illustrated in this analysis do not reflect either the occasional shaping opportunities that occur with Kirkwood Powerhouse releases or the existence of unregulated flow that enters the streams below O'Shaughnessy Dam, Lake Lloyd, and Lake Eleanor; both of these factors would increase the illustrated flow rate. The difference in flow between the two settings that could occur during the concentrated period of flow is illustrated in Figure 2.5-3.

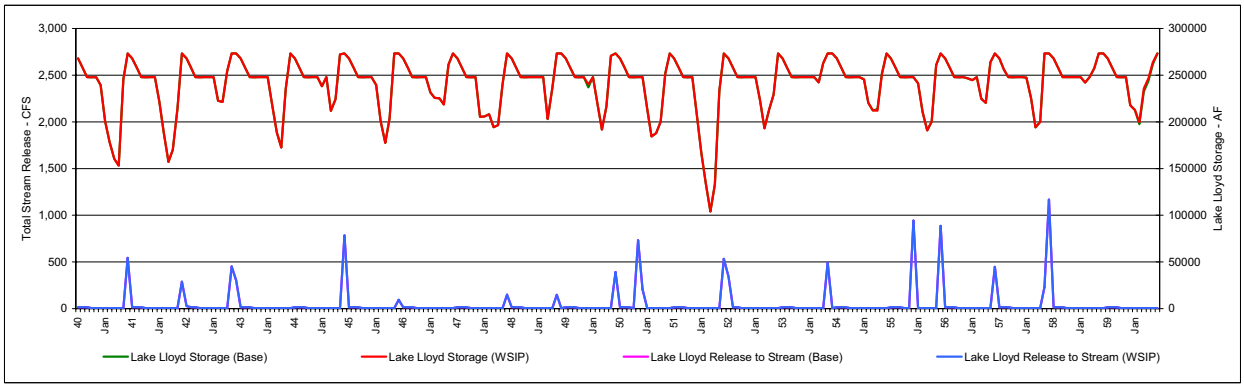
APPENDIX O1

Figure 2.4-1
Lake Lloyd Storage and Stream Release

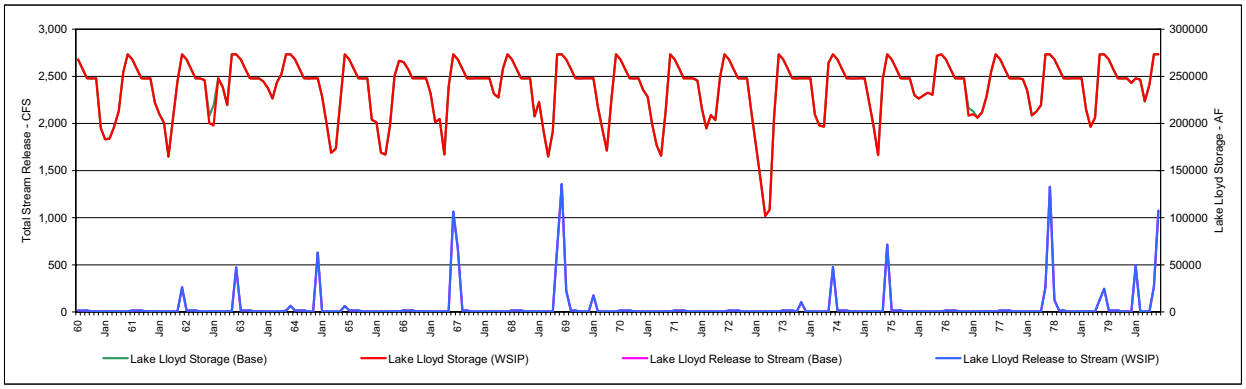
1920 - 1939



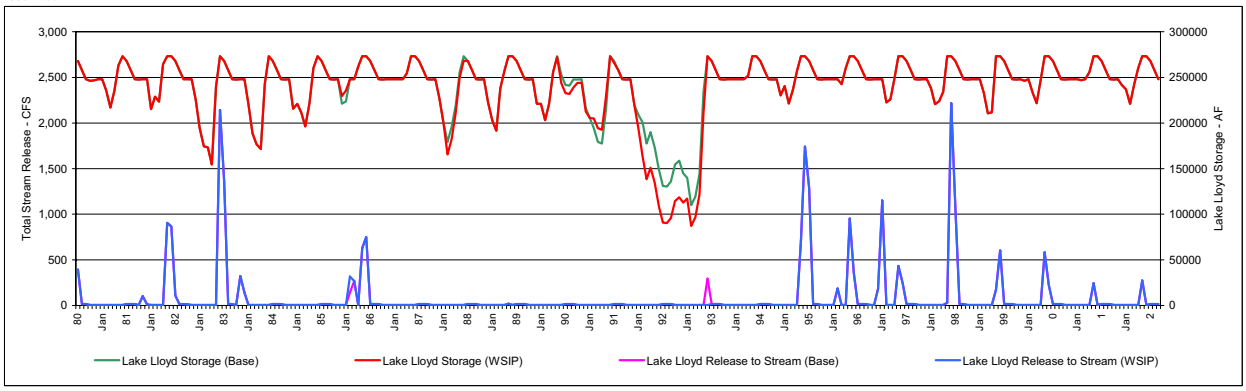
1940 - 1959



1960 - 1979



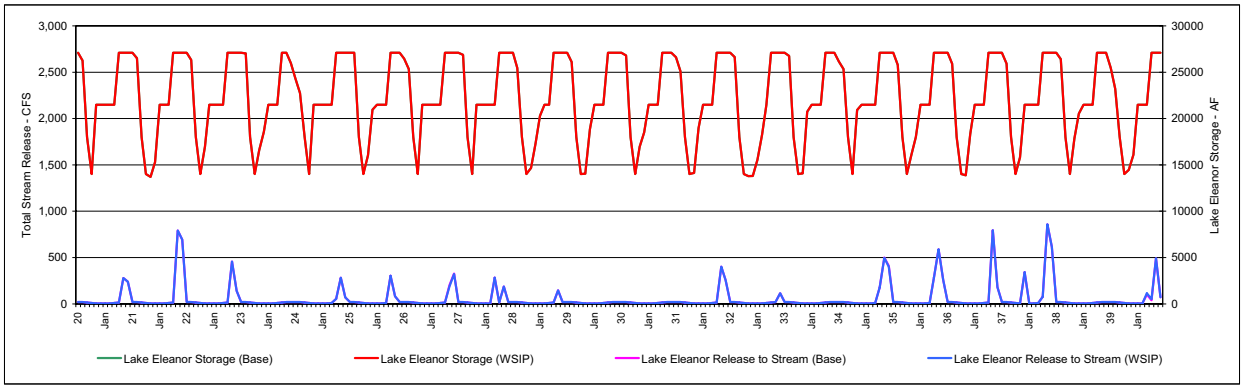
1980 - 2002



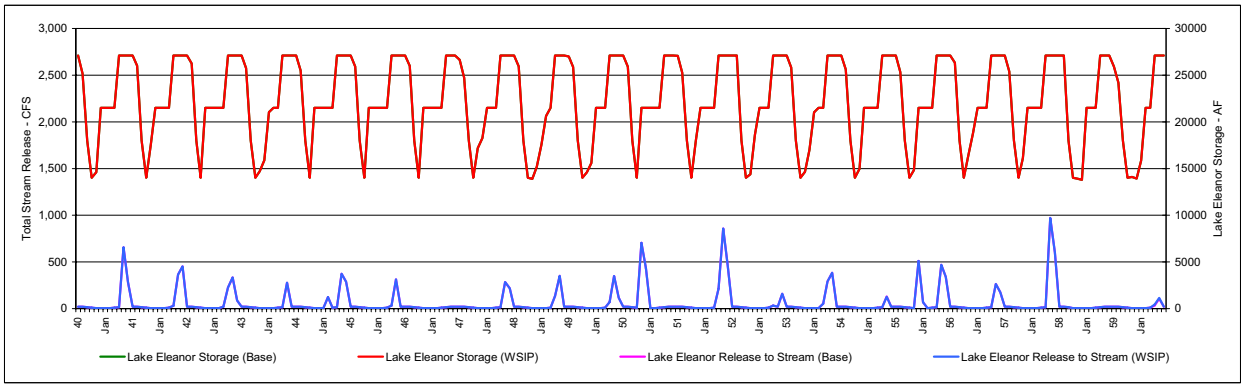
APPENDIX O1

Figure 2.4-2
Lake Eleanor Storage and Stream Release

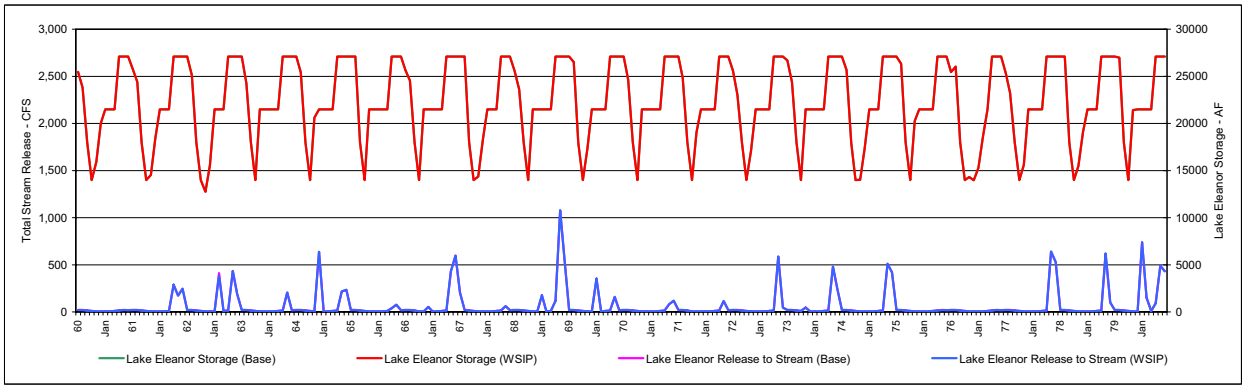
1920 - 1939



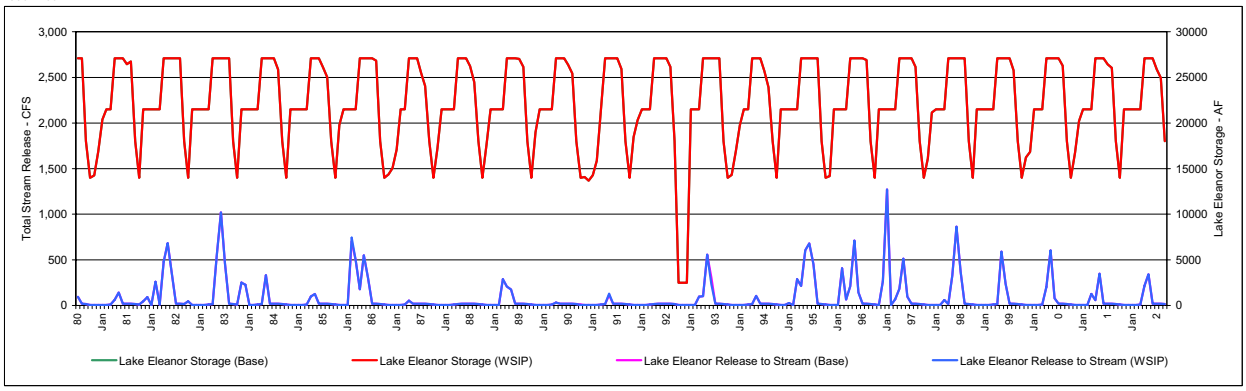
1940 - 1959



1960 - 1979



1980 - 2002



APPENDIX O1

Table 2.4-1

Difference in Lake Lloyd Release to Stream (Acre-feet) WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	-3,924	0	0	0	-3,924
1928	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	-8,042	0	0	0	-8,042
1936	0	0	0	0	0	0	0	0	0	0	0	0	0
1937	0	0	0	0	0	0	0	0	0	0	0	0	0
1938	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	0	0	3,357	0	0	0	0	3,357
1941	0	0	0	0	0	0	0	0	0	0	0	0	0
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	-50	0	0	0	0	0	0	0	0	0	-50
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	9,733	0	0	0	0	0	0	0	9,733
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	1	0	0	0	0	1
1991	0	0	0	0	0	0	0	0	0	1	0	0	1
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	1	0	0	0	0	0	-17,192	0	0	0	-17,191
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	0	0	-1	0	119	0	0	41	-356	0	0	0	-197

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Table 2.4-2

Lake Lloyd Release to Stream (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	334	653	8,224	6,566	1,362	1,319	298	17,483	62,931	22,325	953	922	123,370
Above Normal	307	4,282	1,525	307	870	307	298	10,285	26,807	993	953	922	47,857
Normal	307	298	307	953	278	307	298	6,734	9,633	953	953	922	21,943
Below Normal	307	298	307	307	278	307	485	2,383	2,551	953	953	922	10,051
Dry	307	298	307	307	278	307	298	307	298	953	953	922	5,535
All Years	312	1,193	2,104	1,654	612	505	337	7,412	20,303	5,131	953	922	41,439

Lake Lloyd Release to Stream (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base Sep	WY Total
Wet	334	653	8,227	6,566	754	1,319	298	17,483	64,005	22,325	953	922	123,839
Above Normal	307	4,282	1,525	307	870	307	298	10,088	27,511	993	953	922	48,363
Normal	307	298	307	953	278	307	298	6,734	9,633	953	953	922	21,943
Below Normal	307	298	307	307	278	307	485	2,383	2,551	953	953	922	10,051
Dry	307	298	307	307	278	307	298	307	298	953	953	922	5,535
All Years	312	1,193	2,105	1,654	494	505	337	7,371	20,659	5,131	953	922	41,636

Difference in Lake Lloyd Release to Stream (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	WSIP minus Base Aug	Sep	WY Total
Wet	0	0	-3	0	608	0	0	0	-1,075	0	0	0	-469
Above Normal	0	0	0	0	0	0	0	197	-704	0	0	0	-506
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-1	0	119	0	0	41	-356	0	0	0	-197

Figure 2.5-1

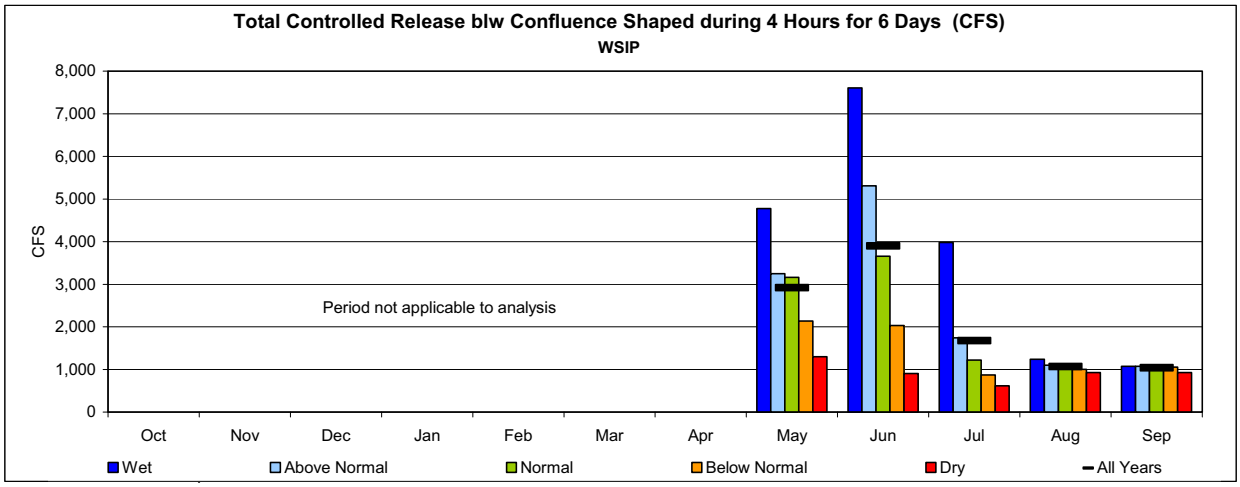


Figure 2.5-2

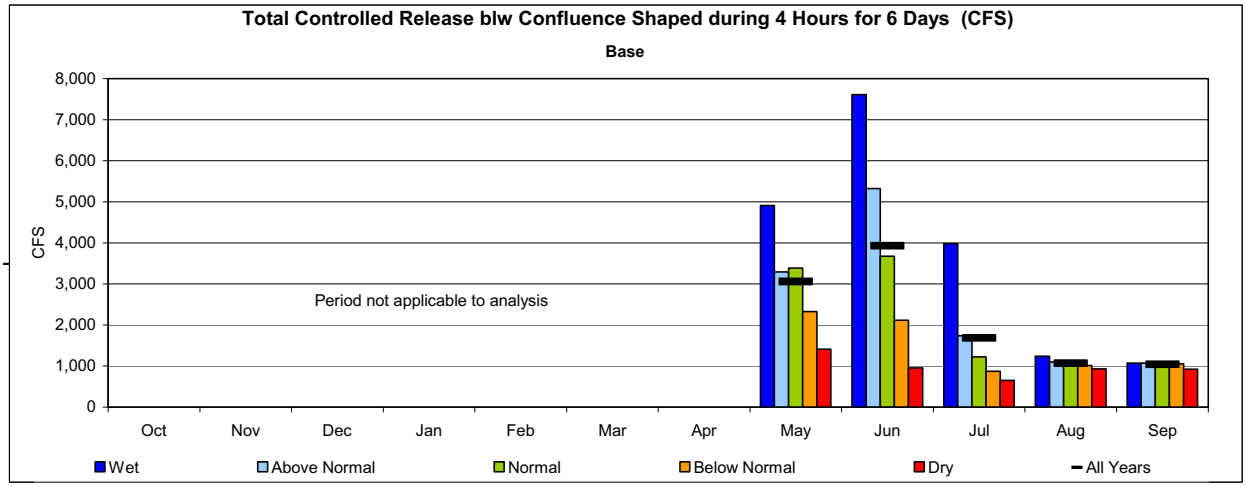
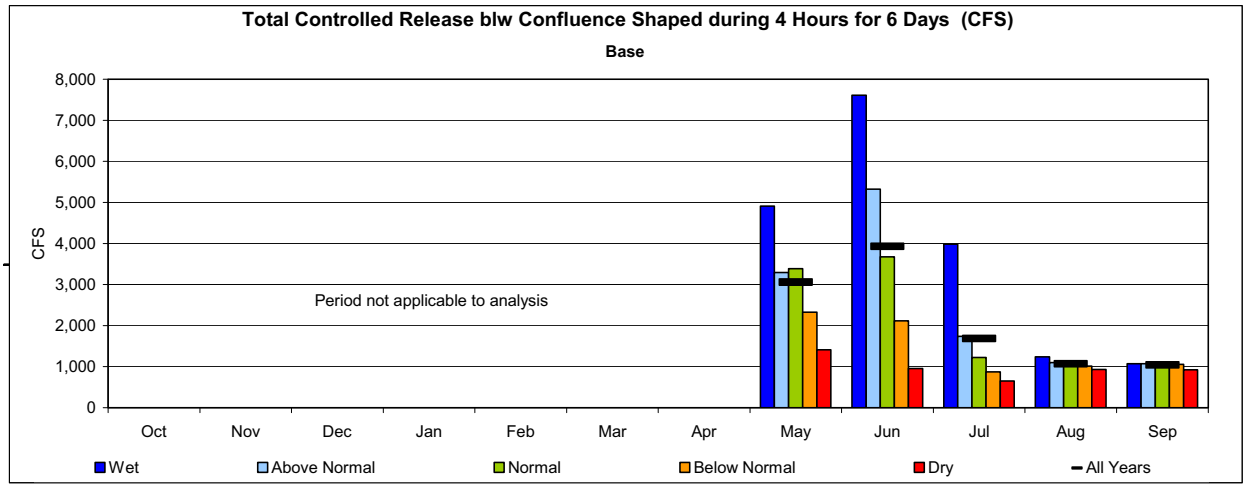


Figure 2.5-3



More detailed review of the 82-year simulation of operations indicates that in only one month of the simulation do circumstances in the WSIP setting result in the shaped flow crossing the threshold to below 1,000 cfs, compared to levels greater than 1,000 cfs in the base setting. In both the WSIP and base settings, in some dry and critical years, circumstances could result in a shaped flow of less than 1,000 cfs; however, results indicate that the WSIP setting would rarely increase the frequency of such an occurrence.

2.6 Don Pedro Reservoir and La Grange Releases

A change in Don Pedro Reservoir operation is caused by changes in inflow to the reservoir. The changes in inflow to the reservoir are the result of net changes within the operation of the upstream SFPUC facilities, described previously, and other changes in SFPUC operations associated with diversions to the Holm, Kirkwood, and Moccasin Powerhouses. Figure 2.6-1 illustrates a chronological trace of the simulation of Don Pedro Reservoir storage and Tuolumne River stream releases from La Grange Dam. Figure 2.6-1 presents the results for the WSIP and base settings.

Supplementing the Figure 2.6-1 representation of Don Pedro Reservoir storage are Table 2.6-1, Don Pedro Reservoir Storage (WSIP); Table 2.6-2, Don Pedro Reservoir (Base); and Table 2.6-3, Difference in Don Pedro Reservoir Storage (WSIP minus Base). The results illustrate that, throughout many years, the storage in Don Pedro Reservoir associated with the WSIP setting would differ from the storage in the base setting, and that this difference would almost always be less storage. Compared to the base setting, the differences in storage (reductions) indicate that inflow to Don Pedro Reservoir would decrease due to greater SFPUC demands and SJPL diversions in the WSIP setting. The decreases in inflow typically occur from winter through early summer. Table 2.6-4 illustrates the difference in inflow to Don Pedro Reservoir between the WSIP and base settings. Generally, the difference is an annual amount of about 27,000 acre-feet, approximating the additional delivery of the SFPUC. The season of inflow reduction is associated with the direct increase in diversions to the SJPL and the replenishment operation of Hetch Hetchy Reservoir. Figure 2.6-2 illustrates the seasonal change in Don Pedro Reservoir inflow, averaged by year type.

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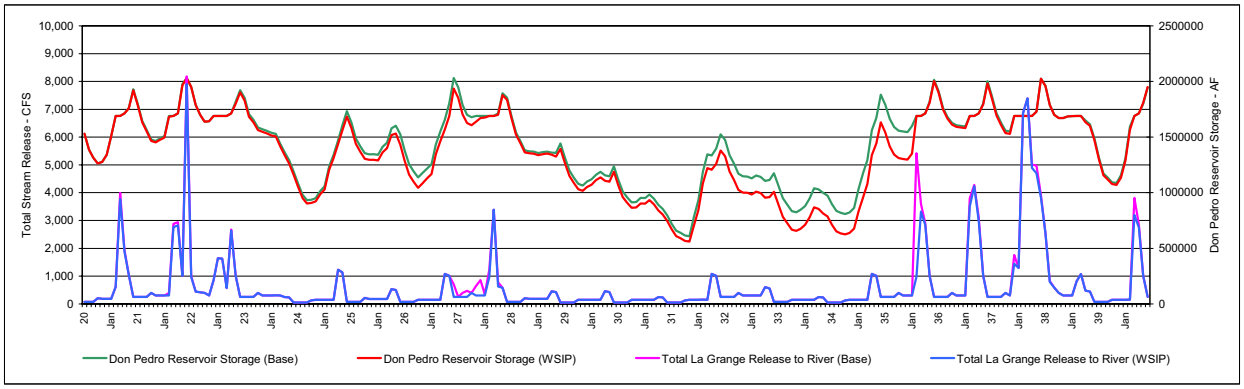
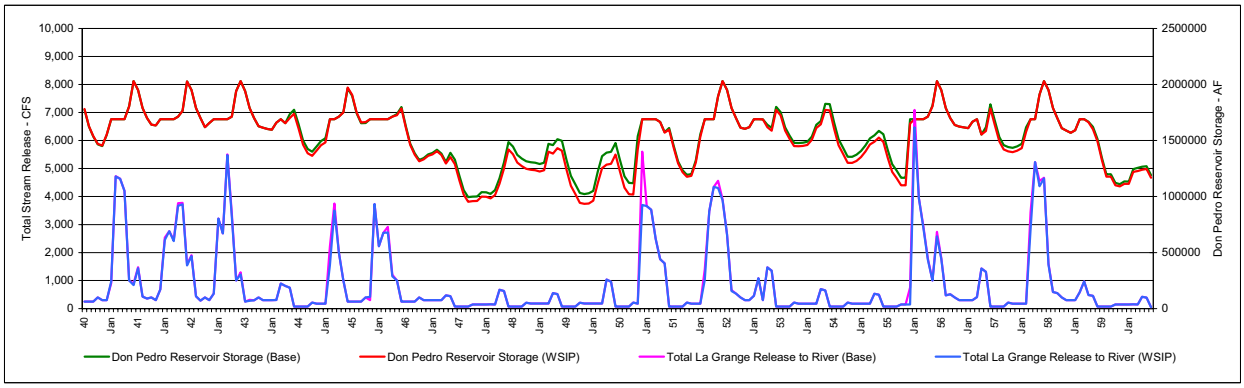
Figure 2.6-1
Don Pedro Reservoir Storage and Release below La Grange Dam

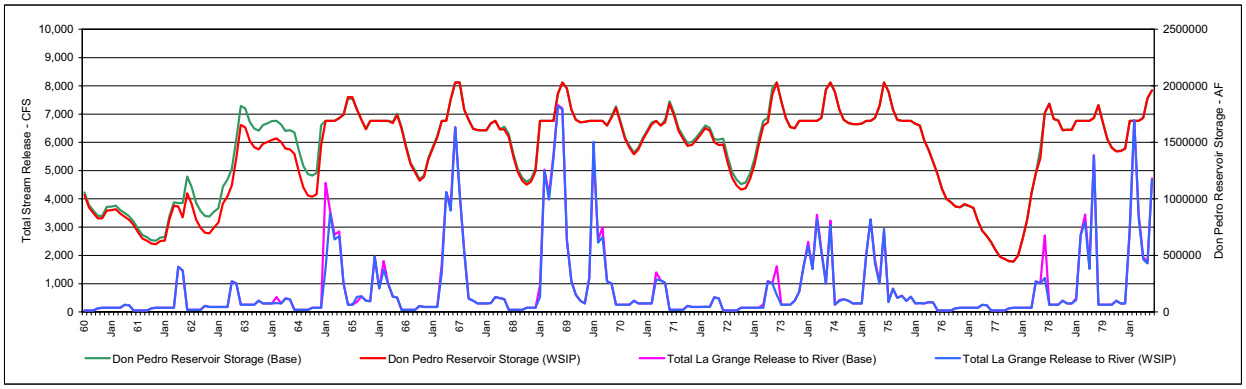
1920 - 1939



1940 - 1959



1960 - 1979



1980 - 2002

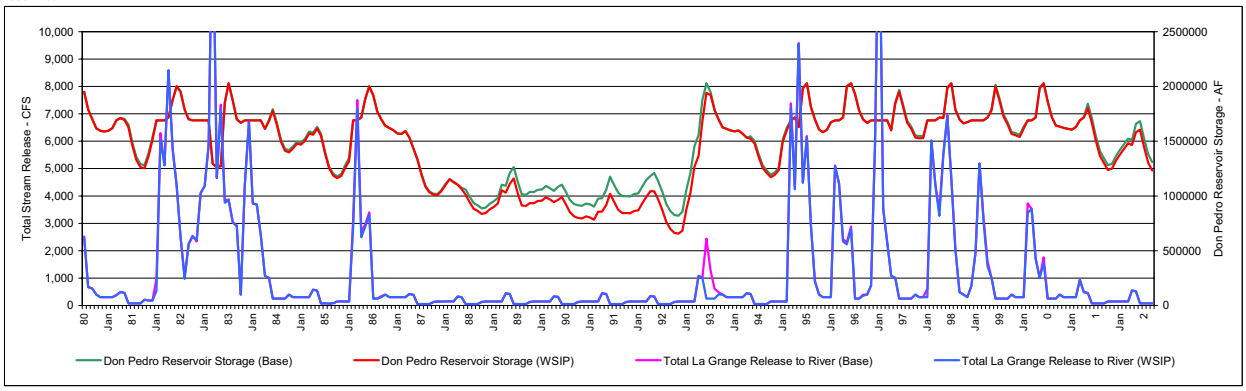


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Table 2.6-1

Don Pedro Reservoir Storage (Acre-feet) WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	1,262,860	1,277,365	1,340,344	1,508,876	1,689,999	1,690,000	1,713,000	1,758,255	1,920,087	1,785,379	1,633,202	1,551,799
1922	1,466,449	1,451,643	1,475,936	1,496,100	1,682,686	1,690,000	1,713,000	1,965,236	2,030,000	1,950,094	1,790,026	1,700,016
1923	1,638,028	1,643,364	1,689,999	1,689,989	1,689,997	1,690,000	1,713,000	1,799,363	1,900,966	1,828,869	1,683,448	1,632,370
1924	1,563,169	1,547,842	1,533,824	1,515,415	1,506,005	1,417,560	1,338,399	1,262,605	1,162,134	1,052,503	951,855	904,167
1925	906,788	921,085	985,076	1,028,777	1,205,262	1,311,674	1,436,468	1,560,568	1,684,578	1,582,202	1,438,920	1,367,376
1926	1,304,106	1,296,082	1,296,519	1,290,435	1,361,093	1,400,064	1,518,241	1,532,438	1,430,226	1,287,212	1,162,635	1,099,288
1927	1,044,610	1,084,270	1,129,224	1,168,777	1,346,690	1,463,332	1,567,658	1,688,723	1,936,134	1,852,362	1,703,718	1,627,130
1928	1,606,224	1,637,560	1,672,026	1,675,150	1,689,999	1,690,000	1,701,151	1,877,285	1,835,437	1,667,682	1,522,481	1,445,074
1929	1,362,145	1,353,824	1,350,930	1,337,716	1,346,569	1,351,080	1,341,527	1,323,621	1,392,489	1,266,466	1,150,912	1,087,613
1930	1,032,080	1,016,460	1,051,972	1,071,954	1,112,838	1,138,506	1,107,377	1,098,218	1,186,818	1,067,154	960,515	908,251
1931	864,235	866,605	904,039	902,201	933,725	896,662	839,706	804,980	747,051	671,410	610,497	591,503
1932	565,821	560,723	704,485	844,787	1,084,372	1,221,695	1,205,745	1,259,030	1,378,752	1,327,642	1,189,590	1,113,456
1933	1,025,224	1,000,826	998,521	983,959	1,008,603	995,965	955,100	959,906	1,007,489	894,719	782,336	724,120
1934	667,461	656,295	676,788	711,356	777,968	868,739	854,724	813,053	786,448	712,923	652,109	634,358
1935	624,570	638,297	677,837	832,051	956,075	1,079,921	1,337,695	1,442,297	1,633,298	1,541,356	1,416,179	1,343,212
1936	1,311,194	1,303,236	1,297,699	1,351,659	1,689,999	1,690,000	1,713,000	1,808,939	2,003,094	1,900,592	1,747,881	1,665,690
1937	1,613,022	1,592,326	1,585,791	1,579,717	1,689,994	1,690,000	1,713,000	1,792,830	1,982,099	1,843,316	1,694,437	1,610,230
1938	1,536,751	1,528,196	1,689,998	1,689,992	1,689,987	1,690,000	1,690,000	1,730,000	2,025,000	1,959,369	1,790,073	1,700,032
1939	1,672,242	1,671,809	1,685,673	1,689,024	1,689,999	1,690,000	1,634,629	1,601,698	1,473,709	1,301,817	1,157,373	1,119,194
1940	1,077,628	1,070,702	1,134,704	1,288,559	1,565,488	1,690,000	1,713,000	1,808,008	1,950,520	1,780,688	1,627,700	1,539,737
1941	1,469,773	1,454,423	1,553,735	1,689,994	1,689,991	1,690,000	1,690,000	1,804,234	2,030,000	1,950,157	1,790,024	1,700,010
1942	1,641,462	1,634,171	1,689,999	1,689,982	1,689,995	1,690,000	1,713,000	1,765,000	2,027,000	1,950,170	1,790,025	1,700,004
1943	1,619,298	1,656,980	1,690,000	1,689,976	1,689,995	1,690,000	1,713,000	1,940,240	2,030,000	1,940,444	1,790,004	1,700,004
1944	1,627,652	1,614,506	1,602,762	1,595,713	1,659,696	1,690,000	1,654,802	1,700,608	1,738,836	1,608,117	1,463,726	1,386,992
1945	1,362,396	1,410,433	1,456,868	1,483,156	1,689,997	1,690,000	1,713,000	1,750,377	1,973,670	1,906,466	1,749,519	1,662,142
1946	1,664,336	1,690,000	1,689,996	1,689,984	1,689,995	1,690,000	1,713,000	1,726,331	1,786,301	1,618,009	1,459,654	1,373,770
1947	1,314,592	1,331,036	1,364,362	1,376,577	1,405,177	1,370,566	1,295,486	1,351,369	1,288,812	1,144,830	1,017,268	954,574
1948	958,700	959,989	998,610	997,725	983,836	1,013,678	1,114,286	1,251,048	1,420,232	1,377,867	1,303,272	1,271,554
1949	1,247,966	1,239,259	1,234,425	1,223,326	1,235,015	1,400,436	1,383,115	1,432,798	1,409,371	1,242,728	1,096,786	1,022,286
1950	944,784	935,019	938,337	962,506	1,119,822	1,253,320	1,285,258	1,291,998	1,375,323	1,221,712	1,078,645	1,020,719
1951	1,018,036	1,422,514	1,689,995	1,689,971	1,689,993	1,690,000	1,664,085	1,570,386	1,596,323	1,438,802	1,296,271	1,217,452
1952	1,176,472	1,184,189	1,305,781	1,533,995	1,689,998	1,690,000	1,690,000	1,895,000	2,030,000	1,951,049	1,790,051	1,700,027
1953	1,614,775	1,604,850	1,619,190	1,689,999	1,689,998	1,688,681	1,619,217	1,588,332	1,773,663	1,724,813	1,589,215	1,514,922
1954	1,449,795	1,449,008	1,452,649	1,459,444	1,505,884	1,611,838	1,643,837	1,773,541	1,769,428	1,605,391	1,456,830	1,379,013
1955	1,300,328	1,300,104	1,318,386	1,350,951	1,401,218	1,464,906	1,489,052	1,525,796	1,487,090	1,348,288	1,221,076	1,163,037
1956	1,100,763	1,099,427	1,651,474	1,689,947	1,689,993	1,690,000	1,713,000	1,804,698	2,030,000	1,950,170	1,790,030	1,700,025
1957	1,639,825	1,624,492	1,616,539	1,610,979	1,668,413	1,690,000	1,553,124	1,584,074	1,786,699	1,635,352	1,492,723	1,419,571
1958	1,403,575	1,396,361	1,409,069	1,432,024	1,578,593	1,690,000	1,690,000	1,910,000	2,030,000	1,950,170	1,790,046	1,700,029
1959	1,611,062	1,589,728	1,567,833	1,592,273	1,689,999	1,690,000	1,662,406	1,600,478	1,493,480	1,324,246	1,178,165	1,178,441
1960	1,101,196	1,090,401	1,113,627	1,113,311	1,220,539	1,228,588	1,240,002	1,245,830	1,168,185	1,034,178	923,226	874,650
1961	827,383	826,615	897,810	899,493	908,561	870,204	842,562	814,709	769,512	703,148	648,423	629,635
1962	604,125	599,069	626,802	630,729	817,825	938,956	931,539	835,624	1,048,335	953,860	814,699	742,797
1963	700,558	694,902	745,217	790,246	957,421	1,023,119	1,119,414	1,363,268	1,654,516	1,631,866	1,513,806	1,455,856
1964	1,437,657	1,487,272	1,502,934	1,521,014	1,535,522	1,502,343	1,443,836	1,438,577	1,397,068	1,238,632	1,101,362	1,031,330
1965	1,018,694	1,042,070	1,471,762	1,689,988	1,689,993	1,690,000	1,713,000	1,743,852	1,900,867	1,898,947	1,790,038	1,700,028
1966	1,615,736	1,690,000	1,689,998	1,689,996	1,689,998	1,690,000	1,670,732	1,742,447	1,620,676	1,452,534	1,306,169	1,236,095
1967	1,160,837	1,194,375	1,348,066	1,447,078	1,544,910	1,690,000	1,690,000	1,880,000	2,030,000	2,030,000	1,790,252	1,700,021
1968	1,619,820	1,607,624	1,605,760	1,605,959	1,668,870	1,690,000	1,614,396	1,614,311	1,547,133	1,375,977	1,237,984	1,160,815
1969	1,124,725	1,154,047	1,243,529	1,689,996	1,689,990	1,690,000	1,690,000	1,930,000	2,030,000	1,975,279	1,790,111	1,700,033
1970	1,676,114	1,681,553	1,689,999	1,689,952	1,689,996	1,690,000	1,649,691	1,718,076	1,804,962	1,670,839	1,531,070	1,453,473
1971	1,394,102	1,437,025	1,524,073	1,589,976	1,659,167	1,690,000	1,647,943	1,676,856	1,840,272	1,736,038	1,599,726	1,530,826
1972	1,469,268	1,477,826	1,521,421	1,571,887	1,625,342	1,603,292	1,501,630	1,475,950	1,480,830	1,319,081	1,185,074	1,119,002
1973	1,081,006	1,094,033	1,176,102	1,304,888	1,484,502	1,646,959	1,675,219	1,921,511	2,030,000	1,863,873	1,716,891	1,634,144
1974	1,625,114	1,690,000	1,689,998	1,689,983	1,689,998	1,690,000	1,717,600	1,964,185	2,030,000	1,943,894	1,790,018	1,700,018
1975	1,671,620	1,661,732	1,660,185	1,665,519	1,689,996	1,690,000	1,717,600	1,824,854	2,030,000	1,950,013	1,790,077	1,700,024
1976	1,690,000	1,690,000	1,690,000	1,664,706	1,649,459	1,519,032	1,432,156	1,326,070	1,216,796	1,085,092	998,502	968,734
1977	932,654	925,543	955,652	938,503	920,299	807,858	717,610	671,981	616,184	544,084	486,059	467,586
1978	447,583	445,345	497,628	642,718	811,604	1,050,470	1,227,230	1,356,274	1,761,000	1,841,159	1,704,419	1,692,926
1979	1,606,278	1,609,357	1,608,413	1,689,999	1,689,995	1,690,000	1,690,000	1,717,600	1,827,795	1,673,824	1,527,042	1,450,952
1980	1,419,903	1,422,622	1,442,656	1,689,977	1,689,987	1,690,000	1,717,600	1,890,400	1,960,200	1,950,171	1,790,057	1,700,035
1981	1,617,942	1,596,204	1,588,406	1,595,955	1,619,607	1,690,000	1,710,315	1,694,081	1,626,429	1,461,340	1,330,112	1,262,473
1982	1,253,640	1,360,563	1,511,306	1,689,997	1,689,988	1,690,000	1,717,600	1,876,400	2,002,900	1,954,717	1,790,097	1,700,116
1983	1,690,000	1,690,000	1,689,995	1,689,966	1,689,989	1,294,700	1,264,000	1,270,800	1,851,400	2,030,000	1,869,137	1,700,118
1984	1,666,919	1,690,000	1,689,992	1,689,972	1,689,993	1,690,000	1,614,072	1,682,328	1,778,205	1,646,266	1,496,949	1,414,071
1985	1,399,091	1,434,211	1,478,590	1,469,173	1,504,226	1,570,360	1,558,812	1,616,719	1,550,570	1,386,112	1,251,881	1,188,728
1986	1,162,153	1,183,366	1,254,950	1,319,946	1,689,994	1,690,000	1,717,600	1,888,300	2,001,400	1,917,776	1,770,749	1,700,004
1987	1,641,221	1,619,848	1,601,298	1,570,175	1,566,241	1,592,870	1,533,147	1,433,211	1,330,588	1,195,991	1,085,371	1,032,594
1988	1,010,460	1,009,573	1,045,756	1,099,567	1,155,125	1,128,364	1,103,870	1,063,204	1,011,973	943,381	884,236	862,821
1989	836,632	844,157	876,836	900,479	930,034	1,051,709	1,029,659	1,110,864	1,160,578	1,025,069	913,162	908,781
1990	935,547	934,238	954,290	956,979	989,562	968,936	944,775	965,169	990,902	924,588	852,141	815,058
1991	799,492	794,262	814,409	803,540	782,227	856,893	858,476	917,797	1,020,071	946,830	874,711	843,590
1992	844,030	841,586	863,738	868,291	931,612	990,953	1,044,352	1,043,659	967,160	874,930	761,589	698,367
1993	662,549	656,233	682,056	877,956	1,027,740	1,267,172	1,365,280	1,684,448	1,941,790	1,923,275	1,785,144	1,700,014
1994	1,627,176	1,612,969	1,599,152	1,589,196	1,599,258	1,567,682	1,531,904	1,523,687	1,478,913	1,356,482	1,256,718	1,211,217
1995	1,172,146	1,191,956	1,236,737	1,494,252	1,599,122	1,690,000	1,717,600	1,629,700	1,982,800	2,030,000	1,814,001	1,700,059
1996	1,608,079	1,583,093	1,604,410	1,672,573	1,689,990	1,690,000	1,717,600	2,002,400	2,030,000	1,930,383	1,782,384	1,700,010
1997	1,667,198	1,690,000	1,689,993	1,689,875	1,689,994	1,690,000	1,598,189	1,839,987	1,951,576	1,810,929	1,668,846	1,615,122
1998	1,533,848	1,527,463	1,528,868	1,690,000	1,689,989	1,690,000	1,717,600	1,714,000	1,987,500	2,030,000	1,790,242	1,700,022
1999	1,662,014	1,675,303	1,690,000	1,689,986	1,689,990	1,690,000	1,717,600	1,781,250	1,998,452	1,868,511	1,726,752	1,652,772
2000	1,566,486	1,554,834	1,539,188	1,615,107	1,689,994	1,690,000	1,717,600	1,981,851	2,030,000	1,864,407	1,719,364	1,644,682
2001	1,634,728	1,622,232	1,613,706	1,605,692	1,629,054	1,690,000	1,716,911	1,801,382	1,668,653	1,504,167	1,365,411	1,300,012
2002	1,238,260	1,249,893	1,323,366	1,378,790	1,430,954	1,481,487	1,466,303	1,583,557	1,606,470	1,443,430	1,305,249	1,232,624
Avg (21-02)	1,289,807	1,299,980	1,345,245	1,393,639	1,456,995	1,482,690	1,485,599	1,553,787	1,637,503	1,537,849	1,401,689	1,333,676

APPENDIX O1

Table 2.6-2

Don Pedro Reservoir Storage (Acre-feet) Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	1,262,860	1,277,365	1,340,344	1,508,876	1,689,999	1,690,000	1,713,000	1,761,443	1,930,520	1,797,950	1,645,718	1,564,274
1922	1,478,898	1,464,086	1,488,379	1,508,546	1,690,000	1,690,000	1,713,000	1,976,410	2,030,000	1,950,099	1,790,026	1,700,016
1923	1,638,028	1,643,364	1,689,999	1,689,989	1,689,997	1,690,000	1,713,000	1,818,377	1,922,031	1,852,026	1,706,504	1,655,352
1924	1,586,104	1,570,766	1,556,748	1,538,346	1,528,938	1,440,484	1,363,083	1,292,124	1,191,623	1,081,942	981,225	933,476
1925	936,035	950,316	1,014,310	1,058,026	1,234,515	1,340,925	1,469,380	1,606,987	1,732,956	1,632,552	1,489,042	1,417,327
1926	1,353,952	1,345,900	1,346,834	1,340,765	1,411,624	1,450,000	1,578,351	1,603,241	1,524,303	1,380,860	1,255,851	1,192,192
1927	1,137,321	1,176,929	1,216,842	1,256,420	1,434,340	1,550,949	1,655,192	1,803,520	2,030,000	1,948,010	1,790,020	1,700,021
1928	1,678,968	1,690,000	1,689,999	1,690,000	1,689,998	1,690,000	1,713,000	1,893,868	1,854,079	1,686,244	1,540,960	1,463,492
1929	1,380,525	1,372,193	1,369,300	1,356,092	1,364,946	1,369,450	1,359,879	1,357,562	1,441,454	1,315,206	1,199,431	1,135,969
1930	1,080,335	1,064,688	1,100,202	1,120,198	1,161,086	1,186,736	1,155,560	1,146,764	1,237,311	1,117,418	1,010,548	958,109
1931	913,983	916,324	953,760	951,937	983,464	946,382	889,375	854,514	796,408	720,530	659,388	640,222
1932	614,427	609,298	782,322	933,923	1,188,819	1,344,750	1,335,842	1,396,503	1,524,497	1,474,909	1,336,173	1,259,546
1933	1,171,011	1,146,531	1,144,232	1,129,714	1,154,369	1,141,676	1,105,123	1,114,013	1,175,047	1,063,689	950,493	891,682
1934	834,658	823,394	847,100	880,225	947,743	1,041,027	1,030,157	998,922	973,445	899,027	837,316	818,914
1935	808,728	822,347	861,895	1,033,870	1,174,138	1,292,343	1,560,572	1,673,269	1,881,369	1,790,532	1,664,245	1,590,449
1936	1,557,918	1,549,822	1,544,402	1,598,351	1,689,990	1,690,000	1,713,000	1,819,283	2,015,519	1,915,146	1,762,372	1,680,135
1937	1,627,437	1,606,733	1,600,208	1,594,139	1,689,993	1,690,000	1,713,000	1,802,168	2,001,518	1,864,836	1,715,862	1,631,586
1938	1,558,064	1,549,496	1,689,998	1,689,992	1,689,987	1,690,000	1,690,000	1,730,000	2,025,000	1,961,552	1,790,078	1,700,032
1939	1,672,242	1,671,809	1,685,673	1,689,024	1,689,999	1,690,000	1,650,408	1,615,820	1,489,897	1,317,931	1,173,414	1,135,182
1940	1,093,582	1,086,647	1,158,651	1,310,792	1,593,586	1,690,000	1,713,000	1,799,130	1,946,542	1,776,728	1,623,757	1,535,806
1941	1,465,850	1,450,503	1,550,425	1,689,995	1,689,991	1,690,000	1,690,000	1,805,604	2,030,000	1,950,161	1,790,024	1,700,010
1942	1,641,462	1,634,171	1,689,999	1,689,981	1,689,995	1,690,000	1,713,000	1,765,000	2,027,000	1,950,170	1,790,025	1,700,004
1943	1,619,298	1,656,980	1,690,000	1,689,976	1,689,995	1,690,000	1,713,000	1,942,425	2,030,000	1,942,627	1,790,008	1,700,004
1944	1,627,652	1,614,506	1,602,762	1,595,713	1,659,696	1,690,000	1,654,802	1,734,412	1,774,644	1,645,955	1,501,393	1,424,533
1945	1,399,858	1,447,874	1,494,310	1,520,609	1,689,996	1,690,000	1,713,000	1,750,810	1,963,956	1,898,978	1,742,064	1,654,710
1946	1,656,919	1,689,894	1,689,996	1,689,984	1,689,995	1,690,000	1,713,000	1,736,559	1,798,610	1,630,265	1,471,855	1,385,929
1947	1,326,726	1,343,162	1,376,489	1,388,708	1,417,308	1,382,693	1,307,600	1,390,047	1,329,468	1,185,303	1,057,555	994,722
1948	998,763	1,000,028	1,038,651	1,037,778	1,023,891	1,058,045	1,163,183	1,304,143	1,486,478	1,445,913	1,370,936	1,338,946
1949	1,315,198	1,306,449	1,301,616	1,290,529	1,302,222	1,471,520	1,458,479	1,511,598	1,497,458	1,330,411	1,184,072	1,109,277
1950	1,031,592	1,021,777	1,028,650	1,050,184	1,222,375	1,359,716	1,391,720	1,399,065	1,477,392	1,324,696	1,181,161	1,122,890
1951	1,119,993	1,539,064	1,689,993	1,689,971	1,689,993	1,690,000	1,667,236	1,574,454	1,611,255	1,455,849	1,313,240	1,234,363
1952	1,193,348	1,201,057	1,322,649	1,555,350	1,689,998	1,690,000	1,690,000	1,895,000	2,030,000	1,953,233	1,790,056	1,700,027
1953	1,614,775	1,604,850	1,619,190	1,689,999	1,689,998	1,688,681	1,640,000	1,613,175	1,800,540	1,753,758	1,618,034	1,543,646
1954	1,478,460	1,477,656	1,481,299	1,488,102	1,534,544	1,640,488	1,672,460	1,827,599	1,825,423	1,661,146	1,512,334	1,434,329
1955	1,355,528	1,355,273	1,373,558	1,406,138	1,456,410	1,520,077	1,546,024	1,586,167	1,556,323	1,417,207	1,289,673	1,231,406
1956	1,168,990	1,167,616	1,689,999	1,689,941	1,689,992	1,690,000	1,713,000	1,811,927	2,030,000	1,950,170	1,790,030	1,700,025
1957	1,639,825	1,624,492	1,616,539	1,610,979	1,668,413	1,690,000	1,553,124	1,618,901	1,823,527	1,674,205	1,531,403	1,458,122
1958	1,442,046	1,434,810	1,447,519	1,470,486	1,617,058	1,690,000	1,690,000	1,910,000	2,030,000	1,950,170	1,790,046	1,700,029
1959	1,611,062	1,589,728	1,567,833	1,592,273	1,689,999	1,690,000	1,667,741	1,621,443	1,514,375	1,345,045	1,198,869	1,199,076
1960	1,121,788	1,110,981	1,134,209	1,133,898	1,244,574	1,255,319	1,267,382	1,271,165	1,191,272	1,057,161	946,099	897,441
1961	850,125	849,343	929,134	930,826	939,897	901,527	873,853	845,916	800,607	734,095	679,218	660,327
1962	634,752	629,679	657,412	661,349	848,446	969,566	962,118	964,682	1,197,152	1,104,181	964,302	891,870
1963	849,308	843,563	885,959	917,711	1,106,156	1,171,799	1,267,951	1,528,432	1,820,963	1,799,778	1,680,978	1,622,475
1964	1,603,934	1,653,458	1,669,127	1,687,254	1,690,000	1,656,765	1,600,305	1,607,032	1,587,306	1,428,003	1,289,861	1,219,197
1965	1,206,172	1,229,442	1,651,739	1,689,963	1,689,993	1,690,000	1,713,000	1,742,309	1,885,372	1,885,703	1,790,014	1,700,028
1966	1,615,736	1,690,000	1,689,998	1,689,996	1,689,997	1,690,000	1,679,726	1,753,603	1,633,911	1,465,709	1,319,283	1,249,164
1967	1,173,879	1,207,410	1,361,102	1,460,117	1,557,950	1,690,000	1,690,000	1,880,000	2,030,000	2,030,000	1,790,257	1,700,021
1968	1,619,820	1,607,624	1,605,760	1,605,959	1,668,870	1,690,000	1,614,396	1,637,897	1,572,754	1,401,482	1,263,370	1,186,117
1969	1,149,974	1,179,282	1,268,765	1,689,993	1,689,990	1,690,000	1,690,000	1,930,000	2,030,000	1,977,463	1,790,116	1,700,033
1970	1,676,114	1,681,553	1,689,999	1,689,956	1,689,996	1,690,000	1,649,691	1,729,567	1,818,530	1,686,532	1,546,693	1,469,043
1971	1,409,639	1,452,554	1,539,602	1,605,510	1,674,702	1,690,000	1,647,943	1,697,455	1,862,918	1,760,768	1,624,350	1,555,368
1972	1,493,760	1,502,304	1,545,901	1,596,374	1,649,831	1,627,771	1,526,087	1,525,014	1,531,842	1,369,860	1,235,617	1,169,376
1973	1,131,276	1,144,274	1,226,345	1,355,146	1,534,763	1,690,000	1,717,600	1,979,879	2,030,000	1,863,873	1,716,891	1,634,144
1974	1,625,114	1,690,000	1,689,998	1,689,982	1,689,998	1,690,000	1,717,600	1,969,221	2,030,000	1,946,078	1,790,023	1,700,018
1975	1,671,620	1,661,732	1,660,185	1,665,519	1,689,996	1,690,000	1,717,600	1,817,373	2,030,000	1,950,017	1,790,077	1,700,024
1976	1,690,000	1,690,000	1,690,000	1,664,706	1,649,459	1,519,032	1,432,156	1,326,070	1,216,796	1,085,092	998,502	968,734
1977	932,654	925,543	947,434	935,499	920,302	807,861	717,614	671,985	616,188	544,088	486,063	467,590
1978	447,587	445,349	497,632	642,722	811,608	1,050,474	1,227,234	1,440,282	1,761,000	1,843,342	1,706,593	1,695,403
1979	1,609,844	1,612,921	1,611,978	1,689,999	1,689,995	1,690,000	1,690,000	1,717,600	1,829,909	1,675,929	1,529,138	1,453,040
1980	1,421,988	1,424,705	1,444,739	1,689,978	1,689,987	1,690,000	1,717,600	1,890,400	1,960,200	1,950,171	1,790,057	1,700,035
1981	1,617,942	1,596,204	1,588,406	1,595,955	1,619,607	1,690,000	1,712,431	1,704,973	1,654,052	1,488,840	1,357,486	1,289,752
1982	1,280,862	1,387,769	1,538,513	1,689,993	1,689,988	1,690,000	1,717,600	1,876,400	2,002,900	1,956,901	1,790,106	1,700,116
1983	1,690,000	1,690,000	1,689,995	1,689,966	1,689,989	1,294,700	1,264,000	1,270,800	1,851,400	2,030,000	1,871,320	1,700,118
1984	1,669,984	1,690,000	1,689,992	1,689,972	1,689,993	1,690,000	1,614,268	1,696,347	1,794,292	1,664,468	1,515,070	1,432,132
1985	1,417,113	1,452,224	1,496,603	1,487,191	1,522,246	1,588,373	1,576,808	1,632,030	1,567,944	1,403,408	1,269,095	1,205,885
1986	1,179,275	1,200,478	1,280,459	1,349,124	1,689,994	1,690,000	1,717,600	1,888,300	2,001,400	1,919,960	1,772,923	1,700,008
1987	1,641,224	1,619,851	1,601,301	1,570,179	1,566,244	1,592,873	1,533,150	1,433,214	1,340,031	1,205,391	1,094,728	1,041,920
1988	1,019,765	1,018,873	1,055,057	1,108,870	1,150,769	1,124,010	1,105,097	1,074,138	1,058,858	995,036	935,643	914,043
1989	887,742	895,237	927,918	951,577	981,136	1,102,792	1,092,141	1,210,143	1,264,389	1,128,410	1,016,022	1,011,279
1990	1,037,824	1,036,456	1,056,513	1,059,232	1,091,823	1,071,159	1,046,896	1,084,276	1,103,876	1,037,040	964,052	926,570
1991	915,957	910,658	930,811	923,793	902,491	977,110	978,586	1,057,934	1,177,077	1,101,096	1,030,307	998,647
1992	998,752	996,218	1,018,377	1,022,977	1,086,311	1,145,594	1,181,922	1,210,224	1,133,188	1,040,230	926,131	862,351
1993	826,188	819,772	853,539	1,058,754	1,208,553	1,454,021	1,556,674	1,878,212	2,030,000	1,950,136	1,790,048	1,700,022
1994	1,627,183	1,612,977	1,599,160	1,589,203	1,599,265	1,567,690	1,531,912	1,544,575	1,501,844	1,379,308	1,279,438	1,233,861
1995	1,194,744	1,214,540	1,259,323	1,516,844	1,621,716	1,690,000	1,717,600	1,629,700	1,982,800	2,030,000	1,816,185	1,700,062
1996	1,608,082	1,583,096	1,604,413	1,672,576	1,689,990	1,690,000	1,717,600	2,002,400	2,030,000	1,932,566	1,784,558	1,700,014
1997	1,667,201	1,690,000	1,689,993	1,689,874	1,689,994	1,690,000	1,610,765	1,854,718	1,968,374	1,829,837	1,687,672	1,633,886
1998	1,552,574	1,546,178	1,547,584	1,689,997	1,689,989	1,690,000	1,717,600	1,714,000	1,987,500	2,030,000	1,790,242	1,700,022
1999	1,662,014	1,675,303	1,690,000	1,689,986	1,689,990	1,690,000	1,717,600	1,793,571	2,015,623	1,887,792	1,745,950	1,671,908
2000	1,585,584	1,573,921	1,558,276	1,634,200	1,689,993	1,690,000	1,717,600	1,992,227	2,030,000	1,864,407	1,719,364	1,644,682
2001	1,634,728	1,622,232	1,613,706	1,605,691	1,629,054	1,690,000	1,716,911	1,843,113	1,712,149	1,547,470	1,408,517	1,342,971
2002	1,281,127	1,292,736	1,366,211	1,421,647	1,473,814	1,524,332	1,509,107	1,659,494	1,684,266	1,520,880	1,382,342	1,309,452
Avg (21-02)	1,329,553	1,339,687	1,382,998	1,428,244	1,487,547	1,512,057	1,516,647	1,595,597	1,679,130	1,579,451	1,442,804	1,374,329

APPENDIX O1

Table 2.6-3

Difference in Don Pedro Reservoir Storage (Acre-feet) WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	0	0	0	0	0	0	0	-3,188	-10,433	-12,571	-12,516	-12,475
1922	-12,449	-12,443	-12,443	-12,446	-7,314	0	0	-11,174	0	-5	0	0
1923	0	0	0	0	0	0	0	-19,014	-21,065	-23,157	-23,056	-22,982
1924	-22,935	-22,924	-22,924	-22,931	-22,933	-22,924	-24,684	-29,519	-29,489	-29,439	-29,370	-29,309
1925	-29,247	-29,231	-29,234	-29,249	-29,253	-29,251	-32,912	-46,419	-48,378	-50,350	-50,122	-49,951
1926	-49,846	-49,818	-50,315	-50,330	-50,531	-49,936	-60,110	-70,803	-94,077	-93,648	-93,216	-92,904
1927	-92,711	-92,659	-87,618	-87,643	-87,650	-87,617	-87,534	-114,797	-93,866	-95,648	-86,302	-72,891
1928	-72,744	-52,440	-17,973	-14,850	1	0	-11,849	-16,583	-18,642	-18,562	-18,479	-18,418
1929	-18,380	-18,369	-18,370	-18,376	-18,377	-18,370	-18,352	-33,941	-48,965	-48,740	-48,519	-48,356
1930	-48,255	-48,228	-48,230	-48,244	-48,248	-48,230	-48,183	-48,546	-50,493	-50,264	-50,033	-49,858
1931	-49,748	-49,719	-49,721	-49,736	-49,739	-49,720	-49,669	-49,534	-49,357	-49,120	-48,891	-48,719
1932	-48,606	-48,575	-77,837	-89,136	-104,447	-123,055	-130,097	-137,473	-145,745	-147,267	-146,583	-146,090
1933	-145,787	-145,705	-145,711	-145,755	-145,766	-145,711	-150,023	-154,107	-167,558	-168,970	-168,157	-167,562
1934	-167,197	-167,099	-170,312	-168,869	-169,775	-172,288	-175,433	-185,869	-186,997	-186,104	-185,207	-184,556
1935	-184,158	-184,050	-184,058	-201,819	-218,063	-212,422	-222,877	-230,972	-248,071	-249,176	-248,066	-247,237
1936	-246,724	-246,586	-246,703	-246,692	9	0	0	-10,344	-12,425	-14,554	-14,491	-14,445
1937	-14,415	-14,407	-14,417	-14,422	1	0	0	-9,338	-19,419	-21,520	-21,425	-21,356
1938	-21,313	-21,300	0	0	0	0	0	0	0	-2,183	-5	0
1939	0	0	0	0	0	0	-15,779	-14,122	-16,188	-16,114	-16,041	-15,988
1940	-15,954	-15,945	-23,947	-22,233	-28,098	0	0	8,878	3,978	3,960	3,943	3,931
1941	3,923	3,920	3,310	-1	0	0	0	-1,370	0	-4	0	0
1942	0	0	0	1	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	-2,185	0	-2,183	-4	0
1944	0	0	0	0	0	0	0	-33,804	-35,808	-37,838	-37,667	-37,541
1945	-37,462	-37,441	-37,442	-37,453	1	0	0	-433	9,714	7,488	7,455	7,432
1946	7,417	106	0	0	0	0	0	-10,228	-12,309	-12,256	-12,201	-12,159
1947	-12,134	-12,126	-12,127	-12,131	-12,131	-12,127	-12,114	-38,678	-40,656	-40,473	-40,287	-40,148
1948	-40,063	-40,039	-40,041	-40,053	-40,055	-44,367	-48,897	-53,095	-66,246	-68,046	-67,664	-67,392
1949	-67,232	-67,190	-67,191	-67,203	-67,207	-71,084	-75,364	-78,800	-88,087	-87,683	-87,286	-86,991
1950	-86,808	-86,758	-90,313	-87,678	-102,553	-106,396	-106,462	-107,067	-102,069	-102,984	-102,516	-102,171
1951	-101,957	-116,550	2	0	0	0	-3,151	-4,068	-14,932	-17,047	-16,969	-16,911
1952	-16,876	-16,868	-16,868	-21,355	0	0	0	0	0	-2,184	-5	0
1953	0	0	0	0	0	0	-20,783	-24,843	-26,877	-28,945	-28,819	-28,724
1954	-28,665	-28,648	-28,650	-28,658	-28,660	-28,650	-28,623	-54,058	-55,995	-55,755	-55,504	-55,316
1955	-55,200	-55,169	-55,172	-55,187	-55,192	-55,171	-56,972	-60,371	-69,233	-68,919	-68,597	-68,369
1956	-68,227	-68,189	-38,525	6	1	0	0	-7,229	0	0	0	0
1957	0	0	0	0	0	0	0	-34,827	-36,828	-38,853	-38,680	-38,551
1958	-38,471	-38,449	-38,450	-38,462	-38,465	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	-5,335	-20,965	-20,895	-20,799	-20,704	-20,635
1960	-20,592	-20,580	-20,582	-20,587	-24,035	-26,731	-27,380	-25,335	-23,087	-22,983	-22,873	-22,791
1961	-22,742	-22,728	-31,324	-31,333	-31,336	-31,323	-31,291	-31,207	-31,095	-30,947	-30,795	-30,692
1962	-30,627	-30,610	-30,610	-30,620	-30,621	-30,610	-30,579	-129,058	-148,817	-150,321	-149,603	-149,073
1963	-148,750	-148,661	-140,742	-127,465	-148,735	-148,680	-148,537	-165,164	-166,447	-167,912	-167,172	-166,619
1964	-166,277	-166,186	-166,193	-166,240	-154,478	-154,422	-156,469	-168,455	-190,238	-189,371	-188,499	-187,867
1965	-187,478	-187,372	-179,977	25	0	0	0	1,543	15,495	13,244	24	0
1966	0	0	0	0	1	0	-8,994	-11,156	-13,235	-13,175	-13,114	-13,069
1967	-13,042	-13,035	-13,036	-13,039	-13,040	0	0	0	0	0	-5	0
1968	0	0	0	0	0	0	0	-23,586	-25,621	-25,505	-25,386	-25,302
1969	-25,249	-25,235	-25,236	3	0	0	0	0	0	-2,184	-5	0
1970	0	0	0	-4	0	0	0	-11,491	-13,568	-15,693	-15,623	-15,570
1971	-15,537	-15,529	-15,529	-15,534	-15,535	0	0	-20,599	-22,646	-24,730	-24,624	-24,542
1972	-24,492	-24,478	-24,480	-24,487	-24,489	-24,479	-24,457	-49,064	-51,012	-50,779	-50,543	-50,374
1973	-50,270	-50,241	-50,243	-50,258	-50,261	-43,041	-42,381	-58,368	0	0	0	0
1974	0	0	0	1	0	0	0	-5,036	0	-2,184	-5	0
1975	0	0	0	0	0	0	0	7,481	0	-4	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	8,218	3,004	-3	-3	-4	-4	-4	-4	-4	-4
1978	-4	-4	-4	-4	-4	-4	-4	-84,008	0	-2,183	-2,174	-2,477
1979	-3,566	-3,564	-3,565	0	0	0	0	0	-2,114	-2,105	-2,096	-2,088
1980	-2,085	-2,083	-2,083	-1	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	-2,116	-10,892	-27,623	-27,500	-27,374	-27,279
1982	-27,222	-27,206	-27,207	4	0	0	0	0	0	-2,184	-9	0
1983	0	0	0	0	0	0	0	0	0	0	-2,183	0
1984	-3,065	0	0	0	0	0	-196	-14,019	-16,087	-18,202	-18,121	-18,061
1985	-18,022	-18,013	-18,013	-18,018	-18,020	-18,013	-17,996	-15,311	-17,374	-17,296	-17,214	-17,157
1986	-17,122	-17,112	-25,509	-29,178	0	0	0	0	0	-2,184	-2,174	-4
1987	-3	-3	-3	-4	-3	-3	-3	-3	-9,443	-9,400	-9,357	-9,326
1988	-9,305	-9,300	-9,301	-9,303	4,356	4,354	-1,227	-10,934	-46,885	-51,655	-51,407	-51,222
1989	-51,110	-51,080	-51,082	-51,098	-51,102	-51,083	-62,482	-99,279	-103,811	-103,341	-102,860	-102,498
1990	-102,277	-102,218	-102,223	-102,253	-102,261	-102,223	-102,121	-119,107	-112,974	-112,452	-111,911	-111,512
1991	-116,465	-116,396	-116,402	-120,253	-120,264	-120,217	-120,110	-140,137	-157,006	-154,266	-155,596	-155,057
1992	-154,722	-154,632	-154,639	-154,686	-154,699	-154,641	-137,570	-166,565	-166,028	-165,300	-164,542	-163,984
1993	-163,639	-163,539	-171,483	-180,798	-180,813	-186,849	-191,394	-193,764	-88,210	-26,861	-4,904	-8
1994	-7	-8	-8	-7	-7	-8	-8	-20,888	-22,931	-22,826	-22,720	-22,644
1995	-22,598	-22,584	-22,586	-22,592	-22,594	0	0	0	0	0	-2,184	-3
1996	-3	-3	-3	-3	0	0	0	0	0	-2,183	-2,174	-4
1997	-3	0	0	1	0	0	-12,576	-14,731	-16,798	-18,908	-18,826	-18,764
1998	-18,726	-18,715	-18,716	3	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	-12,321	-17,171	-19,281	-19,198	-19,136
2000	-19,098	-19,087	-19,088	-19,093	1	0	0	-10,376	0	0	0	0
2001	0	0	0	1	0	0	0	-41,731	-43,496	-43,303	-43,106	-42,959
2002	-42,867	-42,843	-42,845	-42,857	-42,860	-42,845	-42,804	-75,937	-77,796	-77,450	-77,093	-76,828
Avg (21-02)	-39,746	-39,707	-37,753	-34,605	-30,552	-29,368	-31,048	-41,810	-41,627	-41,602	-41,115	-40,653

APPENDIX O1

Table 2.6-4

Difference in Don Pedro Reservoir Inflow (Acre-feet) WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	-13,402	-3,253	-3,191	-7,268	-2,188	0	0	-29,302
1922	0	0	0	0	0	0	-7,366	-11,189	-4,880	-2,188	0	0	-25,623
1923	0	0	0	0	0	0	-2,117	-19,037	-2,117	-2,188	0	0	-25,459
1924	0	0	0	0	0	0	-1,702	-4,834	0	0	0	0	-6,536
1925	0	0	0	0	0	0	-3,692	-13,608	-2,118	-2,188	0	0	-21,606
1926	0	0	-496	0	-197	576	-10,227	-10,859	-23,557	0	0	0	-44,760
1927	0	0	5,045	0	0	0	0	-27,513	-6,321	-2,188	0	0	-30,977
1928	0	0	0	0	0	0	-20,759	-4,770	-2,118	0	0	0	-27,647
1929	0	0	0	0	0	0	0	-15,658	-15,168	0	0	0	-30,826
1930	0	0	0	0	0	0	0	-487	-2,118	0	0	0	-2,605
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	-29,259	-11,274	-15,304	-18,651	-7,164	-7,727	-8,766	-2,188	0	0	-100,333
1933	0	0	0	0	0	0	-4,456	-4,485	-14,010	-2,188	0	0	-25,139
1934	0	0	-3,206	1,494	-892	-2,580	-3,320	-10,927	-1,802	0	0	0	-21,233
1935	0	0	0	-17,702	-16,228	5,562	-10,668	-8,677	-17,892	-2,188	0	0	-67,793
1936	0	0	-106	82	-329	-16,899	-3,635	-10,357	-2,118	-2,188	0	0	-35,550
1937	0	0	-9	-1	-1,778	-3,195	-8,513	-9,349	-10,129	-2,188	0	0	-35,162
1938	0	0	1,711	0	0	-38	-7,142	-17,015	-4,880	-2,188	0	0	-29,552
1939	0	0	0	0	0	0	-15,786	1,619	-2,118	0	0	0	-16,285
1940	0	0	-8,001	1,721	-5,863	-10,103	-5,679	8,890	-4,880	0	0	0	-23,915
1941	0	0	-610	0	-445	-421	-519	-1,372	-2,168	-2,188	0	0	-7,723
1942	0	0	0	-5,541	0	-2,664	-5,524	-2,854	-2,762	-2,188	0	0	-21,533
1943	0	0	0	0	0	-2,001	-6,721	-2,188	-2,118	-2,188	0	0	-15,216
1944	0	0	0	0	0	0	0	-33,846	-2,118	-2,188	0	0	-38,152
1945	0	0	0	0	0	-15,317	-203	-434	10,161	-2,188	0	0	-7,981
1946	0	0	0	0	0	-12,207	-3,612	-10,240	-2,118	0	0	0	-28,177
1947	0	0	0	0	0	0	0	-26,630	-2,118	0	0	0	-28,748
1948	0	0	0	0	0	-4,327	-4,613	-4,372	-13,430	-2,188	0	0	-28,930
1949	0	0	0	6	0	-3,923	-4,351	-3,634	-9,575	0	0	0	-21,477
1950	0	0	-3,551	2,662	-14,868	-3,881	-171	-886	4,635	-1,388	0	0	-17,448
1951	0	-14,654	0	0	0	0	-3,152	-925	-10,896	-2,189	0	0	-31,816
1952	0	0	0	-4,482	0	0	0	-15,879	-2,117	-2,188	0	0	-24,666
1953	0	0	0	0	0	0	-20,792	-4,118	-2,118	-2,188	0	0	-29,216
1954	0	0	0	0	0	0	0	-25,536	-2,118	0	0	0	-27,654
1955	0	0	0	0	0	0	-1,855	-3,549	-9,082	0	0	0	-14,486
1956	0	0	-7,403	0	0	-3,555	-3,068	-7,238	-2,117	-2,188	0	0	-25,569
1957	0	0	0	0	0	0	0	-34,871	-2,117	-2,188	0	0	-39,176
1958	0	0	0	0	0	0	0	-11,490	-1,013	-2,188	0	0	-14,691
1959	0	0	0	0	0	0	-5,337	-15,664	0	0	0	0	-21,001
1960	0	0	0	0	-3,446	-2,707	-674	1,977	2,165	0	0	0	-2,685
1961	0	0	-8,594	0	0	0	0	0	0	0	0	0	-8,594
1962	0	0	0	0	0	0	0	-98,696	-20,248	-2,188	0	0	-121,132
1963	0	0	7,926	13,317	-21,259	0	0	-17,039	-1,841	-2,188	0	0	-21,084
1964	0	0	0	0	0	0	-2,195	-12,402	-22,395	0	0	0	-36,992
1965	0	0	7,403	-5,708	-5,156	-10,711	-9,769	1,545	13,979	-2,188	-2,188	0	-12,793
1966	0	0	-1,152	0	-17,169	0	-8,997	-2,188	-2,118	0	0	0	-31,624
1967	0	0	0	0	0	-5,460	0	-12,427	0	-2,188	-2,188	0	-22,263
1968	0	0	0	0	0	0	0	-23,616	-2,117	0	0	0	-25,733
1969	0	0	0	0	-2,451	-10,837	-7,642	-2,188	-2,118	-2,188	0	0	-27,424
1970	0	0	0	26,592	-5,953	-21,074	0	-11,504	-2,118	-2,188	0	0	-16,245
1971	0	0	0	0	0	0	0	-20,625	-2,117	-2,188	0	0	-24,930
1972	0	0	0	0	0	0	0	-24,703	-2,117	0	0	0	-26,820
1973	0	0	0	0	0	0	0	-16,112	-2,117	0	0	0	-18,229
1974	0	0	0	-8,391	0	-10,465	-4,603	-5,043	-4,879	-2,188	0	0	-35,569
1975	0	0	0	0	0	0	-8,286	7,490	-947	-2,188	0	0	-3,931
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	8,218	-5,216	-3,007	-1	-1	0	0	0	0	0	-7
1978	0	0	0	0	0	0	0	-84,115	-5,616	-2,188	0	-310	-92,229
1979	-1,095	0	0	0	0	-16,218	-2,117	-2,188	-2,118	0	0	0	-23,736
1980	0	0	0	9,723	0	-7,610	-4,880	-2,188	-2,118	-2,188	0	0	-9,261
1981	0	0	0	0	0	0	-2,117	-8,792	-16,794	0	0	0	-27,703
1982	0	0	0	0	-11,554	0	0	-1,902	-1,841	-2,188	-2,188	-2,117	-21,790
1983	-1,047	2,762	-952	0	0	0	0	-9,542	-4,603	-2,188	-2,188	0	-17,758
1984	-3,068	4,603	0	0	0	3,935	-197	-13,841	-2,118	-2,188	0	0	-12,874
1985	0	0	0	0	0	0	0	2,643	-2,117	0	0	0	526
1986	0	0	-8,396	-3,661	12,066	-20,128	-11,300	-5,042	-4,880	-2,188	0	0	-43,529
1987	0	0	0	0	0	0	0	0	-9,457	0	0	0	-9,457
1988	0	0	0	0	13,660	0	-5,580	-9,724	-36,050	-5,001	0	0	-42,695
1989	0	0	0	0	0	0	-11,454	-37,007	-4,880	0	0	0	-53,341
1990	0	0	0	0	0	0	0	-17,279	5,728	0	0	0	-11,551
1991	-5,202	0	0	-3,816	-1	0	0	-20,361	-17,370	2,048	-2,045	0	-46,747
1992	0	0	0	0	0	0	16,950	-29,350	0	0	0	0	-12,400
1993	0	5	-7,936	-9,261	0	-6,104	-4,729	-2,854	-25,296	-2,188	0	0	-58,363
1994	0	0	0	0	0	0	0	-20,907	-2,118	0	0	0	-23,025
1995	0	0	0	0	0	13,327	-9,206	-1,903	-1,841	-2,188	-2,188	0	-3,999
1996	0	0	0	0	-1,690	0	-4,879	-5,042	-4,880	-2,188	0	0	-18,679
1997	0	0	0	-6,207	0	0	-12,582	-2,188	-2,118	-2,188	0	0	-25,283
1998	0	0	0	0	0	-3,118	-11,049	-3,900	-3,775	-2,188	0	0	-24,030
1999	0	0	0	0	0	-8,562	-10,982	-12,335	-4,900	-2,188	0	0	-38,967
2000	0	0	0	0	0	0	0	-10,389	-2,118	0	0	0	-12,507
2001	0	0	0	0	0	0	0	-41,781	-1,904	0	0	0	-43,685
2002	0	0	0	0	0	0	0	-33,284	-2,118	0	0	0	-35,402
Avg (21-02)	-127	-89	-602	-313	-1,242	-2,595	-3,557	-11,996	-4,753	-1,227	-158	-30	-26,689

Figure 2.6-2

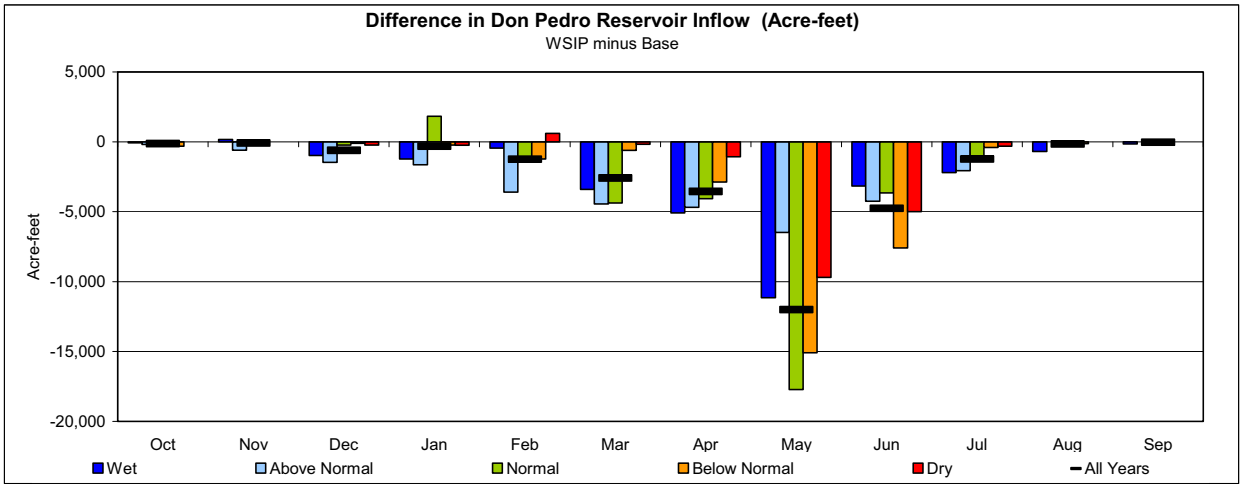

Figure 2.6-1 and Table 2.6-3 illustrate that, during drought sequences, the reduction in inflow to Don Pedro Reservoir can accumulate from year to year. Compared to the base setting, the WSIP would result in lower Don Pedro Reservoir storage during some part of most years, and more predominantly during multi-year drought periods. Figure 2.6-3 illustrates the Don Pedro Reservoir storage for the WSIP setting, averaged by year type. Figure 2.6-4 illustrates the difference in reservoir storage, averaged by year type, in comparing the WSIP and base-Calaveras constrained settings. Also shown is the average difference in storage for the two settings during the 82-year simulation.

Table 2.6-3 illustrates that, in some years (approximately one-third of the years, i.e., the wettest of years), the storage in Don Pedro Reservoir would not be substantially different, because large inflows to the reservoir during these years would require the management of storage (release of flow above minimum stream requirements) to satisfy flood control requirements. During the other years, the reduction in storage could range from a single year's additional diversions by the SFPUC to over 245,000 acre-feet (1936) from the accumulation of several years of additional diversions by the SFPUC. For example, the greatest draw from reservoir storage occurs during the drought of 1976-1977 (during which the WSIP would not cause an incremental additional draw from storage), and the greatest difference in reservoir draw between the base and the WSIP settings occurs during the years of the 1928-1935 drought.

Figure 2.6-5 illustrates the average monthly storage in Don Pedro Reservoir for the 82-year simulation, and the range in storage for each month for the WSIP and base settings. The difference in storage in Don Pedro Reservoir attributed to the upstream effects of the WSIP would affect releases from La Grange Dam to the stream. A difference in the amount of available reservoir space in the winter and spring due to the WSIP would lead to a difference in the ability to regulate inflow, thus potentially changing the amount of water released to the stream that is above minimum release requirements. During periods when inflow differs and Don Pedro Reservoir is at maximum storage capacity within the flood control storage limitation, a change in inflow would directly manifest as a change in releases from La Grange Dam (a change in either more or less flow). Figure 2.6-1 illustrates the stream releases from La Grange Dam for the WSIP and base settings.

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Figure 2.6-3

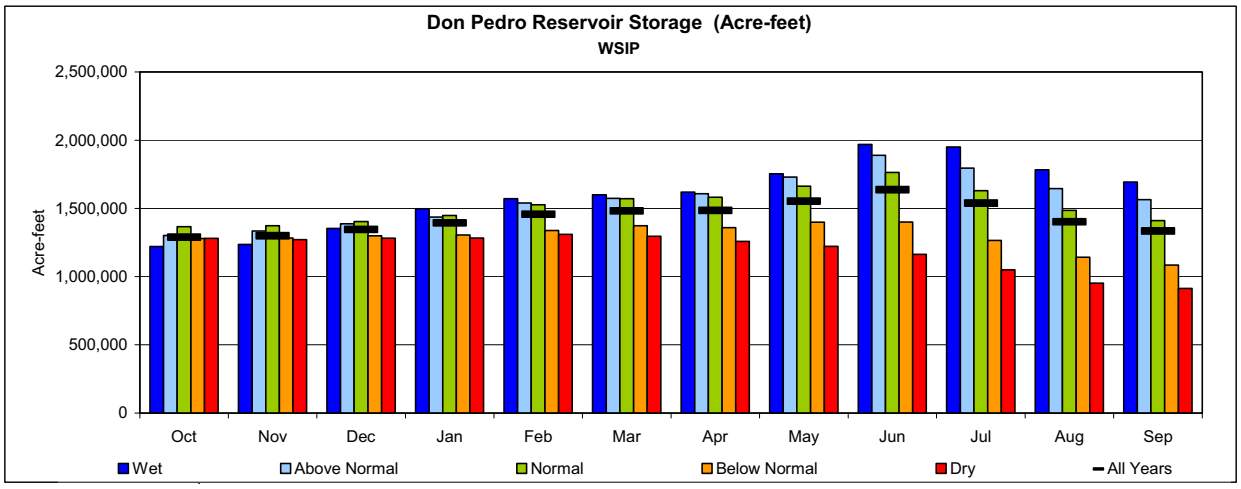


Figure 2.6-4

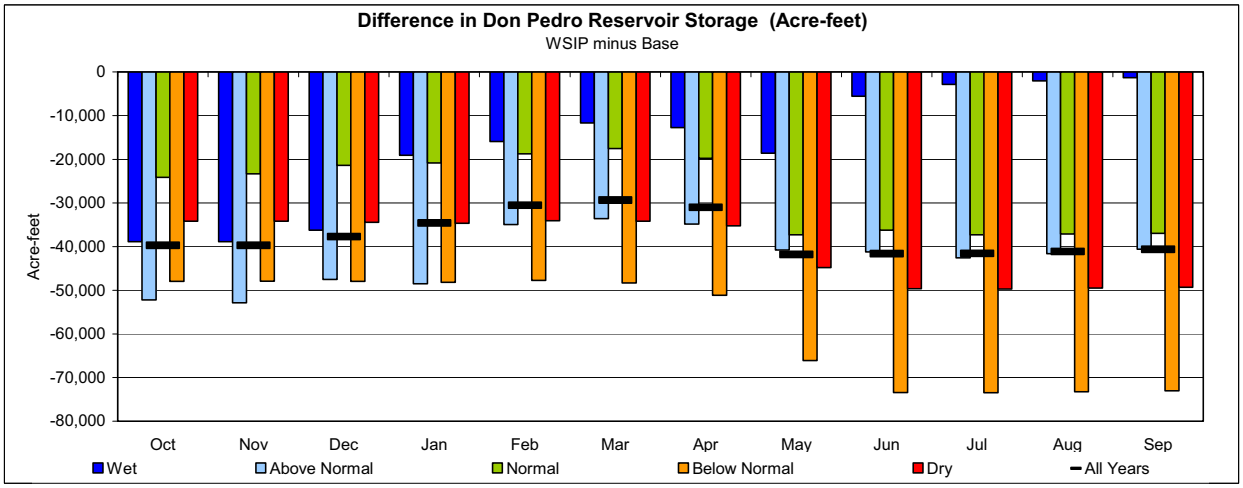
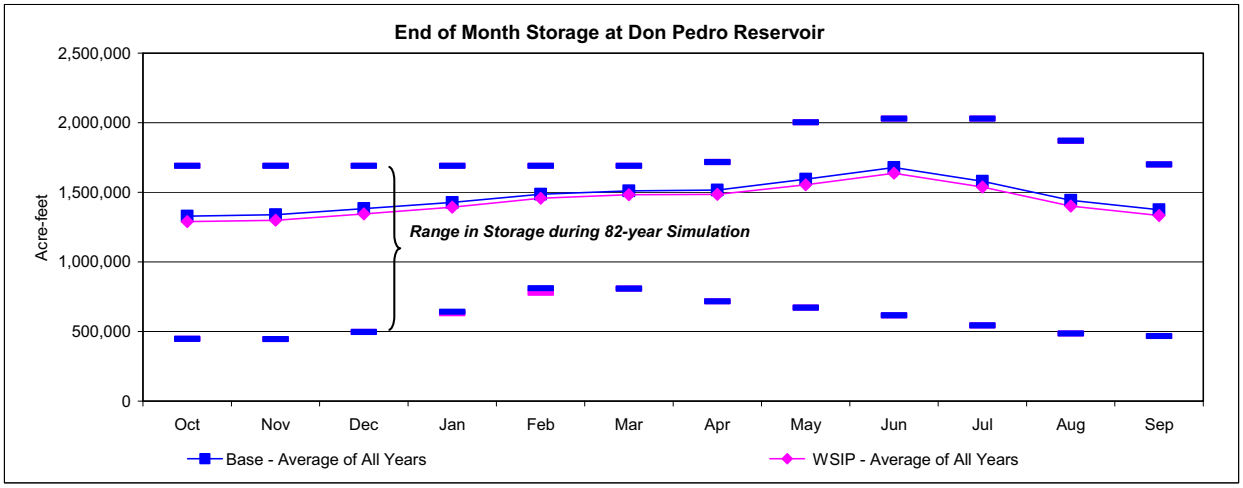


Figure 2.6-5



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Supplementing Figure 2.6-1 are Table 2.6-5 and Table 2.6-6, which illustrate the releases to the Tuolumne River from La Grange Dam for the WSIP and base settings. Table 2.6-7 shows the difference in stream releases between the WSIP and base settings. Consistent with the periods showing changes in Don Pedro Reservoir storage, stream releases following the drawdown periods would indicate a reduction. The additional depletion of reservoir storage would manifest as a reduction in subsequent releases below La Grange Dam to replenish reservoir storage. The same information shown in Table 2.6-7 is illustrated in Table 2.6-8, arranged in descending order based on the San Joaquin River Index. The differences in releases to the Tuolumne River from La Grange Dam would occur only when there would otherwise be releases in excess of minimum Federal Energy Regulatory Commission (FERC) flow requirements, typically during wetter years. Occasional minor reductions in releases would also occur during winter, when the direct diversion of additional water by the SFPUC would lead to a commensurate reduction in inflow to Don Pedro Reservoir. If Don Pedro Reservoir is passing inflow for flood control, a similar commensurate reduction in releases would occur. Table 2.6-7 illustrates the decrease in monthly flow below La Grange Dam that would occur, up to approximately 247,000 acre-feet in one month (February 1936). This reduction is associated with the additional replenishment of Don Pedro Reservoir caused by the additional diversions of the SFPUC during the drought of 1987-1992. The effects of the SFPUC diversions accumulate in Don Pedro Reservoir throughout the drought period. Using the assumption that a change in release volume equates to a delay or acceleration of releasing 6,000 acre-feet per day means that the difference in stream releases from La Grange Dam between the WSIP and the base settings would be a delay in releases above minimum FERC flow requirements for a period longer than a month. Normally, the delay in release would not affect the peak stream release rate during a year. However, infrequently (such as in 1993, which followed a lengthy six-year drought), the WSIP's effect on stream releases could lead to an elimination of all flow in excess of FERC requirements in the year. Such a reduction in flow would not be common and would occur only because of multi-year droughts.

Comparing the WSIP and base settings, Table 2.6-9 illustrates the releases to the Tuolumne River below La Grange Dam; their differences are provided in terms of monthly volumetric flow averaged within year types.

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Table 2.6-5

Total La Grange Release to River (Acre-feet) WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	12,744	10,711	11,068	11,068	33,964	231,996	111,640	64,123	14,876	15,372	15,372	14,876	547,810
1922	24,397	17,852	18,447	18,447	16,661	169,885	167,789	61,936	470,876	59,363	27,204	24,862	1,077,719
1923	24,397	17,852	52,816	101,025	90,321	34,926	156,958	61,936	14,876	15,372	15,372	14,876	600,727
1924	24,397	17,852	18,447	18,447	17,256	18,447	14,650	14,589	2,975	3,074	3,074	2,975	156,183
1925	7,736	8,926	9,223	9,223	8,331	9,223	73,158	69,584	4,463	4,612	4,612	4,463	213,554
1926	13,240	10,413	10,760	10,760	9,719	10,760	31,566	30,449	4,463	4,612	4,612	4,463	145,817
1927	9,223	8,926	9,223	9,223	8,331	9,223	64,241	61,936	14,876	15,372	15,372	14,876	240,822
1928	24,397	17,852	18,447	18,447	53,135	208,209	37,200	35,902	4,463	4,612	4,612	4,463	431,739
1929	12,744	10,711	11,068	11,068	9,997	11,068	26,770	25,952	2,975	3,074	3,074	2,975	131,476
1930	9,223	8,926	9,223	9,223	8,331	9,223	27,049	26,214	2,975	3,074	3,074	2,975	119,510
1931	9,223	8,926	9,223	9,223	8,331	9,223	14,650	14,589	2,975	3,074	3,074	2,975	95,486
1932	7,736	8,926	9,223	9,223	8,628	9,223	64,241	61,936	14,876	15,372	15,372	14,876	239,632
1933	24,397	17,852	18,447	18,447	16,661	18,447	35,753	34,374	4,463	4,612	4,612	4,463	202,528
1934	9,223	8,926	9,223	9,223	8,331	9,223	14,650	14,589	2,975	3,074	3,074	2,975	95,486
1935	7,736	8,926	9,223	9,223	8,331	9,223	64,241	61,936	14,876	15,372	15,372	14,876	239,335
1936	24,397	17,852	18,447	18,447	54,167	204,086	168,811	61,936	14,876	15,372	15,372	14,876	628,639
1937	24,397	17,852	18,447	18,447	194,659	260,123	177,081	61,936	14,876	15,372	15,372	14,876	833,438
1938	24,397	17,852	88,717	79,596	381,104	454,579	291,007	288,864	227,401	156,701	48,636	34,811	2,093,665
1939	24,397	17,852	18,447	18,447	45,240	66,009	28,525	27,598	4,463	4,612	4,612	4,463	264,665
1940	9,223	8,926	9,223	9,223	8,628	196,482	163,672	61,936	14,876	15,372	15,372	14,876	527,809
1941	24,397	17,852	18,447	59,195	262,128	284,760	249,836	61,936	49,928	88,796	26,488	21,347	1,165,110
1942	24,397	17,852	41,845	150,525	153,324	148,197	218,453	228,994	91,485	115,177	26,854	17,017	1,234,120
1943	24,397	17,852	32,826	197,464	149,252	336,578	194,801	61,936	72,671	15,372	17,014	17,597	1,137,760
1944	24,397	17,852	18,447	18,447	17,256	55,093	47,894	45,898	4,463	4,612	4,612	4,463	263,434
1945	13,240	10,413	10,760	10,760	86,052	215,383	119,005	61,936	14,876	15,372	15,372	14,876	588,045
1946	24,397	25,160	229,316	136,983	150,231	166,940	68,500	61,936	14,876	15,372	15,372	14,876	923,959
1947	24,397	17,852	18,447	18,447	16,661	18,447	28,054	27,156	4,463	4,612	4,612	4,463	187,611
1948	9,223	8,926	9,223	9,223	8,628	9,223	39,947	38,477	4,463	4,612	4,612	4,463	151,020
1949	12,744	10,711	11,068	11,068	9,997	11,068	33,037	31,999	4,463	4,612	4,612	4,463	149,842
1950	12,744	10,711	11,068	11,068	9,997	11,068	61,680	58,823	4,463	4,612	4,612	4,463	205,309
1951	13,240	10,413	227,649	225,258	195,815	153,328	104,899	99,341	4,463	4,612	4,612	4,463	1,048,093
1952	13,240	10,413	10,760	10,760	56,975	213,745	258,495	264,611	230,309	162,673	38,667	32,093	1,302,741
1953	24,397	17,852	18,447	27,845	60,046	18,447	87,632	83,153	4,463	4,612	4,612	4,463	355,969
1954	13,240	10,413	10,760	10,760	9,719	10,760	41,422	39,831	4,463	4,612	4,612	4,463	165,055
1955	13,240	10,413	10,760	10,760	9,719	10,760	31,555	30,438	4,463	4,612	4,612	4,463	145,795
1956	9,223	8,926	9,223	397,642	218,902	177,380	103,683	61,936	153,608	108,969	29,023	30,608	1,309,123
1957	24,397	17,852	18,447	18,447	16,661	25,078	85,025	80,709	4,463	4,612	4,612	4,463	304,766
1958	13,240	10,413	10,760	10,760	9,719	173,384	311,309	268,728	276,764	96,627	36,329	32,935	1,250,968
1959	24,397	17,852	18,447	18,447	32,284	59,822	28,824	27,878	4,463	4,612	4,612	4,463	246,101
1960	9,223	8,926	9,223	9,223	8,628	9,223	24,895	24,194	2,975	3,074	3,074	2,975	115,633
1961	7,736	8,926	9,223	9,223	8,331	9,223	14,650	14,589	2,975	3,074	3,074	2,975	93,999
1962	7,736	8,926	9,223	9,223	8,331	9,223	94,959	90,022	4,463	4,612	4,612	4,463	255,793
1963	13,240	10,413	10,760	10,760	9,719	10,760	64,241	61,936	14,876	15,372	15,372	14,876	252,325
1964	24,397	17,852	18,447	18,447	17,256	18,447	28,168	27,263	4,463	4,612	4,612	4,463	188,427
1965	9,223	8,926	9,223	94,896	193,710	157,615	159,589	61,936	14,876	15,372	32,886	32,779	791,031
1966	24,397	22,517	119,607	51,266	82,677	61,610	32,240	31,252	4,463	4,612	4,612	4,463	443,716
1967	12,744	10,711	11,068	11,068	9,997	84,982	252,040	220,298	388,802	257,232	131,931	28,007	1,418,880
1968	24,397	17,852	18,447	18,447	17,256	32,584	28,988	28,031	4,463	4,612	4,612	4,463	204,152
1969	9,223	8,926	9,223	32,847	276,920	244,541	322,211	447,942	425,936	156,634	66,306	35,885	2,036,594
1970	24,397	17,852	73,665	370,017	136,129	162,608	64,241	61,936	14,876	15,372	15,372	14,876	971,341
1971	24,397	17,852	18,447	18,447	16,661	70,249	66,522	63,363	4,463	4,612	4,612	4,463	314,088
1972	13,240	10,413	10,760	10,760	10,066	10,760	30,579	29,524	2,975	3,074	3,074	2,975	138,200
1973	9,223	8,926	9,223	9,223	8,331	9,223	64,241	61,936	35,698	15,372	15,372	14,876	261,644
1974	24,397	42,215	100,199	144,039	84,226	200,904	125,080	61,936	182,580	15,372	23,592	26,455	1,030,995
1975	24,397	17,852	18,447	18,447	112,415	201,425	100,944	61,936	174,642	21,358	50,309	29,597	831,769
1976	35,185	23,322	33,098	18,447	17,256	18,447	20,660	20,224	2,975	3,074	3,074	2,975	198,737
1977	7,736	8,926	9,223	9,223	8,331	9,223	14,650	14,589	2,975	3,074	3,074	2,975	93,999
1978	7,736	8,926	9,223	9,223	8,331	9,223	64,241	61,936	71,448	15,372	15,372	14,876	295,907
1979	24,397	17,852	18,447	25,892	150,953	195,605	90,635	338,861	14,876	15,372	15,372	14,876	923,138
1980	24,397	17,852	18,447	183,143	376,597	204,132	110,674	105,463	278,671	152,585	41,442	36,580	1,549,983
1981	24,397	17,852	18,447	18,447	16,661	22,926	29,256	28,454	4,463	4,612	4,612	4,463	194,590
1982	12,744	10,711	11,068	32,535	338,147	314,765	511,142	350,499	260,216	155,711	59,424	132,689	2,189,651
1983	155,278	142,160	252,175	268,145	324,750	929,999	277,685	441,769	223,430	236,135	186,588	171,850	3,609,964
1984	24,397	262,407	413,016	228,905	204,697	159,934	64,241	61,936	14,876	15,372	15,372	14,876	1,480,029
1985	24,397	17,852	18,447	18,447	16,661	18,447	34,634	33,325	4,463	4,612	4,612	4,463	200,360
1986	9,223	8,926	9,223	9,223	156,378	441,405	148,505	177,029	197,577	15,372	15,372	17,744	1,205,977
1987	24,397	17,852	18,447	18,447	16,661	18,447	25,003	24,296	2,975	3,074	3,074	2,975	175,648
1988	7,736	8,926	9,223	9,223	8,628	9,223	19,297	18,947	2,975	3,074	3,074	2,975	103,301
1989	7,736	8,926	9,223	9,223	8,331	9,223	26,519	25,717	2,975	3,074	3,074	2,975	116,996
1990	7,736	8,926	9,223	9,223	8,331	9,223	19,866	19,480	2,975	3,074	3,074	2,975	104,106
1991	7,736	8,926	9,223	9,223	8,331	9,223	26,397	25,603	2,975	3,074	3,074	2,975	116,760
1992	7,736	8,926	9,223	9,223	8,628	9,223	20,501	20,075	2,975	3,074	3,074	2,975	105,633
1993	7,736	8,926	9,223	9,223	8,331	9,223	64,241	61,936	14,876	15,372	15,372	23,914	248,373
1994	24,397	17,852	18,447	18,447	16,661	18,447	26,774	25,956	2,975	3,074	3,074	2,975	179,079
1995	9,223	8,926	9,223	9,223	8,331	444,650	252,480	587,468	266,389	378,373	180,518	51,840	2,206,644
1996	24,397	17,852	18,447	18,447	282,350	273,866	138,689	137,214	166,467	15,372	15,372	21,277	1,129,750
1997	24,397	42,957	363,466	949,830	195,855	141,961	64,241	61,936	14,876	15,372	15,372	14,876	1,905,139
1998	24,397	17,852	18,447	18,548	334,719	269,674	194,691	338,154	410,419	282,802	127,440	28,820	2,065,963
1999	24,397	17,852	43,763	118,488	288,111	189,381	85,028	61,936	14,876	15,372	15,372	14,876	889,452
2000	24,397	17,852	18,447	18,447	187,912	217,038	100,903	61,936	92,171	15,372	15,372	14,876	784,723
2001	24,397	17,852	18,447	18,447	16,661	58,155	28,763	27,821	4,463	4,612	4,612	4,463	228,693
2002	9,223	8,926	9,223	9,223	8,331	9,223	32,775	31,582	4,463	4,612	4,612	4,463	136,656
Avg (21-02)	18,815	18,888	36,241	57,087	79,135	114,179	95,290	88,906	63,139	36,354	20,200	15,774	644,009

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Table 2.6-6

Total La Grange Release to River (Acre-feet)

Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	12,744	10,711	11,068	11,068	33,964	245,398	114,894	64,123	14,876	15,372	15,372	14,876	564,466
1922	24,397	17,852	18,447	18,447	21,795	177,197	175,154	61,936	486,912	61,546	27,209	24,862	1,115,754
1923	24,397	17,852	52,816	101,025	90,321	34,926	159,076	61,936	14,876	15,372	15,372	14,876	602,845
1924	24,397	17,852	18,447	18,447	17,256	18,447	14,650	14,589	2,975	3,074	3,074	2,975	156,183
1925	7,736	8,926	9,223	9,223	8,331	9,223	73,158	69,584	4,463	4,612	4,612	4,463	213,554
1926	13,240	10,413	10,760	10,760	9,719	10,760	31,566	30,449	4,463	4,612	4,612	4,463	145,817
1927	9,223	8,926	9,223	9,223	8,331	9,223	64,241	61,936	41,783	15,372	24,317	28,032	289,830
1928	24,397	38,122	52,916	21,575	67,986	208,208	46,105	35,902	4,463	4,612	4,612	4,463	513,361
1929	12,744	10,711	11,068	11,068	9,997	11,068	26,770	25,952	2,975	3,074	3,074	2,975	131,476
1930	9,223	8,926	9,223	9,223	8,331	9,223	27,049	26,214	2,975	3,074	3,074	2,975	119,510
1931	9,223	8,926	9,223	9,223	8,331	9,223	14,650	14,589	2,975	3,074	3,074	2,975	95,486
1932	7,736	8,926	9,223	9,223	8,628	9,223	64,241	61,936	14,876	15,372	15,372	14,876	239,632
1933	24,397	17,852	18,447	18,447	16,661	18,447	35,753	34,374	4,463	4,612	4,612	4,463	202,528
1934	9,223	8,926	9,223	9,223	8,331	9,223	14,650	14,589	2,975	3,074	3,074	2,975	95,486
1935	7,736	8,926	9,223	9,223	8,331	9,223	64,241	61,936	14,876	15,372	15,372	14,876	239,335
1936	24,397	17,852	18,447	18,447	301,206	220,976	172,446	61,936	14,876	15,372	15,372	14,876	896,203
1937	24,397	17,852	18,447	18,447	210,859	263,318	185,594	61,936	14,876	15,372	15,372	14,876	861,346
1938	24,397	17,852	108,307	79,596	381,104	454,618	298,150	305,878	232,281	156,701	50,809	34,816	2,144,509
1939	24,397	17,852	18,447	18,447	45,240	66,009	28,525	27,598	4,463	4,612	4,612	4,463	264,665
1940	9,223	8,926	9,223	9,223	8,628	234,677	169,350	61,936	14,876	15,372	15,372	14,876	571,682
1941	24,397	17,852	18,447	55,884	262,574	285,182	250,355	61,936	53,464	90,980	26,493	21,347	1,168,911
1942	24,397	17,852	41,845	156,067	153,323	150,861	223,977	231,848	94,247	117,365	26,854	17,017	1,255,653
1943	24,397	17,852	32,826	197,464	149,252	338,579	201,522	61,936	76,970	15,372	19,188	17,602	1,152,960
1944	24,397	17,852	18,447	18,447	17,256	55,093	47,894	45,898	4,463	4,612	4,612	4,463	263,434
1945	13,240	10,413	10,760	10,760	123,508	230,698	119,207	61,936	14,876	15,372	15,372	14,876	641,018
1946	24,397	17,852	229,210	136,983	150,231	179,148	72,112	61,936	14,876	15,372	15,372	14,876	932,365
1947	24,397	17,852	18,447	18,447	16,661	18,447	28,054	27,156	4,463	4,612	4,612	4,463	187,611
1948	9,223	8,926	9,223	9,223	8,628	9,223	39,947	38,477	4,463	4,612	4,612	4,463	151,020
1949	12,744	10,711	11,068	11,068	9,997	11,068	33,037	31,999	4,463	4,612	4,612	4,463	149,842
1950	12,744	10,711	11,068	11,068	9,997	11,068	61,680	58,823	4,463	4,612	4,612	4,463	205,309
1951	13,240	10,413	344,203	225,255	195,815	153,328	104,899	99,341	4,463	4,612	4,612	4,463	1,164,644
1952	13,240	10,413	10,760	10,760	78,332	213,745	258,495	280,490	232,426	162,673	40,841	32,097	1,344,272
1953	24,397	17,852	18,447	27,845	60,046	18,447	87,632	83,153	4,463	4,612	4,612	4,463	355,969
1954	13,240	10,413	10,760	10,760	9,719	10,760	41,422	39,831	4,463	4,612	4,612	4,463	165,055
1955	13,240	10,413	10,760	10,760	9,719	10,760	31,555	30,438	4,463	4,612	4,612	4,463	145,795
1956	9,223	8,926	46,291	436,178	218,897	180,935	106,751	61,936	162,942	111,157	29,023	30,608	1,402,867
1957	24,397	17,852	18,447	18,447	16,661	25,078	85,025	80,709	4,463	4,612	4,612	4,463	304,766
1958	13,240	10,413	10,760	10,760	9,719	211,842	311,309	280,218	277,777	98,815	36,329	32,935	1,304,117
1959	24,397	17,852	18,447	18,447	32,284	59,822	28,824	27,878	4,463	4,612	4,612	4,463	246,101
1960	9,223	8,926	9,223	9,223	8,628	9,223	24,895	24,194	2,975	3,074	3,074	2,975	115,633
1961	7,736	8,926	9,223	9,223	8,331	9,223	14,650	14,589	2,975	3,074	3,074	2,975	93,999
1962	7,736	8,926	9,223	9,223	8,331	9,223	94,959	90,022	4,463	4,612	4,612	4,463	255,793
1963	13,240	10,413	10,760	10,760	9,719	10,760	64,241	61,936	14,876	15,372	15,372	14,876	252,325
1964	24,397	17,852	18,447	18,447	29,030	18,447	28,168	27,263	4,463	4,612	4,612	4,463	200,201
1965	9,223	8,926	9,223	280,632	198,842	168,325	169,358	61,936	14,876	15,372	21,883	32,755	991,351
1966	24,397	22,516	120,759	51,266	99,846	61,610	32,240	31,252	4,463	4,612	4,612	4,463	462,036
1967	12,744	10,711	11,068	11,068	9,997	103,480	252,040	232,725	388,802	259,420	134,115	28,012	1,454,182
1968	24,397	17,852	18,447	18,447	17,256	32,584	28,988	28,031	4,463	4,612	4,612	4,463	204,152
1969	9,223	8,926	9,223	58,091	279,368	255,378	329,852	450,130	428,053	156,634	68,480	35,889	2,089,247
1970	24,397	17,852	73,665	343,421	142,086	183,682	64,241	61,936	14,876	15,372	15,372	14,876	971,776
1971	24,397	17,852	18,447	18,447	16,661	85,781	66,522	63,363	4,463	4,612	4,612	4,463	329,620
1972	13,240	10,413	10,760	10,760	10,066	10,760	30,579	29,524	2,975	3,074	3,074	2,975	138,200
1973	9,223	8,926	9,223	9,223	8,331	16,427	64,861	61,936	96,088	15,372	15,372	14,876	329,858
1974	24,397	42,215	100,199	152,431	84,225	211,369	129,683	61,936	192,487	15,372	25,766	26,460	1,066,540
1975	24,397	17,852	18,447	18,447	112,415	201,425	109,230	61,936	168,121	23,541	50,313	29,597	835,721
1976	35,185	23,322	33,098	18,447	17,256	18,447	20,660	20,224	2,975	3,074	3,074	2,975	198,737
1977	7,736	8,926	9,223	9,223	8,331	9,223	14,650	14,589	2,975	3,074	3,074	2,975	93,999
1978	7,736	8,926	9,223	9,223	8,331	9,223	64,241	61,936	160,931	15,372	15,372	14,876	385,390
1979	24,397	17,852	18,447	29,457	150,953	211,824	92,753	341,049	14,876	15,372	15,372	14,876	947,228
1980	24,397	17,852	18,447	175,502	376,598	211,743	115,553	107,651	280,789	154,773	41,442	36,580	1,561,327
1981	24,397	17,852	18,447	18,447	16,661	22,926	29,256	28,454	4,463	4,612	4,612	4,463	194,590
1982	12,744	10,711	11,068	59,750	349,698	314,765	511,142	352,402	262,057	155,711	63,782	134,816	2,238,646
1983	156,324	139,398	253,127	268,146	324,750	929,999	277,685	451,311	228,033	238,323	186,588	174,030	3,627,714
1984	24,397	260,868	413,016	228,905	204,697	155,998	64,241	61,936	14,876	15,372	15,372	14,876	1,474,554
1985	24,397	17,852	18,447	18,447	16,661	18,447	34,634	33,325	4,463	4,612	4,612	4,463	200,360
1986	9,223	8,926	9,223	9,223	173,491	461,532	159,805	182,071	202,457	15,372	15,372	19,911	1,266,606
1987	24,397	17,852	18,447	18,447	16,661	18,447	25,003	24,296	2,975	3,074	3,074	2,975	175,648
1988	7,736	8,926	9,223	9,223	8,628	9,223	19,297	18,947	2,975	3,074	3,074	2,975	103,301
1989	7,736	8,926	9,223	9,223	8,331	9,223	26,519	25,717	2,975	3,074	3,074	2,975	116,996
1990	7,736	8,926	9,223	9,223	8,331	9,223	19,866	19,480	2,975	3,074	3,074	2,975	104,106
1991	7,736	8,926	9,223	9,223	8,331	9,223	26,397	25,603	2,975	3,074	3,074	2,975	116,760
1992	7,736	8,926	9,223	9,223	8,628	9,223	20,501	20,075	2,975	3,074	3,074	2,975	105,633
1993	7,736	8,926	9,223	9,223	8,331	9,223	64,241	61,936	145,263	78,663	37,258	28,803	468,826
1994	24,397	17,852	18,447	18,447	16,661	18,447	26,774	25,956	2,975	3,074	3,074	2,975	179,079
1995	9,223	8,926	9,223	9,223	8,331	453,913	261,686	589,371	268,231	380,561	180,518	54,017	2,233,223
1996	24,397	17,852	18,447	18,447	284,044	273,866	143,569	142,256	171,347	15,372	15,372	23,444	1,148,413
1997	24,397	42,960	363,466	956,038	195,854	141,961	64,241	61,936	14,876	15,372	15,372	14,876	1,911,349
1998	24,397	17,852	18,447	37,270	334,716	272,793	205,739	342,054	414,193	284,990	127,440	28,820	2,108,711
1999	24,397	17,852	43,763	118,488	288,111	197,943	96,010	61,936	14,876	15,372	15,372	14,876	908,996
2000	24,397	17,852	18,447	18,447	207,006	217,038	100,903	61,936	104,647	15,372	15,372	14,876	816,293
2001	24,397	17,852	18,447	18,447	16,661	58,155	28,763	27,821	4,463	4,612	4,612	4,463	228,693
2002	9,223	8,926	9,223	9,223	8,331	9,223	32,775	31,582	4,463	4,612	4,612	4,463	136,656
Avg (21-02)	18,828	18,994	38,798	60,559	84,433	117,947	97,139	90,047	67,933	37,419	20,654	16,126	668,876

APPENDIX O1

Table 2.6-7

Difference in Total La Grange Release to River (Acre-feet) WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	-13,402	-3,254	0	0	0	0	0	-16,656
1922	0	0	0	0	-5,134	-7,312	-7,365	0	-16,036	-2,183	-5	0	-38,035
1923	0	0	0	0	0	0	-2,118	0	0	0	0	0	-2,118
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	-26,907	0	-8,945	-13,156	-49,008
1928	0	-20,270	-34,469	-3,128	-14,851	1	-8,905	0	0	0	0	0	-81,622
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	-247,039	-16,890	-3,635	0	0	0	0	0	-267,564
1937	0	0	0	0	-16,200	-3,195	-8,513	0	0	0	0	0	-27,908
1938	0	0	-19,590	0	0	-39	-7,143	-17,014	-4,880	0	-2,173	-5	-50,844
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	-38,195	-5,678	0	0	0	0	0	-43,873
1941	0	0	0	3,311	-446	-422	-519	0	-3,536	-2,184	-5	0	-3,801
1942	0	0	0	-5,542	1	-2,664	-5,524	-2,854	-2,762	-2,188	0	0	-21,533
1943	0	0	0	0	0	-2,001	-6,721	0	-4,299	0	-2,174	-5	-15,200
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	-37,456	-15,315	-202	0	0	0	0	0	-52,973
1946	0	7,308	106	0	0	-12,208	-3,612	0	0	0	0	0	-8,406
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	-116,554	3	0	0	0	0	0	0	0	0	-116,551
1952	0	0	0	0	-21,357	0	0	-15,879	-2,117	0	-2,174	-4	-41,531
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	-37,068	-38,536	5	-3,555	-3,068	0	-9,334	-2,188	0	0	-93,744
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	-38,458	0	-11,490	-1,013	-2,188	0	0	-53,149
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	-11,774	0	0	0	0	0	0	0	-11,774
1965	0	0	0	-185,736	-5,132	-10,710	-9,769	0	0	0	11,003	24	-200,320
1966	0	1	-1,152	0	-17,169	0	0	0	0	0	0	0	-18,320
1967	0	0	0	0	0	-18,498	0	-12,427	0	-2,188	-2,184	-5	-35,302
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	-25,244	-2,448	-10,837	-7,641	-2,188	-2,117	0	-2,174	-4	-52,653
1970	0	0	0	26,596	-5,957	-21,074	0	0	0	0	0	0	-435
1971	0	0	0	0	0	-15,532	0	0	0	0	0	0	-15,532
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	-7,204	-620	0	-60,390	0	0	0	-68,214
1974	0	0	0	-8,392	1	-10,465	-4,603	0	-9,907	0	-2,174	-5	-35,545
1975	0	0	0	0	0	0	-8,286	0	6,521	-2,183	-4	0	-3,952
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	-89,483	0	0	0	-89,483
1979	0	0	0	-3,565	0	-16,219	-2,118	-2,188	0	0	0	0	-24,090
1980	0	0	0	7,641	-1	-7,611	-4,879	-2,188	-2,118	-2,188	0	0	-11,344
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	-27,215	-11,551	0	0	-1,903	-1,841	0	-4,358	-2,127	-48,995
1983	-1,046	2,762	-952	-1	0	0	0	-9,542	-4,603	-2,188	0	-2,180	-17,750
1984	0	1,539	0	0	0	3,936	0	0	0	0	0	0	5,475
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	-17,113	-20,127	-11,300	-5,042	-4,880	0	0	-2,167	-60,629
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	-130,387	-63,291	-21,886	-4,889	-220,453
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	-9,263	-9,206	-1,903	-1,842	-2,188	0	-2,177	-26,579
1996	0	0	0	0	-1,694	0	-4,880	-5,042	-4,880	0	0	-2,167	-18,663
1997	0	-3	0	-6,208	1	0	0	0	0	0	0	0	-6,210
1998	0	0	0	-18,722	3	-3,119	-11,048	-3,900	-3,774	-2,188	0	0	-42,748
1999	0	0	0	0	0	-8,562	-10,982	0	0	0	0	0	-19,544
2000	0	0	0	0	-19,094	0	0	0	-12,476	0	0	0	-31,570
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	-13	-106	-2,557	-3,472	-5,298	-3,768	-1,849	-1,141	-4,793	-1,065	-454	-352	-24,868

APPENDIX O1

Table 2.6-8

Difference in Total La Grange Release to River (Acre-feet)

Matrix Data for Water Year 1921-2002 Rank Ordered by Descending SJR Index

WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1983	-1,046	2,762	-952	-1	0	0	0	-9,542	-4,603	-2,188	0	-2,180	-17,750
1969	0	0	0	-25,244	-2,448	-10,837	-7,641	-2,188	-2,117	0	-2,174	-4	-52,653
1995	0	0	0	0	0	-9,263	-9,206	-1,903	-1,842	-2,188	0	-2,177	-26,579
1938	0	0	-19,590	0	0	-39	-7,143	-17,014	-4,880	0	-2,173	-5	-50,844
1998	0	0	0	-18,722	3	-3,119	-11,048	-3,900	-3,774	-2,188	0	0	-42,748
1982	0	0	0	-27,215	-11,551	0	0	-1,903	-1,841	0	-4,358	-2,127	-48,995
1967	0	0	0	0	0	-18,498	0	-12,427	0	-2,188	-2,184	-5	-35,302
1952	0	0	0	0	-21,357	0	0	-15,879	-2,117	0	-2,174	-4	-41,531
1958	0	0	0	0	0	-38,458	0	-11,490	-1,013	-2,188	0	0	-53,149
1980	0	0	0	7,641	-1	-7,611	-4,879	-2,188	-2,118	-2,188	0	0	-11,344
1978	0	0	0	0	0	0	0	0	-89,483	0	0	0	-89,483
1922	0	0	0	0	-5,134	-7,312	-7,365	0	-16,036	-2,183	-5	0	-38,035
1956	0	0	-37,068	-38,536	5	-3,555	-3,068	0	-9,334	-2,188	0	0	-93,744
1942	0	0	0	-5,542	1	-2,664	-5,524	-2,854	-2,762	-2,188	0	0	-21,533
1941	0	0	0	3,311	-446	-422	-519	0	-3,536	-2,184	-5	0	-3,801
1986	0	0	0	0	-17,113	-20,127	-11,300	-5,042	-4,880	0	0	-2,167	-60,629
1993	0	0	0	0	0	0	0	0	-130,387	-63,291	-21,886	-4,889	-220,453
1997	0	-3	0	-6,208	1	0	0	0	0	0	0	0	-6,210
1996	0	0	0	0	-1,694	0	-4,880	-5,042	-4,880	0	0	-2,167	-18,663
1943	0	0	0	0	0	-2,001	-6,721	0	-4,299	0	-2,174	-5	-15,200
1937	0	0	0	0	-16,200	-3,195	-8,513	0	0	0	0	0	-27,908
1974	0	0	0	-8,392	1	-10,465	-4,603	0	-9,907	0	-2,174	-5	-35,545
1975	0	0	0	0	0	0	-8,286	0	6,521	-2,183	-4	0	-3,952
1965	0	0	0	-185,736	-5,132	-10,710	-9,769	0	0	0	11,003	24	-200,320
1936	0	0	0	0	-247,039	-16,890	-3,635	0	0	0	0	0	-267,564
1984	0	1,539	0	0	0	3,936	0	0	0	0	0	0	5,475
1979	0	0	0	-3,565	0	-16,219	-2,118	-2,188	0	0	0	0	-24,090
1945	0	0	0	0	-37,456	-15,315	-202	0	0	0	0	0	-52,973
1999	0	0	0	0	0	-8,562	-10,982	0	0	0	0	0	-19,544
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	-26,907	0	-8,945	-13,156	-49,008
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	7,308	106	0	0	-12,208	-3,612	0	0	0	0	0	-8,406
1973	0	0	0	0	0	-7,204	-620	0	-60,390	0	0	0	-68,214
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	-19,094	0	0	0	-12,476	0	0	0	-31,570
1940	0	0	0	0	0	-38,195	-5,678	0	0	0	0	0	-43,873
1923	0	0	0	0	0	0	-2,118	0	0	0	0	0	-2,118
1921	0	0	0	0	0	-13,402	-3,254	0	0	0	0	0	-16,656
1970	0	0	0	26,596	-5,957	-21,074	0	0	0	0	0	0	-435
1951	0	0	-116,554	3	0	0	0	0	0	0	0	0	-116,551
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	-15,532	0	0	0	0	0	0	-15,532
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	-20,270	-34,469	-3,128	-14,851	1	-8,905	0	0	0	0	0	-81,622
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	1	-1,152	0	-17,169	0	0	0	0	0	0	0	-18,320
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	-11,774	0	0	0	0	0	0	0	-11,774
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.6-9

Total La Grange Release to River (Acre-feet)
(Average within Year Type - Grouped by SJR Index Year Type)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	23,400	21,274	46,524	114,653	173,074	256,125	198,288	189,097	194,963	106,979	51,787	37,222	1,413,386
Above Normal	17,105	28,309	69,075	77,774	95,901	127,962	95,279	80,555	20,035	14,739	14,739	14,263	655,737
Below Normal	17,484	14,199	22,701	17,789	25,120	41,604	58,393	55,751	4,463	4,612	4,612	4,463	271,190
Dry	20,655	15,449	15,964	15,964	17,937	27,291	30,572	29,530	4,349	4,494	4,494	4,349	191,046
Critical	13,260	11,611	12,560	11,644	10,648	11,644	21,061	20,600	2,975	3,074	3,074	2,975	125,127
All Years	18,815	18,888	36,241	57,087	79,135	114,179	95,290	88,906	63,139	36,354	20,200	15,774	644,009

Total La Grange Release to River (Acre-feet)
(Average within Year Type - Grouped by SJR Index Year Type)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base Sep	WY Total
Wet	23,443	21,159	48,924	127,347	176,452	262,303	202,891	192,904	207,184	110,618	52,966	37,877	1,464,068
Above Normal	17,105	27,789	75,925	76,419	114,110	136,500	97,174	80,683	25,904	14,739	15,265	15,037	696,650
Below Normal	17,484	15,888	25,669	18,049	27,788	42,899	59,135	55,751	4,463	4,612	4,612	4,463	280,813
Dry	20,655	15,449	15,964	15,964	18,842	27,291	30,572	29,530	4,349	4,494	4,494	4,349	191,951
Critical	13,260	11,611	12,560	11,644	10,648	11,644	21,061	20,600	2,975	3,074	3,074	2,975	125,127
All Years	18,828	18,994	38,798	60,559	84,433	117,947	97,139	90,047	67,933	37,419	20,654	16,126	668,876

Difference in Total La Grange Release to River (Acre-feet)
(Average within Year Type - Grouped by SJR Index Year Type)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP minus Base Sep	WY Total
Wet	-44	115	-2,400	-12,694	-3,378	-6,178	-4,603	-3,807	-12,220	-3,639	-1,180	-655	-50,682
Above Normal	0	520	-6,850	1,355	-18,209	-8,537	-1,895	-129	-5,869	0	-526	-774	-40,913
Below Normal	0	-1,689	-2,968	-261	-2,668	-1,294	-742	0	0	0	0	0	-9,623
Dry	0	0	0	0	-906	0	0	0	0	0	0	0	-906
Critical	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	-13	-106	-2,557	-3,472	-5,298	-3,768	-1,849	-1,141	-4,793	-1,065	-454	-352	-24,868

2.7 Calaveras and San Antonio Reservoirs, Alameda Creek, and Downstream

Compared to the base setting, Calaveras Reservoir operations would substantively change in the WSIP setting. With the restoration of Calaveras Reservoir operating capacity, the reservoir would operate with a larger storage capacity. Figure 2.7-1 illustrates a chronological trace of the simulation of Calaveras Reservoir storage and stream releases from Calaveras Dam. Shown in Figure 2.7-1 are the results for the WSIP and base settings.

The current operation of Calaveras Reservoir (base-Calaveras constrained setting) is modeled to be greatly constrained, to vary only within a limited storage range. Although a within-year cyclic operation occurs for the conservation of local watershed runoff, there is relatively little reservoir storage available for year-to-year carryover and multi-year drought use. In the WSIP setting, a greater within-year cyclic operation occurs, providing for a greater use of local watershed runoff. Also, during prolonged periods of drought (i.e., multiple years in duration), reservoir storage would be drawn to supplement runoff available to the regional system and other water supply resources. Figure 2.7-2 illustrates the average monthly storage in Calaveras Reservoir for the 82-year simulation, and the range in storage for each month for the WSIP and base settings.

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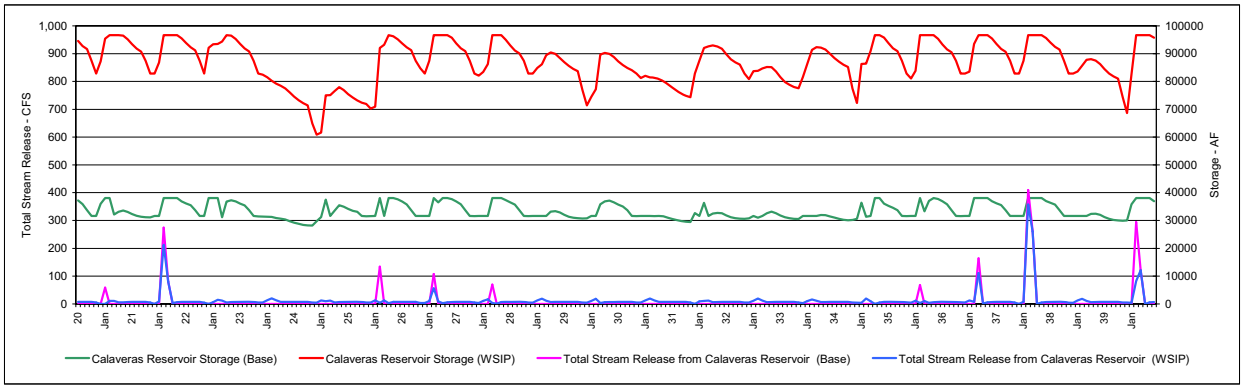
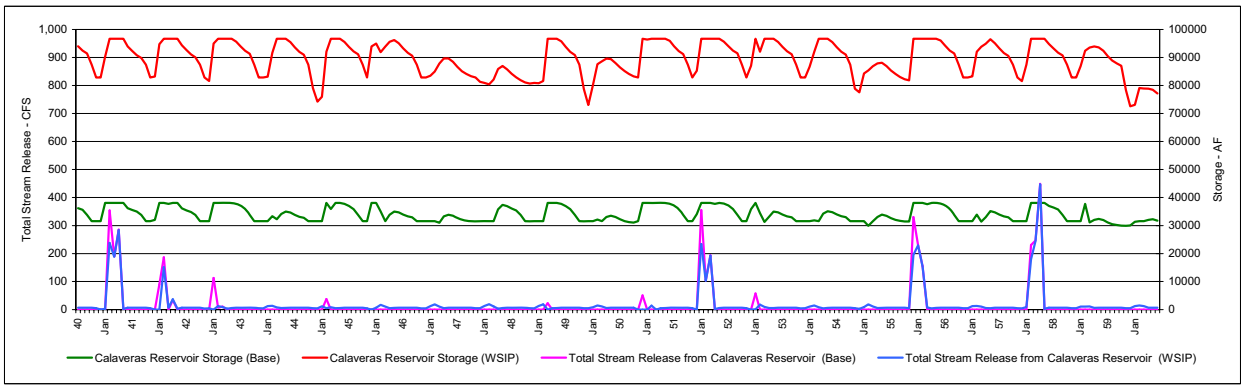
Figure 2.7-1
Calaveras Reservoir Storage and Stream Release

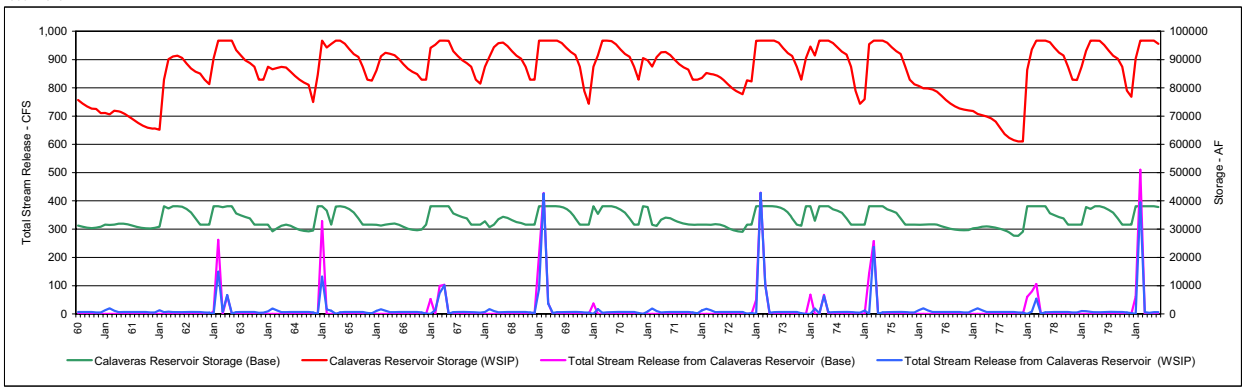
1920 - 1939



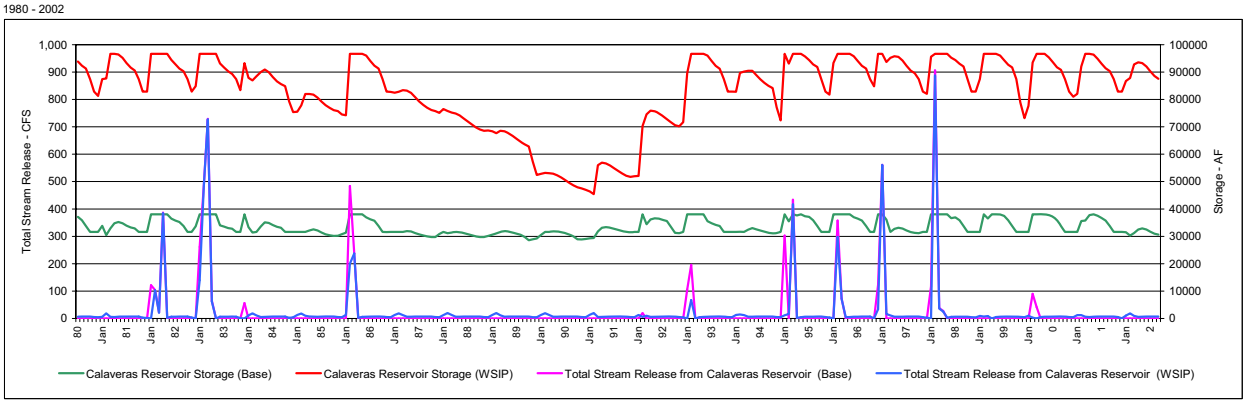
1940 - 1959



1960 - 1979

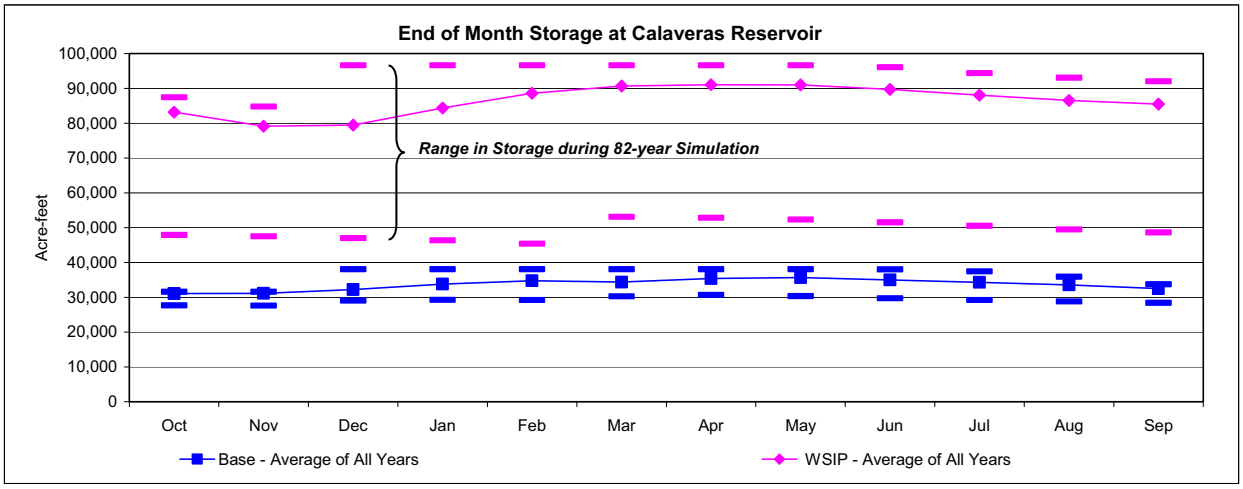


1980 - 2002



APPENDIX O1

Figure 2.7-2



In the WSIP setting (as compared to the base setting), there would be two categorical changes in releases to Calaveras Creek below Calaveras Dam: the addition of flows representing the flow objectives associated with the 1997 California Department of Fish and Game Memorandum of Understanding (MOU); and the reduction of stream releases during wetter-year/wetter-season flows due to the restored operational capacity of Calaveras Reservoir. Supplementing the Figure 2.7-1 representation of Calaveras Dam stream releases is Table 2.7-1, which illustrates releases for the WSIP and base settings and the difference in releases between the two.

Table 2.7-1

Total Stream Release from Calaveras Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	429	246	998	4,985	14,425	9,862	5,085	255	386	417	425	415	37,928
Above Normal	425	258	172	746	3,196	2,688	606	327	396	424	428	417	10,082
Normal	429	275	194	548	725	506	265	370	408	428	430	417	4,995
Below Normal	428	275	246	672	876	596	345	389	411	430	430	417	5,515
Dry	429	292	281	778	1,044	747	375	407	416	430	430	417	6,044
All Years	428	269	374	1,526	4,004	2,850	1,314	350	403	426	428	417	12,788

Total Stream Release from Calaveras Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base Sep	WY Total
Wet	0	0	1,741	9,267	16,622	9,968	5,024	0	0	0	0	0	42,623
Above Normal	0	0	184	2,685	5,918	3,096	459	0	0	0	0	0	12,342
Normal	0	0	216	364	898	353	0	0	0	0	0	0	1,831
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	420	2,436	4,645	2,656	1,076	0	0	0	0	0	11,233

Difference in Total Stream Release from Calaveras Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP minus Base Sep	WY Total
Wet	429	246	-744	-4,282	-2,197	-106	61	255	386	417	425	415	-4,694
Above Normal	425	258	-12	-1,939	-2,721	-408	147	327	396	424	428	417	-2,259
Normal	429	275	-22	184	-173	154	265	370	408	428	430	417	3,164
Below Normal	428	275	246	672	876	596	345	389	411	430	430	417	5,515
Dry	429	292	281	778	1,044	747	375	407	416	430	430	417	6,044
All Years	428	269	-46	-910	-641	194	239	350	403	426	428	417	1,556

Compared to the base setting, diversions from Alameda Creek to Calaveras Reservoir would increase in the WSIP setting. With the current constraints on Calaveras Reservoir storage, diversions to Calaveras Creek are rejected. With the restoration of operational storage in the reservoir, the opportunity to divert water into the reservoir would increase.

To provide a context for the amount of water diverted at the Alameda Creek Diversion Dam (ACDD), Table 2.7-2 illustrates the estimated runoff (inflow) to the dam, averaged by year type. Table 2.7-3 compares diversions to Calaveras Reservoir in the WSIP and base settings. An increase in diversions during the winter season due to WSIP operation would generally occur during normal or wetter year types, as reservoir storage space would accommodate diversions. During summer in all years and during all periods in below-normal and normal years, diversions would continue as they do currently. A few exceptions occur when diversions would be reduced from that of the base setting.

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Table 2.7-2

Total Inflow to ACDD (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	7	156	2,472	7,382	8,284	6,064	3,608	1,035	227	42	18	12	29,308
Above Normal	18	183	1,817	4,394	5,619	3,692	1,976	542	139	23	11	7	18,420
Normal	7	41	1,589	1,840	2,684	2,029	939	332	87	8	5	3	9,564
Below Normal	7	42	554	1,069	1,689	1,271	395	246	64	6	4	3	5,350
Dry	7	16	222	314	531	382	238	124	38	3	3	2	1,880
All Years	9	88	1,327	2,993	3,759	2,683	1,425	454	111	17	8	5	12,880

Table 2.7-3

Calaveras Reservoir Inflow from Upper Alameda Creek (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	7	128	1,093	1,113	302	337	649	861	227	42	18	12	4,790
Above Normal	11	159	1,226	1,936	1,883	563	1,017	542	139	23	11	7	7,518
Normal	7	35	1,004	1,580	1,888	1,570	826	332	87	8	5	3	7,345
Below Normal	7	42	536	1,024	1,587	1,042	395	246	64	6	4	3	4,956
Dry	7	16	222	314	473	382	238	124	38	3	3	2	1,823
All Years	8	77	818	1,200	1,239	780	627	421	111	17	8	5	5,310

Calaveras Reservoir Inflow from Upper Alameda Creek (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base Sep	WY Total
Wet	7	128	1,093	415	185	307	637	904	227	42	18	12	3,977
Above Normal	11	159	691	722	325	596	1,284	542	139	23	11	7	4,510
Normal	7	35	634	972	815	1,123	813	332	87	8	5	3	4,833
Below Normal	7	42	536	1,024	1,587	1,042	395	246	64	6	4	3	4,956
Dry	7	16	222	314	473	382	238	124	38	3	3	2	1,823
All Years	8	77	635	694	684	693	677	429	111	17	8	5	4,037

Difference in Calaveras Reservoir Inflow from Upper Alameda Creek (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	WSIP minus Base Aug	Sep	WY Total
Wet	0	0	0	697	117	30	12	-43	0	0	0	0	813
Above Normal	0	0	535	1,215	1,558	-33	-267	0	0	0	0	0	3,008
Normal	0	0	369	608	1,074	447	13	0	0	0	0	0	2,511
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	183	506	555	86	-50	-8	0	0	0	0	1,272

Commensurate with changes in diversions from Alameda Creek to Calaveras Reservoir would be changes in flow below the ACDD. Table 2.7-4 illustrates the flow below the ACDD for the WSIP and base settings. Table 2.7-4 shows that, opposed to diversions to Calaveras Reservoir, flow passing the ACDD would decrease in the WSIP setting. With operational capacity restored at Calaveras Reservoir, there would be more opportunity (and need) to divert Alameda Creek flows; thus, flow passing the dam would be reduced.

Table 2.7-4

Flow Passing Alameda Creek Diversion Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	0	28	1,379	6,269	7,982	5,727	2,960	173	0	0	0	0	24,518
Above Normal	7	23	591	2,457	3,735	3,129	959	0	0	0	0	0	10,903
Normal	0	6	585	260	796	459	113	0	0	0	0	0	2,219
Below Normal	0	0	18	45	102	229	0	0	0	0	0	0	394
Dry	0	0	0	0	57	0	0	0	0	0	0	0	58
All Years	1	12	509	1,793	2,520	1,903	798	34	0	0	0	0	7,570

Flow Passing Alameda Creek Diversion Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base Sep	WY Total
Wet	0	28	1,379	6,967	8,099	5,757	2,972	130	0	0	0	0	25,331
Above Normal	7	23	1,126	3,672	5,294	3,096	692	0	0	0	0	0	13,911
Normal	0	6	954	868	1,870	906	126	0	0	0	0	0	4,731
Below Normal	0	0	18	45	102	229	0	0	0	0	0	0	394
Dry	0	0	0	0	57	0	0	0	0	0	0	0	58
All Years	1	12	692	2,299	3,075	1,989	748	26	0	0	0	0	8,843

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	WSIP minus Base Aug	Sep	WY Total
Wet	0	0	0	-697	-117	-30	-12	43	0	0	0	0	-813
Above Normal	0	0	-535	-1,215	-1,558	33	267	0	0	0	0	0	-3,008
Normal	0	0	-369	-608	-1,074	-447	-13	0	0	0	0	0	-2,511
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-183	-506	-555	-86	50	8	0	0	0	0	-1,272

Flow below the confluence of Alameda Creek and Calaveras Creek is affected by releases from Calaveras Dam to the stream, flow passing the ACDD, and unregulated flow below the ACDD and Calaveras Dam. Table 2.7-5 illustrates the flow below the confluence for the WSIP and base settings, and the difference in inflow between the two. The notable differences between the WSIP and the base

settings are the addition of stream flows representing the 1997 MOU and the reduction of wetter-year/wet-season flows due to the restoration of Calaveras Reservoir storage.

Table 2.7-5

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	430	326	2,721	12,263	23,595	16,575	8,647	605	417	429	429	417	66,854
Above Normal	437	326	1,007	3,801	7,708	6,379	1,876	430	418	430	429	417	23,658
Normal	429	304	1,006	1,077	1,907	1,293	536	430	417	429	430	417	8,675
Below Normal	429	297	324	859	1,214	1,046	417	430	417	430	430	417	6,709
Dry	429	298	307	813	1,168	816	418	430	417	430	430	417	6,373
All Years	431	310	1,063	3,728	7,053	5,185	2,349	464	417	430	429	417	22,276

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base Sep	WY Total
Wet	1	80	3,465	17,243	25,909	16,711	8,598	307	30	12	4	2	72,361
Above Normal	12	68	1,554	6,954	11,987	6,754	1,462	103	22	6	2	1	28,926
Normal	1	29	1,397	1,501	3,154	1,586	284	60	9	2	0	0	8,022
Below Normal	1	22	78	186	338	450	72	41	7	0	0	0	1,195
Dry	1	6	26	35	124	69	43	23	1	0	0	0	328
All Years	3	41	1,292	5,145	8,250	5,077	2,060	106	14	4	1	1	21,993

Difference in Flow below Alameda/Calaveras Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP minus Base Sep	WY Total
Wet	429	246	-744	-4,979	-2,314	-136	49	298	386	417	425	415	-5,507
Above Normal	425	258	-547	-3,153	-4,279	-375	414	327	396	424	428	417	-5,267
Normal	429	275	-391	-424	-1,247	-293	251	370	408	428	430	417	653
Below Normal	428	275	246	672	876	596	345	389	411	430	430	417	5,515
Dry	429	292	281	778	1,044	747	375	407	416	430	430	417	6,044
All Years	428	269	-229	-1,417	-1,197	108	289	358	403	426	428	417	283

A flow recapture facility in Alameda Creek below Calaveras Reservoir is incorporated in the WSIP setting. This facility is assumed to recapture flows explicitly released from Calaveras Dam in the representation of the 1997 MOU. The effect of the recapture is a reduction in the flow that occurs below the confluence of Alameda and Calaveras Creeks, but only to the extent that releases were explicitly made from Calaveras Reservoir. Flows below this diversion have been estimated and noted as the flow above the Alameda and San Antonio Creek confluence. Table 2.7-6 illustrates the flow at this location for the WSIP and base settings. The flows identified at this location indicate flow occurring below the confluence of Alameda and Calaveras Creeks (described above), with the addition of estimated unregulated stream accretions between the Alameda-Calaveras Creek confluence and the Alameda-San Antonio Creek confluence minus the water assumed to be recaptured (diverted) by the SFPUC from the creek.

Table 2.7-6

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	6	154	3,113	13,610	25,199	17,720	9,297	556	76	33	15	9	69,788
Above Normal	19	150	1,203	4,350	8,422	6,871	2,127	217	54	20	9	6	23,450
Normal	7	64	1,131	909	1,740	1,219	466	128	28	9	4	3	5,706
Below Normal	7	56	183	404	678	717	154	91	20	5	3	2	2,321
Dry	6	19	70	98	231	145	91	48	9	3	2	2	724
All Years	9	89	1,129	3,838	7,188	5,297	2,396	207	38	14	7	4	20,215

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base Sep	WY Total
Wet	6	154	3,973	18,714	27,673	17,977	9,358	513	76	33	15	9	78,502
Above Normal	19	150	1,922	7,772	13,068	7,467	1,861	217	54	20	9	6	32,566
Normal	7	64	1,716	1,881	3,712	2,007	479	128	28	9	4	3	10,037
Below Normal	7	56	183	404	678	717	154	91	20	5	3	2	2,321
Dry	6	19	70	98	231	145	91	48	9	3	2	2	724
All Years	9	89	1,560	5,733	9,019	5,624	2,355	198	38	14	7	4	24,650

Difference in Alameda Creek Flow abv San Antonio Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP minus Base Sep	WY Total
Wet	0	0	-860	-5,104	-2,474	-258	-61	43	0	0	0	0	-8,714
Above Normal	0	0	-719	-3,422	-4,646	-596	266	0	0	0	0	0	-9,117
Normal	0	0	-585	-972	-1,972	-788	-13	0	0	0	0	0	-4,331
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-431	-1,895	-1,831	-328	41	8	0	0	0	0	-4,435

The difference in San Antonio Reservoir storage between the WSIP and base settings is the result of several factors, and is predominantly due to the restoration of the operational capacity of Calaveras Reservoir and the maintenance of Hetch Hetchy conveyance. Figure 2.7-3 illustrates a chronological trace of the simulation of San Antonio Reservoir storage and stream releases from the dam. Shown in Figure 2.7-3 are the results for the WSIP and base settings. In the base setting, the limited operating

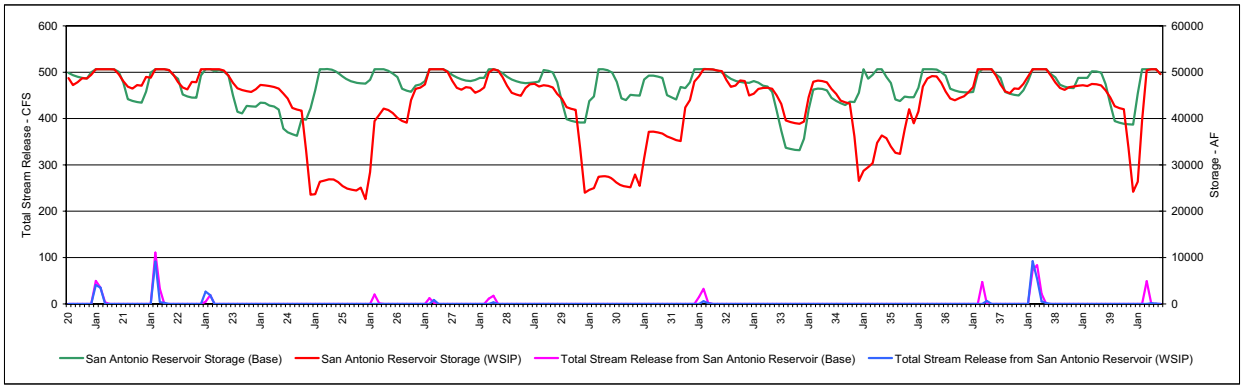
storage capacity at Calaveras Reservoir leads to a different operation at San Antonio Reservoir, one that draws relatively more stored water for system demands when the draw from Calaveras Reservoir is constrained due to limited storage. The resultant effect is that the WSIP setting would retain more storage in San Antonio Reservoir than occurs in the base setting. The exception to this outcome is during cyclic maintenance of Hetch Hetchy conveyance that would constrain Hetch Hetchy diversions every year, but most dramatically every fifth year. During these periods, additional water would be drawn from San Antonio Reservoir and the other Bay Area reservoirs to serve systemwide deliveries when limited or no water would be available from Hetch Hetchy. The coincidence of wet local Bay Area watershed hydrology, reservoir storage balancing among the Bay Area reservoirs, and maintenance would affect the severity of drawdown and the rate of replenishment of San Antonio Reservoir.

Also affecting the magnitude of draw from San Antonio Reservoir are modeling assumptions for the balancing of total Bay Area reservoir storage among the five major SFPUC reservoirs. The model balances storage among reservoirs by way of an input file by the modeler concerning the relative draw (percentage) from each reservoir under various storage conditions. These are discretionary inputs in the model, and the logic and relative percentages are meant to mimic the current practice and discretion of the system operators based on recognition of the physical conveyance constraints within the system and the ability of each reservoir to provide yield and water delivery security. The logic currently favors the retention of storage in the Peninsula reservoirs for security reasons, and thus the provision of additional water between the settings is balanced between San Antonio and Calaveras Reservoirs. Figure 2.7-4 illustrates the average monthly storage in San Antonio Reservoir for the 82-year simulation, and the range in storage for each month for the WSIP and base settings.

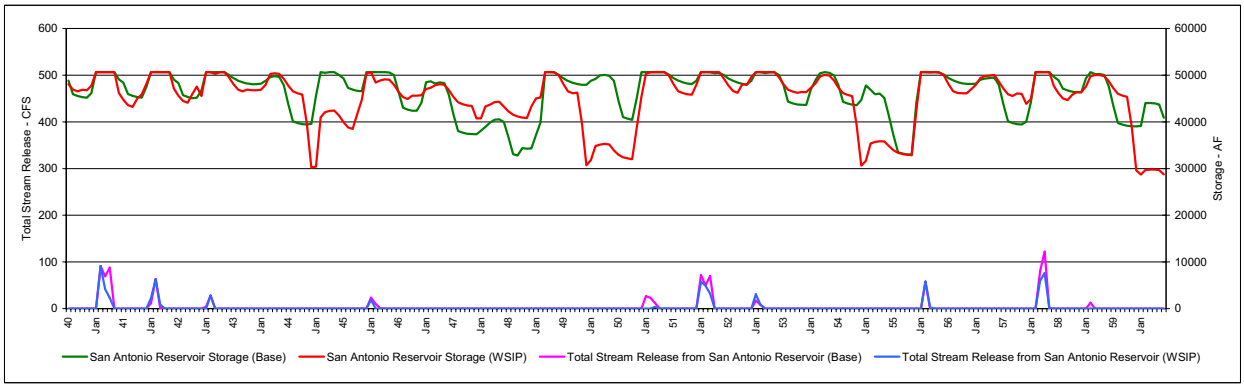
APPENDIX O1

Figure 2.7-3
San Antonio Reservoir Storage and Stream Release

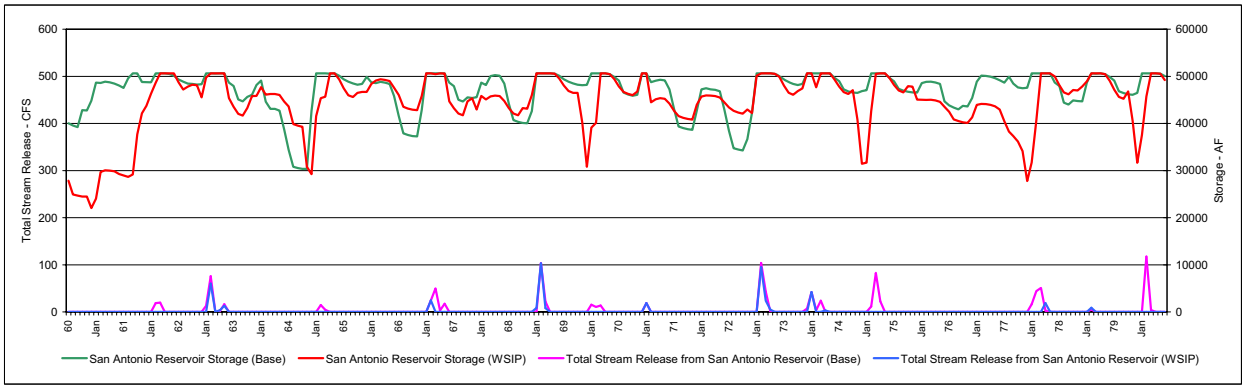
1920 - 1939



1940 - 1959



1960 - 1979



1980 - 2002

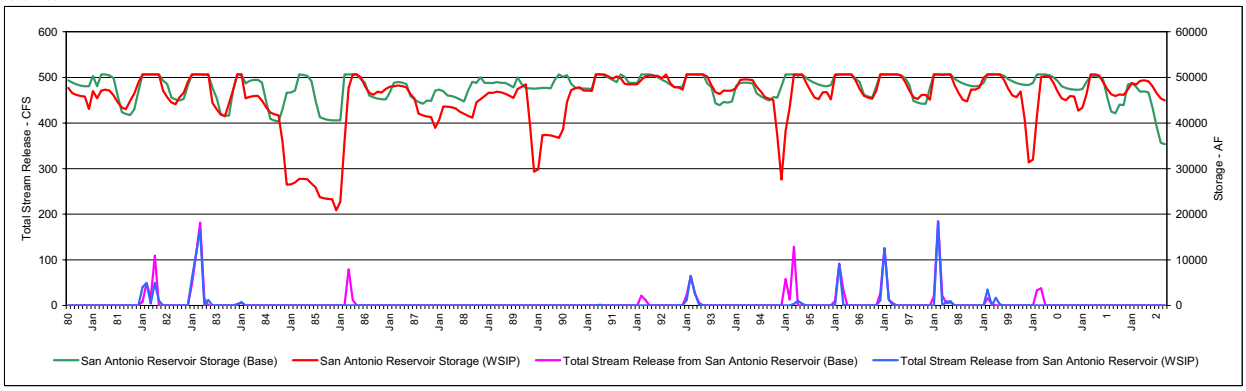
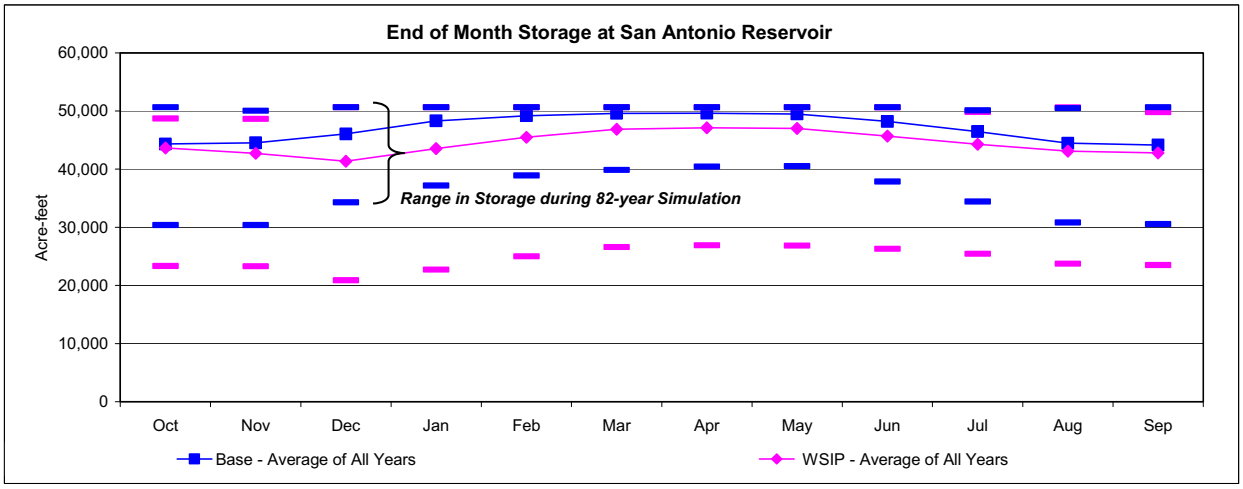


Figure 2.7-4



There would very little change in stream releases below San Antonio Reservoir between the WSIP and base settings. With storage conditions lower at some times and higher at other times, a difference in the ability to regulate reservoir inflow and avoid stream releases is expected. Given the sometimes rigid constraints within the modeling assumptions, the model will overestimate the frequency and magnitude of stream releases from San Antonio Reservoir under any of the investigated settings. The flexibility that occurs in actual operations would likely avoid most of the releases represented by the model. The modeled stream releases from San Antonio Reservoir and difference between releases for the WSIP setting and base setting are shown in Table 2.7-7. The differences between the two settings range from increases to decreases in flow, generally with decreases in releases. This modeled circumstance reflects the different resulting storage operations between the two settings, as seen in Figure 2.7-3. As described above, the model will overestimate the frequency and magnitude of releases from San Antonio Reservoir, and the actual releases from San Antonio Reservoir in any setting and the difference between settings are expected to be minor.

Table 2.7-7

Total Stream Release from San Antonio Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	0	0	44	1,208	3,251	1,558	658	151	0	0	0	0	6,870
Above Normal	0	0	0	442	1,381	158	192	62	0	0	0	0	2,235
Normal	0	0	11	287	78	6	13	0	0	0	0	0	395
Below Normal	0	0	0	0	0	0	4	0	0	0	0	0	4
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	11	383	936	338	172	42	0	0	0	0	1,882

Total Stream Release from San Antonio Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base Sep	WY Total
Wet	0	0	101	1,322	3,669	3,288	1,398	94	0	0	0	0	9,872
Above Normal	0	0	26	687	1,909	1,487	116	58	0	0	0	0	4,283
Normal	0	0	7	370	441	237	65	0	0	0	0	0	1,120
Below Normal	0	0	0	0	41	0	0	0	0	0	0	0	41
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	26	472	1,206	996	309	30	0	0	0	0	3,041

Difference in Total Stream Release from San Antonio Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	WSIP minus Base Aug	Sep	WY Total
Wet	0	0	-57	-114	-418	-1,730	-740	57	0	0	0	0	-3,002
Above Normal	0	0	-26	-246	-528	-1,329	77	4	0	0	0	0	-2,048
Normal	0	0	5	-82	-363	-231	-52	0	0	0	0	0	-724
Below Normal	0	0	0	0	-41	0	4	0	0	0	0	0	-37
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-16	-89	-270	-658	-138	12	0	0	0	0	-1,159

Flow below the confluence of Alameda and San Antonio Creeks is influenced by releases from San Antonio Reservoir and flow arriving at the location from Alameda Creek, which includes upstream impairment by SFPUC operations and facilities. Table 2.7-8 illustrates the flow below the confluence for the WSIP and base settings, and the differences in flow between the two. The differences are particularly due to the effects of restoring Calaveras Reservoir operating capacity in the WSIP setting.

Table 2.7-8

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	6	154	3,157	14,818	28,449	19,278	9,955	707	76	33	15	9	76,658
Above Normal	19	150	1,203	4,792	9,803	7,029	2,320	279	54	20	9	6	25,685
Normal	7	64	1,142	1,197	1,818	1,224	478	128	28	9	4	3	6,101
Below Normal	7	56	183	404	678	717	159	91	20	5	3	2	2,326
Dry	6	19	70	98	231	145	91	48	9	3	2	2	724
All Years	9	89	1,140	4,221	8,124	5,635	2,567	249	38	14	7	4	22,097

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base Sep	WY Total
Wet	6	154	4,075	20,036	31,342	21,266	10,756	607	76	33	15	9	88,374
Above Normal	19	150	1,948	8,459	14,977	8,954	1,977	276	54	20	9	6	36,849
Normal	7	64	1,723	2,251	4,153	2,244	544	128	28	9	4	3	11,157
Below Normal	7	56	183	404	720	717	154	91	20	5	3	2	2,363
Dry	6	19	70	98	231	145	91	48	9	3	2	2	724
All Years	9	89	1,587	6,205	10,225	6,620	2,664	229	38	14	7	4	27,691

Difference in Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP minus Base Sep	WY Total
Wet	0	0	-917	-5,217	-2,892	-1,988	-801	100	0	0	0	0	-11,716
Above Normal	0	0	-745	-3,667	-5,174	-1,925	343	4	0	0	0	0	-11,164
Normal	0	0	-581	-1,054	-2,335	-1,020	-66	0	0	0	0	0	-5,056
Below Normal	0	0	0	0	-41	0	4	0	0	0	0	0	-37
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-447	-1,984	-2,101	-986	-97	20	0	0	0	0	-5,595

2.8 Crystal Springs and San Andreas Reservoirs

Fundamental to the difference in storage operations between the WSIP setting and the base setting is the restoration of reservoir operation capacity in the WSIP setting, which does not occur in the base setting. Full capacity of the restored reservoir is 22,150 million gallons (approximately 67,980 acre-feet), and the current full operating capacity is 18,520 million gallons (approximately 56,840 acre-feet). The result is the operation of Crystal Springs Reservoir at a higher maximum storage in the WSIP setting. Figure 2.8-1 illustrates a chronological trace of the simulation of Crystal Springs Reservoir storage and stream releases from Crystal Springs Dam. Shown in Figure 2.8-1 are the results for the WSIP and base settings.

Compared to the base setting, the WSIP setting would generally result in a shifting of the maximum storage level and the normal range of reservoir operation to a greater volume (elevation); the lower end of the monthly operating range would normally be greater in storage than in the base setting. In some years, the variation from maximum storage to minimum storage may increase in the WSIP setting. The cyclic greater draw from storage in the WSIP setting every fifth year is associated with the maintenance of the Hetch Hetchy conveyance system.

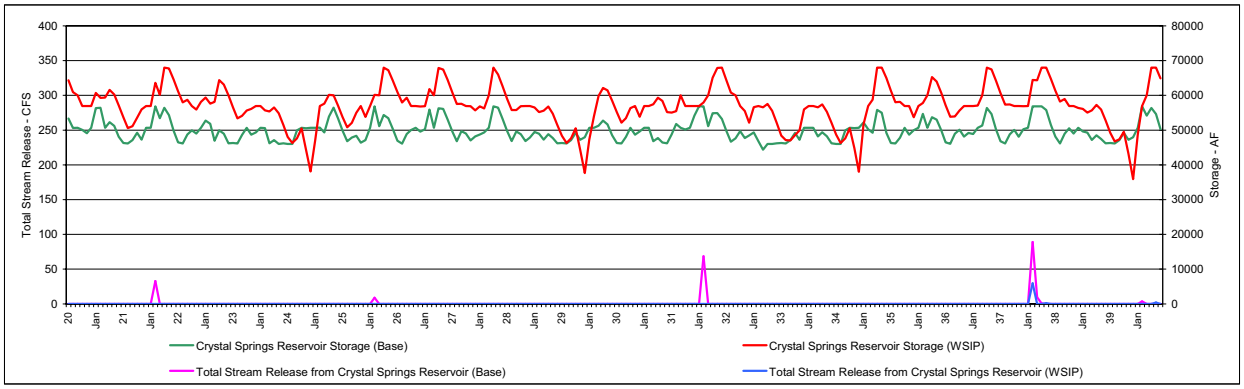
Figure 2.8-2 illustrates the average monthly storage in Crystal Springs Reservoir for the 82-year simulation, and the range in storage for each month for the WSIP and base settings. Consistent with the discussion above, the WSIP setting would result in reservoir storage operating at a higher average and higher upper-range than the base setting. This circumstance predominantly occurs due to the restoration of the operating capacity of Crystal Springs Reservoir.

There is minimal difference in stream releases between the WSIP and the base setting (which could be either an increase or decrease in the release). The potential difference is attributed to whether the resulting storage in the reservoir is higher or lower between the two settings. Part of the difference in modeled Crystal Springs Reservoir storage is due to modeling assumptions for the proportionate management of storage among the Bay Area reservoirs, and the coincidence of constrained conveyance flow rates. In actual operations, it is anticipated that system operators would manage the reservoir system such that stream releases would be minimal under any setting and essentially no difference would occur between the WSIP and base settings.

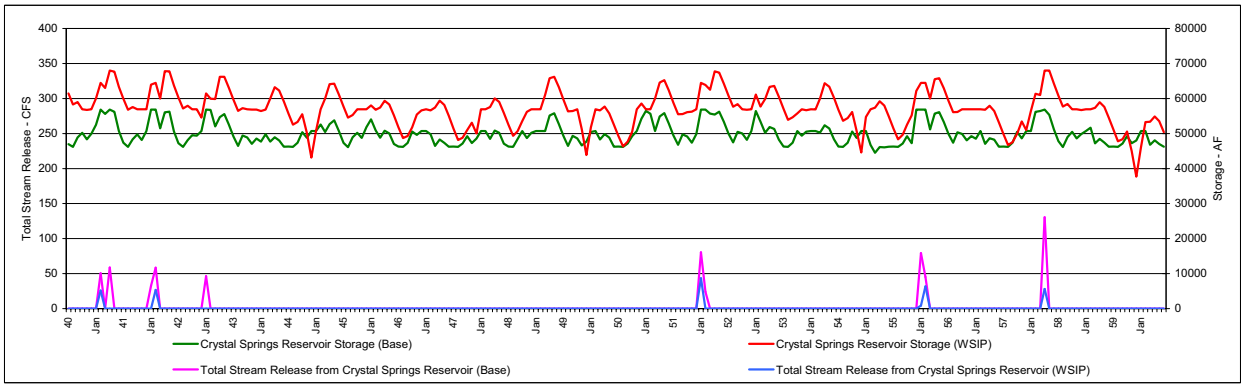
APPENDIX O1

Figure 2.8-1
Crystal Springs Reservoir Storage and Release

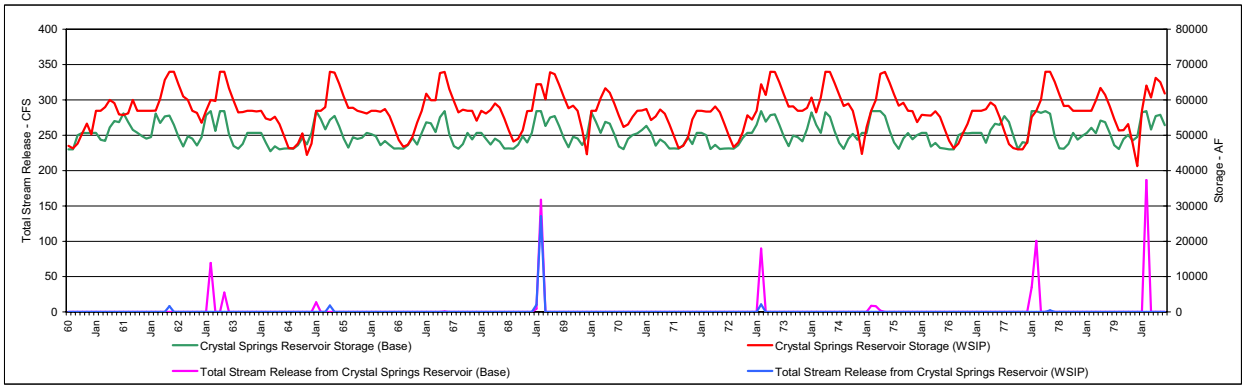
1920 - 1939



1940 - 1959



1960 - 1979



1980 - 2002

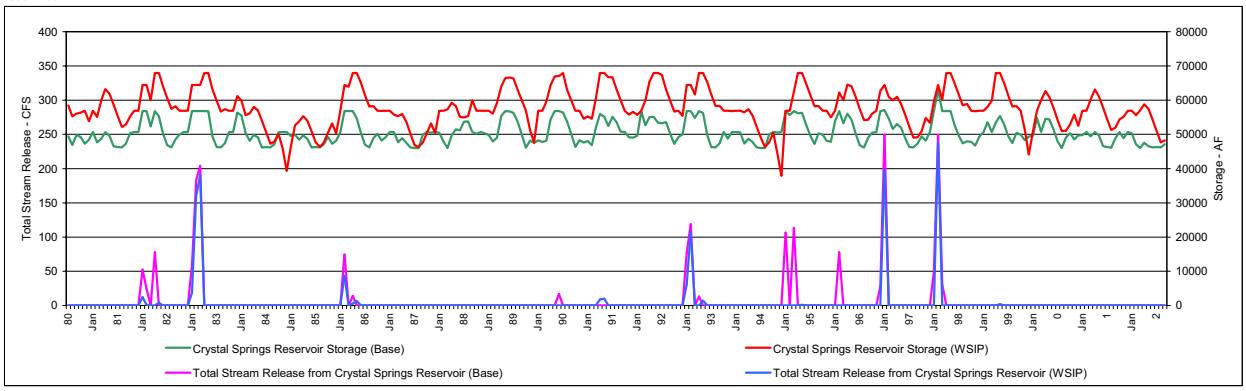


Figure 2.8-2

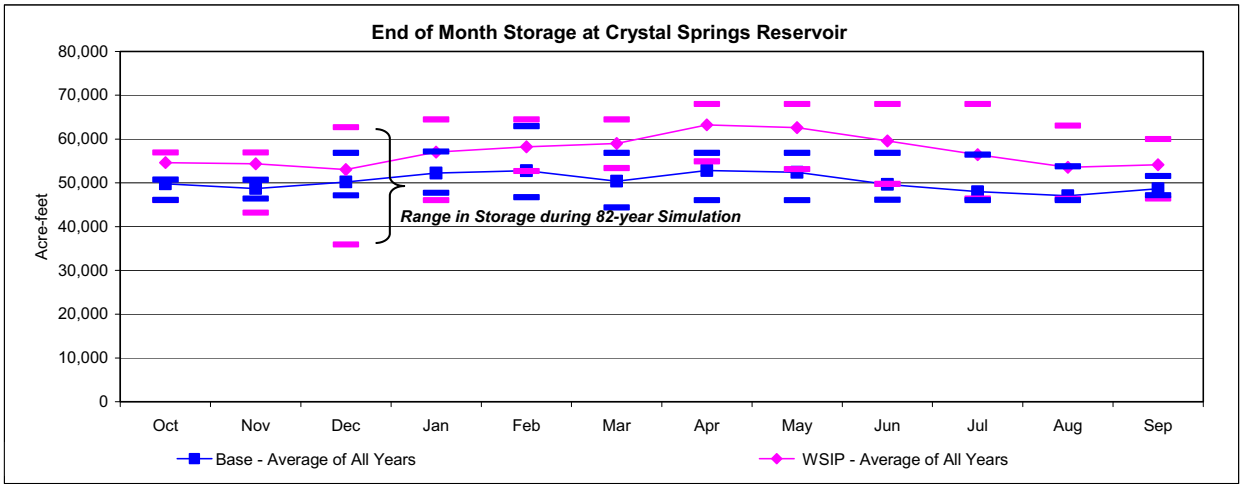


Table 2.8-1 illustrates the stream releases for the WSIP and base settings, and the difference in modeled flows between the two settings. A greater range in Crystal Springs Reservoir operation would lead to an increased potential to regulate reservoir inflow, which would lead to less risk in needing to make stream releases. However, as described above, actual system operations will attempt to minimize releases under any setting; thus, the difference in releases between the WSIP and base setting will be minimal, if any.

Table 2.8-1

Total Stream Release from Crystal Springs Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	0	0	0	1,098	2,435	732	115	48	0	0	0	0	4,428
Above Normal	0	0	0	111	353	0	32	47	0	0	0	0	544
Normal	0	0	0	0	0	0	0	31	0	0	0	0	31
Below Normal	0	0	0	0	0	0	31	35	0	0	0	0	67
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	237	548	143	36	33	0	0	0	0	997

Total Stream Release from Crystal Springs Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base Sep	WY Total
Wet	0	0	107	2,744	4,279	1,376	1,047	2	0	0	0	0	9,556
Above Normal	0	0	0	618	1,343	29	52	100	0	0	0	0	2,142
Normal	0	0	0	0	268	0	0	0	0	0	0	0	268
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	62	0	0	0	62
All Years	0	0	21	664	1,166	274	215	21	12	0	0	0	2,373

Difference in Total Stream Release from Crystal Springs Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

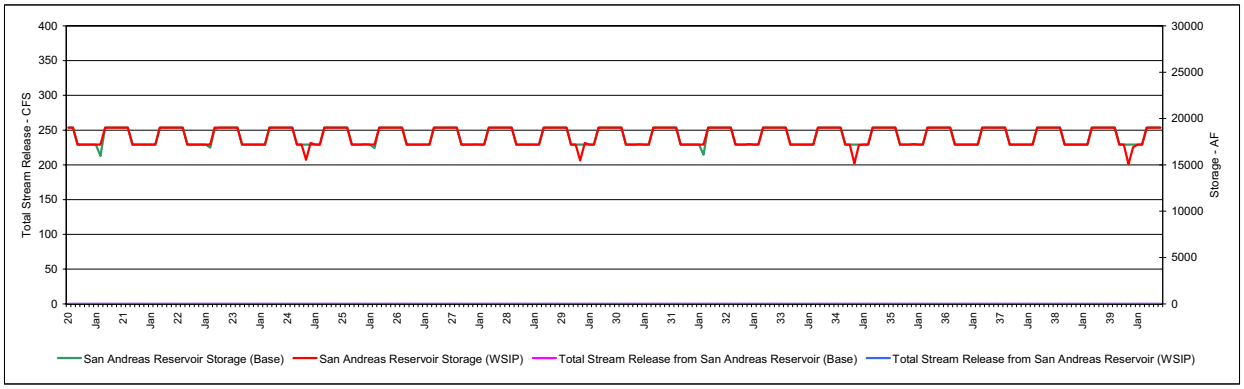
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP minus Base Sep	WY Total
Wet	0	0	-107	-1,646	-1,844	-643	-932	46	0	0	0	0	-5,127
Above Normal	0	0	0	-507	-990	-29	-20	-52	0	0	0	0	-1,598
Normal	0	0	0	0	-268	0	0	31	0	0	0	0	-237
Below Normal	0	0	0	0	0	0	31	35	0	0	0	0	67
Dry	0	0	0	0	0	0	0	0	-62	0	0	0	-62
All Years	0	0	-21	-426	-617	-132	-179	12	-12	0	0	0	-1,376

San Andreas Reservoir operations would generally be the same between the WSIP and base settings. Reservoir storage would follow a systematic filling and lowering each year. Figure 2.8-3 illustrates a chronological trace of the simulation of San Andreas Reservoir storage and stream releases from Crystal Springs Dam. Shown in Figure 2.8-3 are the results for the WSIP and base settings. There are no projected stream releases from San Andreas Reservoir in any setting. Notable in Figure 2.8-3 is the difference in storage operation every fifth year. The WSIP setting storage operation differs from that in the base settings. The differences in operation arise from the assumed difference in Hetch Hetchy conveyance maintenance in each setting. In the WSIP setting, the maintenance occurs systematically every year, and to a greater degree every fifth year, which constrains the amount of Hetch Hetchy water supplied to serve water demands in the Bay Area. As discussed previously, during these winter periods, the Bay Area reservoir system accommodates the reduction in imported supply by serving the Bay Area water deliveries with the local watersheds' runoff and storage. At San Andreas Reservoir, the serving of

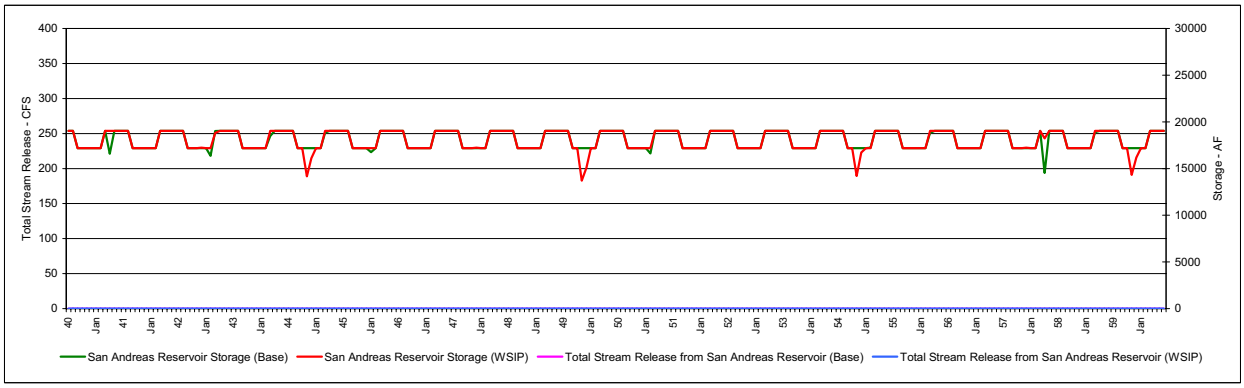
APPENDIX O1

Figure 2.8-3
San Andreas Reservoir Storage and Stream Release

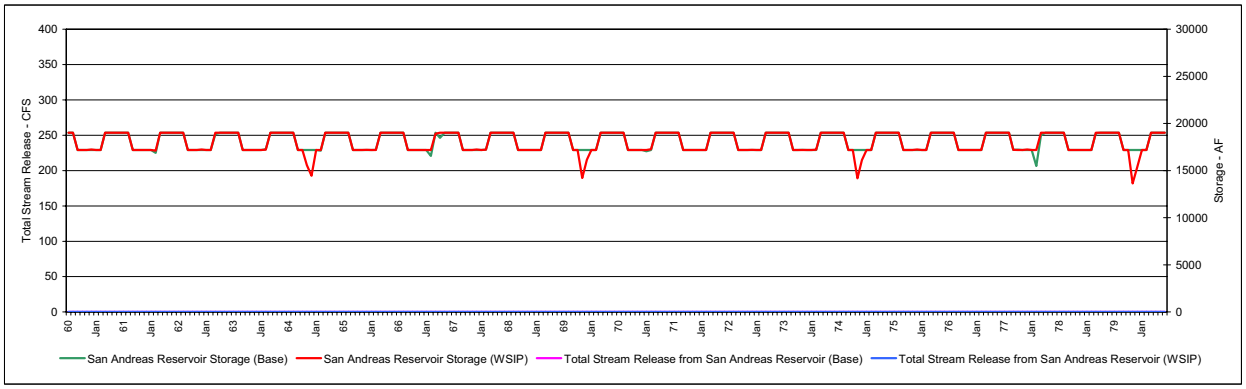
1920 - 1939



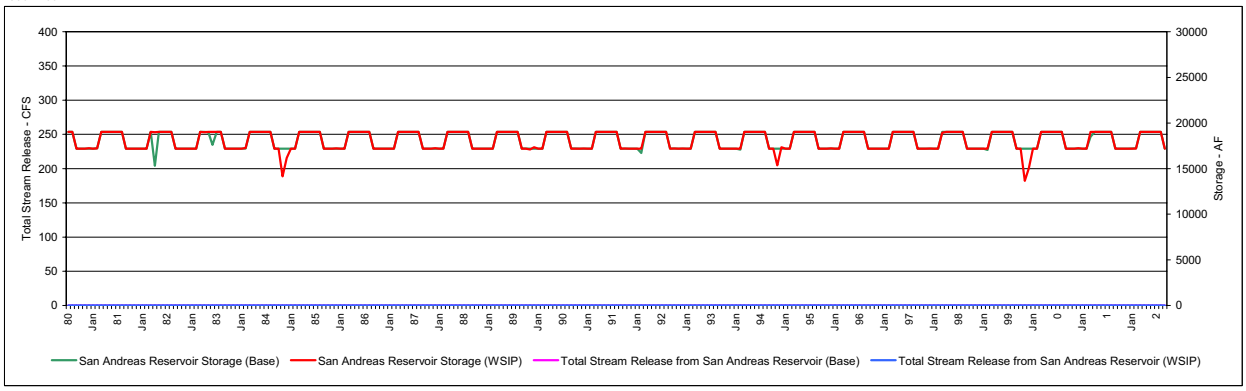
1940 - 1959



1960 - 1979

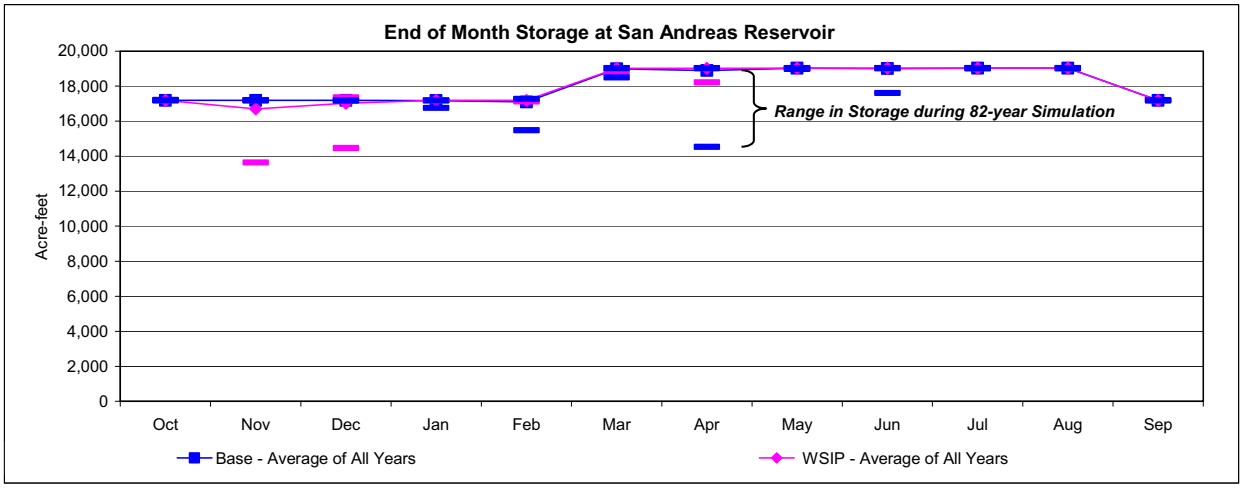


1980 - 2002



water demand affects the reservoir when additional required water production at Harry Tracy Water Treatment Plant (Harry Tracy WTP) associated with the WSIP or the base-Calaveras unconstrained setting exceeds the ability to maintain San Andreas Reservoir storage with pumping from Crystal Springs Reservoir. The model assumes that the conveyance capacity from Crystal Springs Reservoir is the same among all of the settings. The additional water demand of the WSIP setting and the current demand of the base-Calaveras unconstrained setting require additional production from Harry Tracy WTP to be drawn from San Andreas Reservoir. Figure 2.8-4 illustrates the average monthly storage in San Andreas Reservoir for the 82-year simulation, and the range in storage for each month for the WSIP and base settings.

Figure 2.8-4



2.9 Pilarcitos Reservoir

The Coastside County Water District's (Coastside CWD) water demand and its SFPUC purchase request are projected to increase within the WSIP planning horizon of 2030. Within the context of the 2030 purchase request of 300 mgd, Coastside CWD's portion has been estimated to amount to about 3 mgd. This projected purchase request is approximately 1 mgd greater that its current purchase request. Considering the current physical constraints to deliveries from the SFPUC to Coastside CWD and the ongoing planning activities in the watershed, the precise means of serving Coastside CWD's additional purchase request (and the resultant potential changes in the operation of SFPUC facilities and their affected environs) are uncertain.[2]

Assuming a range of potential means to serve the additional purchase request from Coastside CWD, the following are potential hydrologic effects on SFPUC facilities and their affected environs:

- Due to limited yield from Pilarcitos Reservoir, additional diversions would be required from Crystal Springs Reservoir.
- If deliveries to Coastside CWD from Pilarcitos Reservoir increase during the winter season, these deliveries could potentially reduce storage in Pilarcitos Reservoir, thereby potentially reducing diversions to the San Mateo Creek watershed. Although the increased delivery would increase releases to Pilarcitos Creek from Pilarcitos Dam for a period of time, the increase would subsequently lead to a reduction in spills past Stone Dam.
- Additional wintertime deliveries could also potentially impair the ability to provide carryover storage into the summer season from Pilarcitos Reservoir, and subsequently lead to an acceleration of the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.

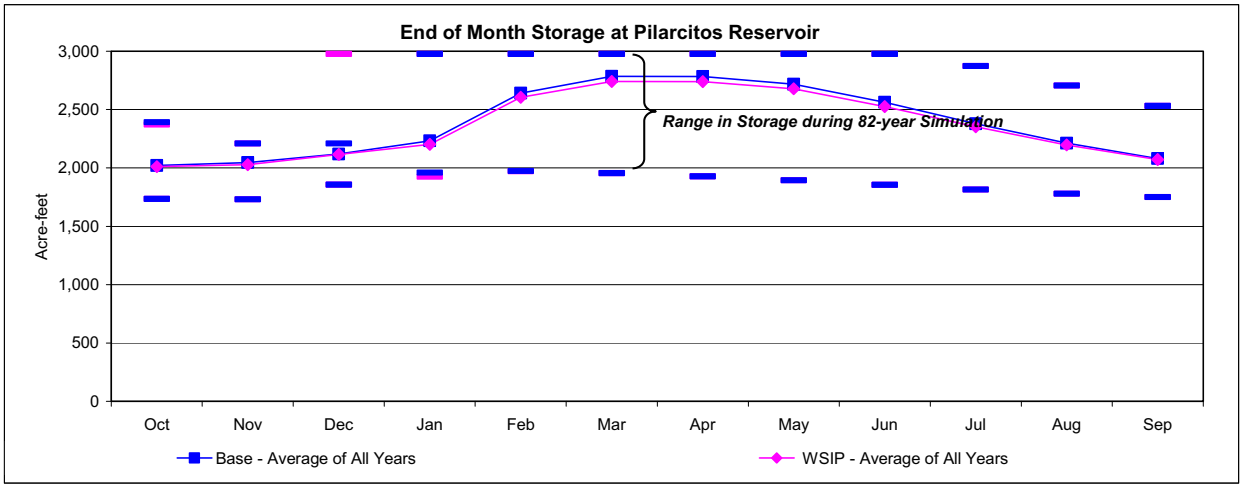
[2] See "Analysis of SFPUC Pilarcitos/Coastside County Water District Operations," Memorandum by Daniel B. Steiner, March 8, 2007.

- An increase in summertime deliveries from Pilarcitos Creek could also accelerate the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.

Figure 2.9-1 illustrates the average monthly storage in Pilarcitos Reservoir for the 82-year simulation, and the range in storage for each month for the WSIP and base settings for one possible outcome of the SFPUC providing deliveries for Coastside CWD's increase in demand. Figure 2.9-2 illustrates a chronological trace of the simulation of Pilacitos Reservoir storage and stream releases from Pilarcitos Dam. Shown in the figures are the results for the WSIP and base settings. Assumed in the operation is an increase in purchase request by Coastside CWD, distributed on a proportionate monthly pattern during the year consistent with historical SFPUC deliveries. Also assumed is a conveyance constraint of 2 mgd to Coastside CWD from the Pilarcitos Creek source of water. When the assumed monthly purchase request of Coastside CWD exceeds this conveyance constraint, Coastside CWD's request is met with deliveries from Crystal Springs Reservoir.

The effect of the assumed Coastside CWD operation in combination with the effects of the rest of the SFPUC regional system operation results in occasional differences in the storage operation of Pilarcitos Reservoir. Overall, there would be a slightly lower average storage at Pilarcitos Reservoir. Several factors contribute to the changes. Additional water is drawn from Pilarcitos Reservoir to the San Mateo Creek watershed in reaction to additional demands being served from the SFPUC system. Pilarcitos Reservoir is at times also drawn to meet the increase in demand from Coastside CWD during months (e.g., spring months) when available conveyance capacity from Stone Dam exists. Both of these additional draws from the reservoir would deplete storage below that experienced in the base setting. Pilarcitos storage would typically replenish at the expense of reservoir spills that would have occurred at a future date, and within a year storage would end the same as in the base setting, as the reservoir would still be subsequently depleted to the minimum level at the spillway crest.

Figure 2.9-1

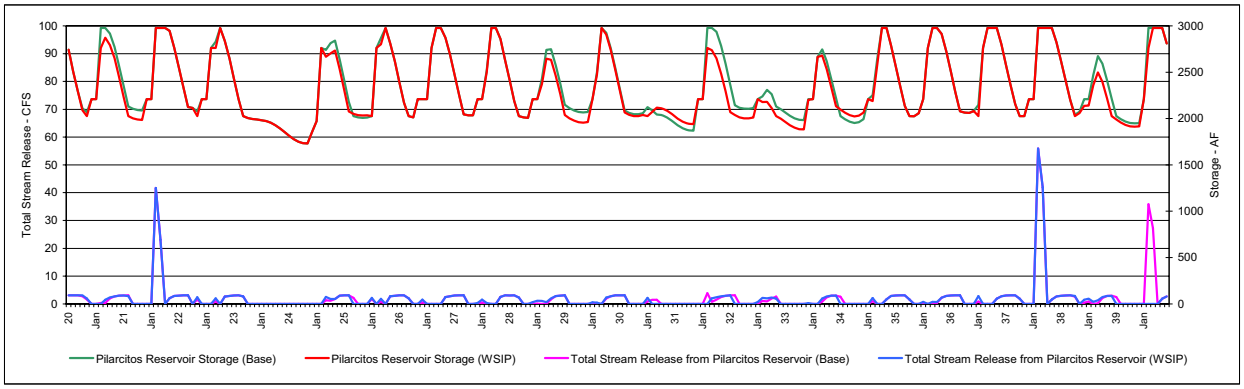


Stream releases from Pilarcitos Dam are also shown in Figure 2.9-2. Releases can occur for diversions at Stone Dam for Coastside CWD deliveries, conveyance to the San Mateo Creek watershed (e.g., Crystal Springs Reservoir), and reservoir spills. Pilarcitos Creek typically gains flow from unregulated tributary streams and runoff below Pilarcitos Dam. The differences in flow between the WSIP setting and base setting are shown chronologically in Table 2.9-1 and summarized by monthly averages within year types in Table 2.9-2. The positive changes in flows during the winter and spring are indicative of the additional draw of water from the reservoir to serve the increased demand of Coastside CWD during the period when conveyance capacity exists from Stone Dam. The few reductions in flow during the summer are indicative of years when additional releases earlier in a year lead to the reservoir being depleted to minimum storage earlier in the year, thus reducing the amount of water released in a later month. Reductions in flow during the winter and spring are indicative of the reservoir replenishing additionally depleted storage associated with the WSIP setting.

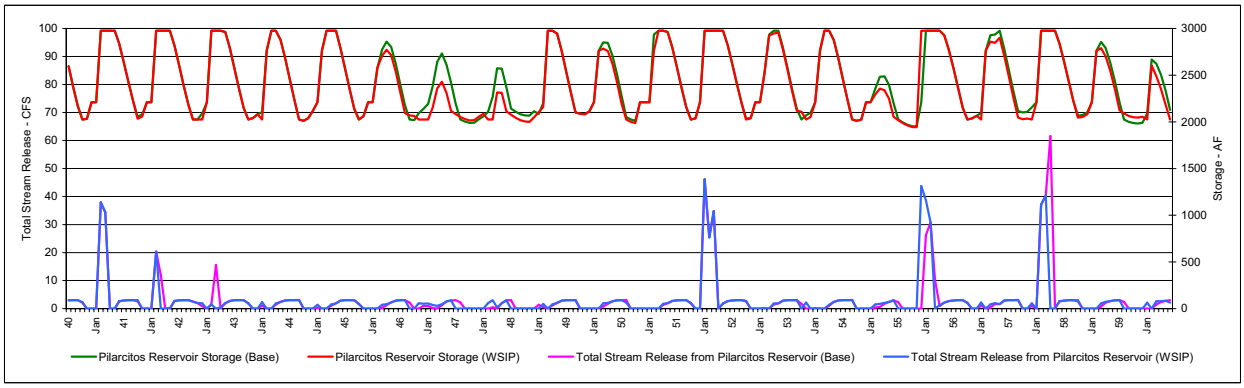
APPENDIX O1

Figure 2.9-2
Pilarcitos Reservoir Storage and Stream Release

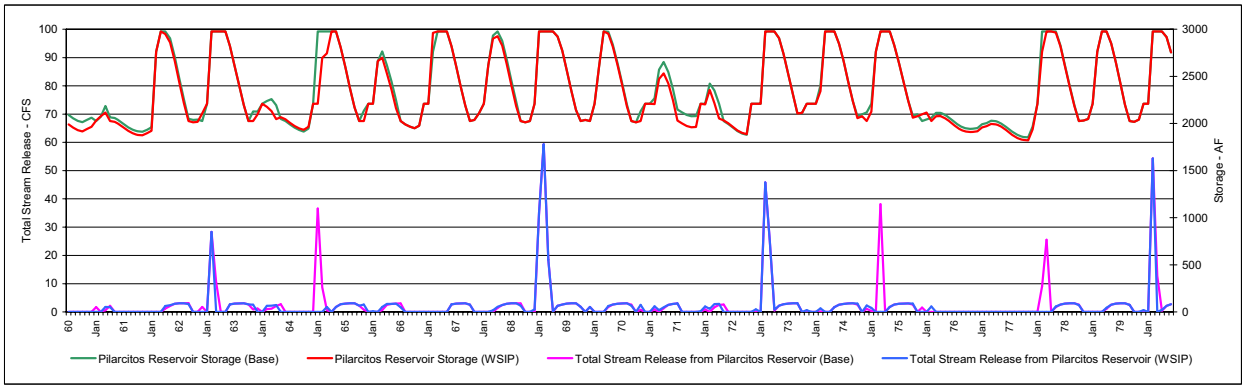
1920 - 1939



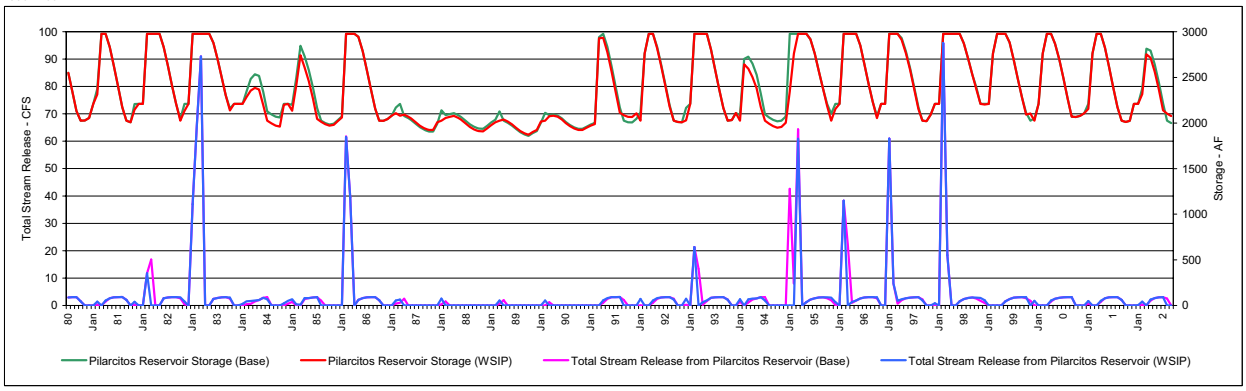
1940 - 1959



1960 - 1979



1980 - 2002



APPENDIX O1

Table 2.9-1

Difference in Total Stream Release from Pilarcitos Reservoir (Acre-feet) WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	21	21	0	0	-21	68	21	0	0	0	-15	0	95
1922	0	0	0	3	0	0	0	0	0	0	0	0	3
1923	0	51	0	0	0	68	0	0	0	0	0	0	119
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	75	36	0	0	0	0	-128	-18
1926	0	0	0	24	0	68	0	0	0	0	0	0	92
1927	0	0	64	0	0	0	0	0	0	0	0	0	64
1928	0	0	21	64	18	0	0	0	0	0	0	0	104
1929	0	0	37	64	58	37	21	0	0	0	0	0	217
1930	0	0	0	34	25	0	21	0	0	0	0	0	79
1931	0	0	0	79	-80	-92	0	0	0	0	0	0	-93
1932	0	0	0	0	-211	79	52	17	0	0	-187	0	-250
1933	0	0	0	40	61	68	21	-43	0	0	0	0	146
1934	0	0	15	0	0	68	21	0	0	-157	0	0	-53
1935	0	0	0	0	64	0	0	0	0	0	0	0	64
1936	0	0	0	46	0	46	21	0	0	0	0	0	113
1937	0	0	0	122	0	0	0	0	0	0	0	0	122
1938	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	16	0	64	64	40	68	21	0	-6	-150	0	0	117
1940	0	0	0	0	-1,991	-1,677	0	0	0	0	0	0	-3,668
1941	0	0	0	0	0	0	0	0	0	0	0	0	0
1942	21	0	0	0	0	-734	0	0	0	0	0	0	-713
1943	0	0	64	0	0	-958	21	0	0	0	0	0	-874
1944	0	0	0	77	0	0	21	0	0	0	0	0	98
1945	0	0	0	64	0	0	21	0	0	0	0	0	85
1946	0	0	0	0	0	68	21	0	0	0	0	-128	-40
1947	0	110	48	54	61	58	21	0	0	-187	-136	0	30
1948	0	0	0	0	107	160	21	0	0	-187	0	0	101
1949	0	0	0	-83	61	0	21	0	0	0	0	0	-2
1950	0	0	0	0	0	68	21	0	0	0	-58	0	30
1951	0	0	0	0	0	0	21	0	0	0	0	0	21
1952	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	7	0	0	0	12	0	21	0	0	0	0	0	40
1954	-104	128	0	9	0	0	21	0	0	0	0	0	54
1955	0	0	0	0	61	68	21	0	0	-137	0	0	13
1956	0	0	2,689	766	0	-624	21	0	0	0	0	0	2,851
1957	0	0	0	68	0	68	21	0	0	0	0	0	157
1958	0	0	59	0	0	0	-3,661	0	0	0	0	0	-3,602
1959	21	0	0	0	0	68	21	0	0	0	-148	0	-38
1960	0	0	0	129	0	68	21	0	-49	0	0	0	168
1961	0	0	0	-104	0	75	-30	0	0	0	0	0	-59
1962	0	0	0	0	0	0	52	17	0	0	0	-18	51
1963	0	0	-107	0	0	-639	0	0	0	0	0	0	-747
1964	1	101	-74	0	61	68	21	-166	0	0	0	0	11
1965	0	0	0	-2,248	-485	68	0	0	0	0	0	0	-2,666
1966	0	110	0	15	0	68	21	0	0	-86	0	0	128
1967	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	34	21	0	0	0	0	-49	6
1969	0	0	55	0	0	0	12	0	0	0	0	0	68
1970	0	0	0	0	0	0	21	0	0	0	0	-20	1
1971	0	106	0	0	61	40	21	0	0	0	0	0	227
1972	0	0	15	64	61	68	21	-162	0	0	0	0	67
1973	0	0	55	0	0	0	21	0	0	0	0	0	76
1974	0	37	0	0	61	0	0	0	0	0	0	0	98
1975	21	0	72	64	0	-2,341	0	0	0	0	0	0	-2,184
1976	21	0	-93	0	108	0	0	0	0	0	0	0	36
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	-503	-1,569	0	17	0	0	0	0	-2,054
1979	-10	0	0	0	0	0	21	0	0	0	0	0	11
1980	0	0	37	0	0	-783	21	0	0	0	0	0	-726
1981	0	0	0	0	61	0	21	0	0	0	0	0	82
1982	0	62	0	0	0	-1,032	0	0	0	0	0	0	-970
1983	19	62	0	0	0	0	0	0	0	0	0	0	80
1984	21	0	0	34	61	68	21	0	0	-44	0	0	160
1985	0	46	64	64	21	18	21	0	0	0	-106	0	129
1986	0	0	0	0	-12	0	0	0	0	0	0	0	-12
1987	0	0	0	0	61	68	-145	0	0	0	0	0	-16
1988	0	0	0	130	-83	0	0	0	0	0	0	0	47
1989	0	0	0	0	0	75	-116	0	0	0	0	0	-41
1990	0	0	0	0	98	-73	0	0	0	0	0	0	25
1991	0	0	0	0	0	0	52	17	0	0	0	-117	-47
1992	0	0	0	148	0	0	52	17	0	0	0	-17	201
1993	0	0	138	0	0	-820	52	17	0	0	0	0	-613
1994	-1	0	0	62	0	68	21	0	0	-75	0	0	74
1995	0	0	0	-2,620	-442	-213	0	0	0	0	0	0	-3,275
1996	21	53	64	0	0	-1,360	21	0	0	0	0	0	-1,201
1997	21	0	0	0	0	68	21	0	0	0	0	-20	90
1998	0	0	49	0	0	0	0	0	0	0	0	0	49
1999	21	62	64	0	0	0	0	0	0	0	0	0	147
2000	21	-101	104	0	0	0	21	0	0	0	0	0	45
2001	0	0	0	64	0	0	21	0	0	0	0	0	85
2002	0	0	0	6	61	0	21	0	0	0	-155	0	-67
Avg (21-02)	2	10	43	-33	-31	-132	-34	-3	-1	-12	-10	-6	-208

Table 2.9-2

Total Stream Release from Pilarcitos Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	57	11	188	837	2,116	1,563	19	70	152	175	183	176	5,547
Above Normal	63	44	47	15	432	102	31	117	161	181	185	169	1,546
Normal	56	9	8	34	32	32	83	143	171	183	152	116	1,018
Below Normal	52	28	9	39	23	61	126	146	164	149	96	47	940
Dry	38	7	13	59	44	79	61	56	51	7	0	0	416
All Years	53	20	53	193	522	360	64	107	141	140	124	102	1,878

Total Stream Release from Pilarcitos Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base Sep	WY Total
Wet	54	3	4	953	2,144	1,770	242	70	152	175	183	177	5,927
Above Normal	56	37	20	137	605	641	22	115	161	181	186	169	2,328
Normal	55	3	7	15	24	9	60	139	171	185	164	128	960
Below Normal	57	6	7	15	6	23	103	154	164	171	124	65	894
Dry	36	0	11	26	17	41	70	69	55	44	8	0	378
All Years	52	10	10	225	553	493	98	110	141	152	134	108	2,085

Difference in Total Stream Release from Pilarcitos Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	WSIP minus Base Aug	Sep	WY Total
Wet	4	8	184	-116	-28	-207	-223	0	0	0	0	-1	-380
Above Normal	6	7	27	-121	-173	-539	9	2	0	0	-1	0	-782
Normal	1	7	1	19	8	23	23	3	0	-3	-12	-11	59
Below Normal	-5	23	2	24	17	38	24	-9	0	-22	-28	-17	46
Dry	2	7	2	32	27	38	-9	-13	-3	-37	-8	0	38
All Years	2	10	43	-33	-31	-132	-34	-3	-1	-12	-10	-6	-208

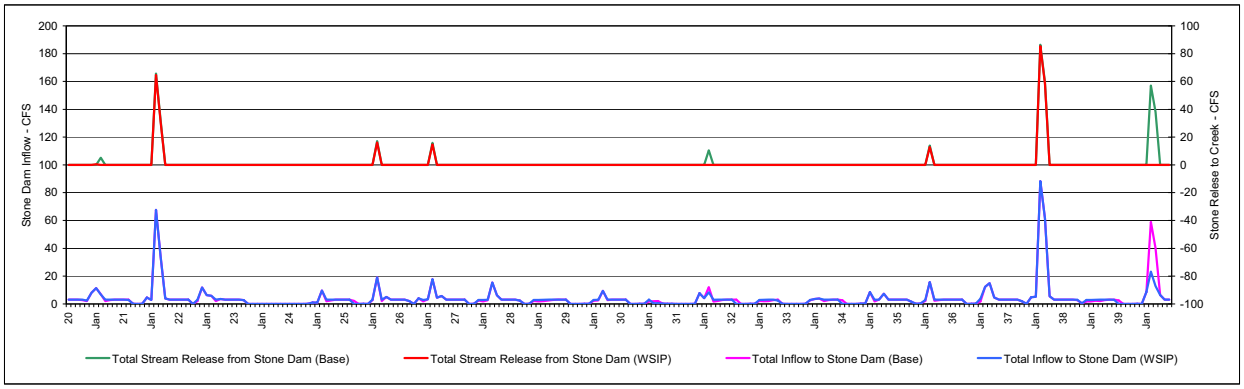
The effect of the WSIP on Pilarcitos Creek flows below Stone Dam is different than the effect on flows below Pilarictos Dam. Figure 2.9-3 illustrates the chronological trace of inflow to Stone Dam, which includes releases from Pilarcitos Dam to Pilarcitos Creek and unregulated flow occurring to the stream below Pilarcitos Dam, and releases (spills) from Stone Dam to Pilarcitos Creek. Shown in the figure are the results for the WSIP setting and the base setting. The flow past Stone Dam is typically minor (zero in modeling results, but may be measurable in terms of leakage and seepage past the dam), as inflow to the dam is diverted to Coastside CWD or to the San Mateo watershed. Releases past Stone Dam are typically the result of unregulated flow below Pilarcitos Dam exceeding the delivery needs of Coastside CWD at a time when the storage level at Crystal Springs Reservoir rejects the water from the Pilarcitos watershed.

The changes in flow below Stone Dam would typically occur during the rainy season between the months of January and March, in at least one month during about half of the years. Table 2.9-3 summarizes the results of the WSIP and base settings in terms of average monthly flows by year type, and the average differences in flow between the two settings.

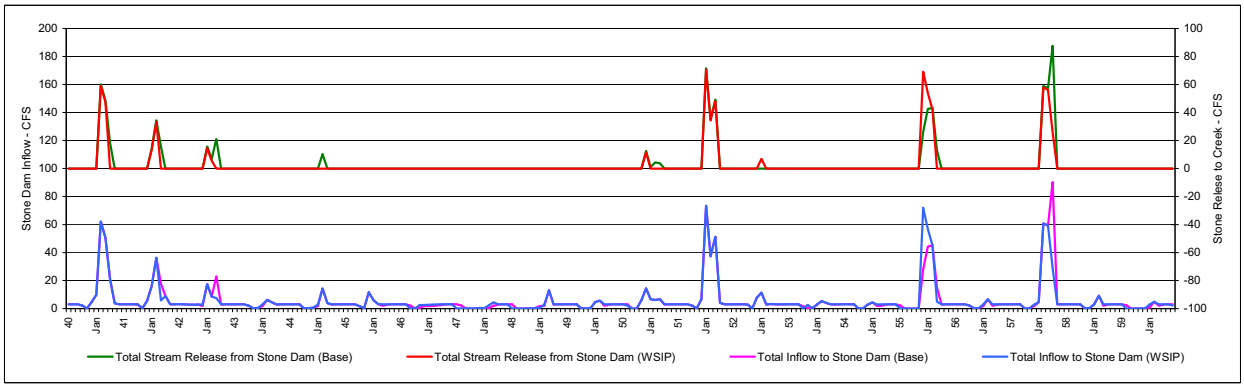
APPENDIX O1

Figure 2.9-3
Stone Dam Stream Release and Inflow

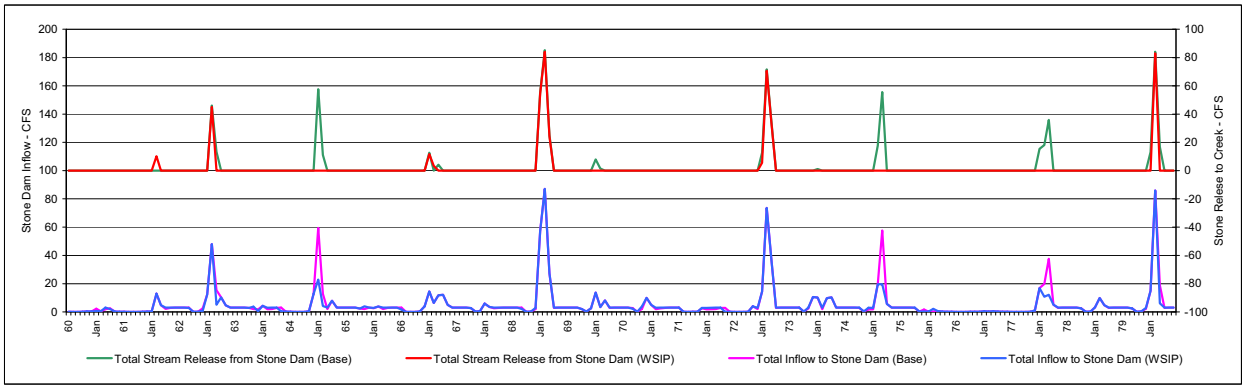
1920 - 1939



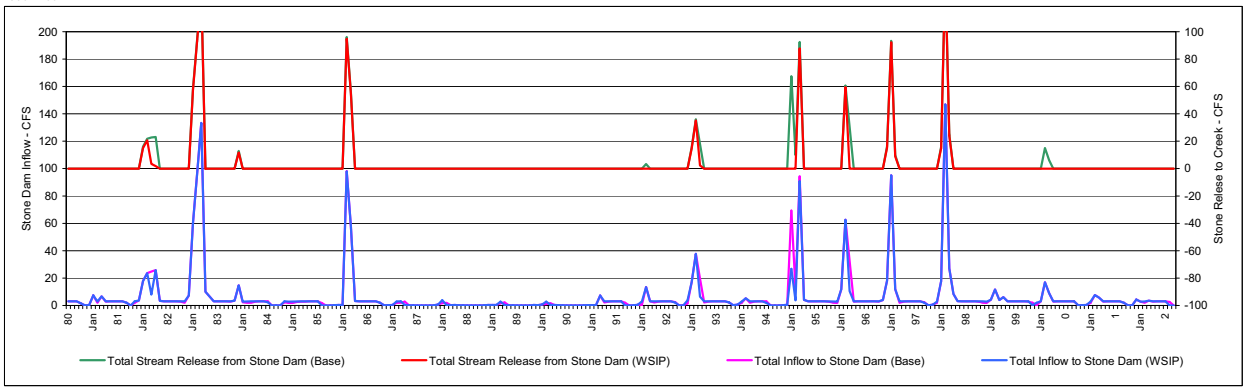
1940 - 1959



1960 - 1979



1980 - 2002



APPENDIX O1

Table 2.9-3

Total Stream Release from Stone Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	324	1,493	3,176	2,188	103	0	0	0	0	0	7,282
Above Normal	0	0	42	108	734	120	0	0	0	0	0	0	1,003
Normal	0	0	45	27	135	0	0	0	0	0	0	0	208
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	81	319	798	452	20	0	0	0	0	0	1,669

Total Stream Release from Stone Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	164	1,819	3,252	2,509	479	0	0	0	0	0	8,223
Above Normal	0	0	46	384	1,174	921	0	0	0	0	0	0	2,525
Normal	0	0	49	30	197	0	0	0	0	0	0	0	276
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	51	440	917	680	94	0	0	0	0	0	2,182

Difference in Total Stream Release from Stone Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

WSIP minus Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	160	-326	-77	-322	-377	0	0	0	0	0	-941
Above Normal	0	0	-4	-277	-440	-801	0	0	0	0	0	0	-1,522
Normal	0	0	-4	-3	-62	0	0	0	0	0	0	0	-69
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	30	-122	-118	-229	-74	0	0	0	0	0	-513

APPENDIX O2

Memorandum

Subject: **HH/LSM Assumptions and Results – CEQA Alternatives Modified WSIP**
From: **Daniel B. Steiner**
Date: **April 29, 2008**

1. Introduction

This memorandum summarizes assumptions for, and discusses the interpretation of, the HH/LSM results for the simulation of the CEQA alternative referred to as the Modified WSIP Alternative. The Draft PEIR analyzed six CEQA alternatives: (1) No Program, (2) No Purchase Request Increase, (3) Aggressive Conservation/Water Recycling and Local Groundwater, (4) Lower Tuolumne River Diversion, (5) Year-round Desalination at Oceanside Alternative, and (6) Regional Desalination for Drought. The scenarios represent CEQA program alternatives that vary from the WSIP on key program components in a manner expected to avoid or reduce potentially significant effects of the proposed program. The Modified WSIP Alternative supplements the previously described analyses. Tables 1-1 and 1-2 summarize the components, various modeling assumptions, and performance and hydrologic results for the Modified WSIP Alternative in comparison to the modeled existing (2005) base setting (with Calaveras Reservoir constrained by DSOD restrictions) and the WSIP setting.

The hydrology that would result under this alternative is primarily discussed in terms of a comparison to the proposed program and contrasted to the baseline condition of the PEIR, namely the simulated current (2005) operation of the SFPUC regional water system assuming that the Calaveras and Crystal Springs Reservoirs operation are constrained by DSOD restrictions. Only primary hydrologic parameters such as projected water deliveries, reservoir storage, and stream flows are compared, and only those parameters that have been identified as key hydrologic factors that could lead to environmental impacts are illustrated.

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Table 1-1
Setting Characteristics and Modeling Assumptions (Part 1/3)

Assumptions and Characteristics of Setting and/or Program	Units	Baseline: Baseline Conditions[1] - Calaveras Constrained	Proposed WSIP	CEQA Alternatives[3]: Modified WSIP
Time Horizon for Setting of Analysis / Date[4]		2005	2030	2030
HH/LSM Simulation Study Name[5]		Base1LT	WSIP1LT	ModWSIPLT
System Wide Parameters				
Customer Purchase Request (Demand Level)[6]	MGD	265	300	300
Demand Level Supplied from Other Sources[7]				
Regional Recycled Water/Conservation/Groundwater in SF	MGD	0	10	10
Other Regional Recycled Water/Conservation/Groundwater	MGD	0	0	10
Demand Level Supplied from Tuolumne + Local Watersheds[8]	MGD	265	290	280
Average Annual Deliveries and Supplies[9]				
Deliveries from Tuolume + Local Watersheds (Average Annual)	MGD	258	287	277
Supply or Deliveries from Other Sources - Regional Recl/Cons/GW	MGD	0	10	20
Total Deliveries and Supply for Demand Level (Average Annual)	MGD	258	297	297
Features and Facilities[10]				
Regional Reclaimed Water/Conservation/Groundwater - SF			●	●
Regional Reclaimed Water/Conservation/Groundwater - Other				●
Calaveras Reservoir - 12.4 BG (Constrained)		●		
Calaveras Reservoir - 31.6 BG (Restored/Unconstrained)			●	●
Calaveras Reseroivr Release for Fish			●	●
Calaveras Reservoir Release for Fish & Flow Recapture			●	●
Alameda Creek Diversion Dam Bypass Flow & Recapture				●
Pilarcitos Reservoir Pump for Creek Summer Release				●
Crystal Springs Reservoir - 18.52 BG (Constrained)		●		
Crystal Springs Reservoir - 20.28 BG (Restricted)				●
Crystal Springs Reservoir - 22.15 BG (Restored/Unconstrained)			●	●
Sunol Valley Water Treatment Plant Expansion			●	●
Sunol Valley Water Treatment Plant Feed from SJPL			●	●
Harry Tracy Water Treatment Plant Expansion			●	●
Bay Division Pipeline Increased Conveyance			●	●
San Joaquin Pipeline Increased Conveyance			●	●
Desalination Project				
Westside Groundwater Project			●	●
Tuolumne River Transfer			**29,350 (From Storage)**	**19,600 (From Conserved Water)**
Water Supply Reliability[11]				

Action	Level	Baseline: Rationing %	Proposed WSIP: Rationing %	CEQA Alternatives[3]: Modified WSIP: Rationing %
Implement Drought Water Supply Action (Westside GW or Desal)	1	NA	GW	GW
Rationing (Level 1)	2	10	10	10
Rationing (Level 2)	3	20	20	20
Rationing (Level 3)	4	25	25	25

Years	Baseline: Action Level	Proposed WSIP: Action Level	CEQA Alternatives[3]: Modified WSIP: Action Level
1921			
1924	2	1	1
1925		1	1
1926		1	1
1929		1	1
1930		1	1
1931	3	2	2
1932			
1933			
1934	2	1	1
1935			
1939			
1944			
1946			
1947			
1948		1	1
1949			
1950		1	
1953			
1954			
1955		1	1
1957			
1959			
1960	2	1	1
1961	3	2	2
1962			
1964		1	1
1966			
1968			
1971			
1972		1	1
1976	2	1	1
1977	3	2	2
1979			
1981			
1984			
1985		1	1
1987	2	1	1
1988	3	2	2
1989	3	2	2
1990	3	3	3
1991	3	2	2
1992	3	3	3
1994	2	1	1
DD1993	4	3	3
DD1994	4	3	3

		Baseline	Proposed WSIP	CEQA Alternatives[3]: Modified WSIP
Max Drought Rationing - Policy Cap[12]	DD	Incidental 25%	20%	20%
	Historical	Incidental 20%	20%	20%

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Table 1-1
Setting Characteristics and Modeling Assumptions (Part 2/3)

Assumptions and Characteristics of Setting and/or Program	Units	Baseline		CEQA Alternatives[3]
		Baseline Conditions[1] - Calaveras Constrained	Proposed WSIP	Modified WSIP
System Wide Parameters				
Incremental Supply - Average[13]				
System Customer Purchase Request Level	MGD	265	300	300
Demand Level Supplied from Other Sources	MGD	0	10	20
Demand Level Supplied from Tuolumne + Local Watersheds	MGD	265	290	280
System Deliveries	MGD	258	287	277
Regional Desalination	MGD	0	0	0
San Joaquin Pipelines (Tuolumne Diversion)	MGD	221	245	236
Inferred Local Watershed Production	MGD	37	41	40
Addt'l Tuolumne Diversion (Compared to Calaveras Constrained)	MGD		24	15
Incremental Design Drought Supply[14]				
From Other Sources - Regional Recl/Cons/GW (Every Year)	MGD	0	10	20
Restoration of Calaveras Reservoir Capacity (w/ flow recapture)	MGD	0	7	7
Restoration of Crystal Springs Capacity[21]		0	1	0
MID/TID Transfer to SFPUC (Results in additional diversion from TR)	MGD	0	25	17
Westside Basin Conjunctive Use (8,100 acre-feet Storage)	MGD	0	6	6
Regional Desalination (26 mgd)	MGD	0	0	0
Sum of Incremental Supplies	MGD	0	48	49
Yield - Without Other Sources Added (Compared to Calaveras Constrained)	MGD	219	257	248
Yield - With Other Sources Added (Compared to Calaveras Constrained)	MGD	219	267	268
Design Drought Delivery Calculator[15]				
	MGD			
Average Annual Delivery During	Year 1	265	290	280
Average Annual Delivery During	Year 2	239	290	280
Average Annual Delivery During	Year 3	212	261	252
Average Annual Delivery During	Year 4	212	261	252
Average Annual Delivery During	Year 5	212	232	224
Average Annual Delivery During	Year 6	212	261	252
Average Annual Delivery During	Year 7	212	232	224
Average Annual Delivery During	Year 8	199	232	224
Average Annual Delivery During	Last 6 Mo	99	116	112
	DD Ave	219	256	247
Firm Yield (Nominal) Not Including Other Sources	MGD	219	256	247
Local System Operational Parmeters				
Crystal Springs Reservoir Operation				
Storage - Minimum/Maximum	BG	5.4 - 18.52	5.4 - 22.15	5.4 - 20.28
	TAF	16.6 - 56.8	16.6 - 68.0	16.6 - 62.2
Fall/Winter Operation Storage		16.52 BG (50.7 TAF)	18.55 BG (56.9 TAF)	18.28 BG (56.1 TAF)
Stream Release		Up to 250 cfs to not exceed 18.52 BG	Up to 250 cfs to not exceed 21 BG	Up to 600 cfs to not exceed 20.28 BG
Calaveras Reservoir Operation				
Storage - Minimum/Maximum	BG	8.4 - 12.4	8.4 - 31.5	Same
	TAF	25.7 - 38.0	25.7 - 96.8	as
Fall/Winter Operation Storage		10.3 BG (31.6 TAF)	27.0 BG (82.9 TAF)	WSIP
Alameda Creek Release/Recapture[16]	AFY	0	Up to 6,300	Same as WSIP
San Andreas Reservoir Operation				
Storage - Minimum/Maximum	BG	3.0 - 6.2	3.0 - 6.2	Same
	TAF	9.2 - 19.0	9.2 - 19.0	as
Fall/Winter Operation Storage		5.6 BG (17.2 TAF)	5.6 BG (17.2 TAF)	Baseline and WSIP
San Antonio Reservoir Operation				
Storage - Minimum/Maximum	BG	1.0 - 16.5	1.0 - 16.5	Same
	TAF	3.1 - 50.5	3.1 - 50.5	as
Fall/Winter Operation Storage		15.9 BG (48.8 TAF)	15.9 BG (48.8 TAF)	Baseline and WSIP
Pilarcitos Reservoir Operation				
Storage - Minimum/Maximum	BG	0.66 - 0.97	0.66 - 0.97	Same as Baseline and WSIP
	TAF	2.0 - 3.0	2.0 - 3.0	Allowed to draw additional
Fall/Winter Operation Storage		0.72 BG (2.2 TAF)	0.72 BG (2.2 TAF)	0.1 BG (0.3 TAF) for summer flow
Water Treatment Plants				
Sunol Valley Water Treatment Plant Maximum	MGD	120	160	Same as WSIP
		90 MGD from Calaveras	90 MGD from Calaveras + Recapture	Same as WSIP
Sunol Valley Water Treatment Plant Minimum	MGD	20	20	Same as Baseline and WSIP
		From Calavers & San Antonio & SJPL	From Calavers & San Antonio & SJPL	Same as Baseline and WSIP
Harry Tracy Water Treatment Plant Maximum	MGD	120	140	Same as WSIP
Harry Tracy Water Treatment Plant Minimum	MGD	20	20	Same as Baseline and WSIP
Conveyance				
Bay Division Pipeline Maximum		340 MGD Jun - Sep 320 MGD Apr, May & Oct 290 MGD Nov - Mar	380 MGD Apr - Oct 320 MGD Nov - Mar	Same as WSIP
Bay Division Pipeline Maintenance		Cycle one pipeline out Nov - Mar each year (average remaining capacity rotation) maximum 230 MGD	Same as Baselines, except maximum 320 MGD	Same as WSIP

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Table 1-1
Setting Characteristics and Modeling Assumptions (Part 3/3)

Assumptions and Characteristics of Setting and/or Program	Units	Baseline Baseline Conditions[1] - Calaveras Constrained	Proposed WSIP	CEQA Alternatives[3] Modified WSIP
Tuolumne River System Operational Parameters				
Hetch Hetchy Reservoir Operation				
Storage - Minimum/Maximum	TAF	26.1 - 360.4	26.1 - 360.4	Same
Fall/Winter Operation Storage		30 TAF winter buffer	30 TAF winter buffer	as
1987 Stipulation Minimum Release Flows		Yes	Yes	Baseline and
1987 Stipulation Supplemental Release Flows		No	No	WSIP
Cherry Reservoir Operation				
Storage - Minimum/Maximum	TAF	1.0 - 273.3	1.0 - 273.3	Same as
Fall/Winter Operation Storage		25.3 TAF winter buffer	25.3 TAF winter buffer	Baseline and WSIP
Eleanor Reservoir Operation				
Storage - Minimum/Maximum	TAF	0.0 - 27.1	0.0 - 27.1	Same as
Fall/Winter Operation Storage		Required Minimum Storage	Reqrd Minimum Stor	Baseline and WSIP
New Don Pedro Water Bank Account				
Storage - Minimum/Maximum	TAF	0.0 - 570.0 Temporary storage up to 740 TAF during Apr - Sep	0.0 - 570.0 Temp stor up to 740 TAF during Apr - Sep	Same as Baseline and WSIP
Conveyance				
San Joaquin Pipelines Maximum	MGD	290	313	Same as WSIP
San Joaquin Pipelines Minimum	MGD	70	70	Same as WSIP
San Joaquin Pipelines Flow Rate Changes		11 Stepwise	17 Stepwise	Same as WSIP
		Surrogate minimum changes by allowing only 7 changes in a year	Allow up to 7 changes in a year (surrogate)	Same as WSIP
San Joaquin Pipelines Maintenance		Cycle one pipeline out Nov - Mar each year (average remaining capacity rotation) maximum 210 MGD	Cyclic 5-year mantenance (see note)	Same as WSIP
TID/MID Operational Parameters			Note: Cyclic 5-year maintenance, maximum capacity available Apr - Oct all years 271 MGD available all other months except 0 MGD available Year 5 Nov - Dec and 135.5 MGD available Year 1 and Year 3 Dec	
Districts' Tuolumne Diversion[17]		Varies annually based on land use and water availability Annual average 875 TAF	Set equal to baseline conditions. SFPUC effects measured by the result of reducing inflow to DP and its effect upon La Grange releases to the TR	Same as WSIP but reduced by amount of water transfer
Tuolumne River La Grange Flow Releases				
Don Pedro, 1996 FERC		X	X	X
VAMP - considered but not modeled[18]		X	X	X

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Table 1-2
Summary of Modeling Results (Part 1/2)

HH/LSM Simulation Results	Units	Baseline		CEQA Alternatives[3]
		Baseline Conditions[1] - Calaveras Constrained	Proposed WSIP	Modified WSIP
Design Drought Production & Disposition[19]				
San Joaquin Pipeline Diversion	MGD	208.7	235.0	226.7
Bay-Area Deliveries	MGD	218.3	248.9	240.0
Added Groveland & Coastside Delivery	MGD	2.6	3.6	3.6
Local Reservoir Evaporation	MGD	10.7	12.5	12.5
Inflow from ACDD	MGD	1.3	1.6	0.7
Flow Recapture	MGD	0	5.3	5.4
Local Reservoir Stream Release	MGD	0.6	5.4	4.6
Desalination	MGD	0	0	0
Westside Basin	MGD	0	5.6	5.6
District Transfer to NDP Water Bank	MGD	0	24.7	16.5
Local Storage - Begin	MG	53,854	77,310	75,440
Local Storage - End	MG	18,403	18,495	18,644
Study Average Production & Disposition (1921-02)[20]				
Tuolumne River System				
Reservoirs				
Hetch Hetchy				
Inflow	AF	749,605	749,605	749,605
River	AF	275,255	267,021	270,577
Stream Minimum Release	AF	65,728	65,593	65,595
Tunnel	AF	470,709	478,932	475,373
Evaporation	AF	3,893	3,869	3,872
Reservoir	AF	281,938	275,235	278,130
Cherry				
Inflow	AF	279,293	279,293	279,293
Eleanor Gravity	AF	289	289	289
Eleanor Pump	AF	118,251	118,274	118,316
River	AF	41,636	41,439	41,364
Stream Minimum Release	AF			
Tunnel	AF	352,692	352,915	353,056
Evaporation	AF	3,505	3,501	3,501
Reservoir	AF	239,971	239,309	239,182
Eleanor				
Inflow	AF	169,617	169,617	169,617
Eleanor Gravity	AF	289	289	289
Eleanor Pump	AF	118,251	118,274	118,316
River	AF	49,171	49,148	49,106
Stream Minimum Release	AF			
Evaporation	AF	1,906	1,906	1,906
Reservoir	AF	22,191	22,191	22,191
Don Pedro Reservoir				
Inflow	AF	1,587,517	1,560,828	1,570,640
MID Diversion	AF	302,054	302,055	282,455
TID Diversion	AF	573,164	573,168	573,168
LaGrange Total Stream	AF	668,876	644,009	671,982
LaGrange Minimum Stream Release	AF	221,477	221,477	221,477
Total Evaporation	AF	43,493	42,604	43,474
Reservoir	AF	1,472,337	1,434,872	1,473,248
Water Bank Account				
Balance	AF	514,299	516,733	515,541
Transfer	AF	0	29,350	19,600
San Joaquin Pipelines				
Volume (AF)	AF	247,763	274,450	264,634
Volume (MG)	MG	80,734	89,429	86,231
Rate (MGD)	MGD	221	245	236
Max Rate (MGD)	MGD	290	313	313
Min Rate (MGD)	MGD	70	0	0
East Bay System				
Reservoirs				
Calaveras				
Inflow	MG	12,368	12,368	12,368
From ACDD	MG	1,316	1,730	1,163
Stream	MG	3,660	4,167	3,768
Stream Flow Recapture	MG	0	1,538	1,893
To SVWTP	MG	9,013	8,244	8,068
To San Antonio	MG	0	0	0
Evaporation	MG	1,023	1,704	1,710
Resevoir	MG	10,969	28,170	28,324
San Antonio				
Inflow	MG	2,468	2,468	2,468
From Calaveras/SJPL	MG	1,173	1,734	1,242
Stream	MG	991	613	805
To SVWTP	MG	1,693	2,628	1,906
Evaporation	MG	1,012	973	1,006
Resevoir	MG	15,323	14,490	15,136
Alameda Creek Diversion Dam				
Inflow	MG	4,197	4,197	4,197
To Calaveras Reservoir	MG	1,316	1,730	1,163
Spill	MG	2,881	2,467	3,034
Alameda Creek Confluence				
Accretion	MG	625	625	625
From ACDD	MG	2,881	2,467	3,034
From Calaveras Dam	MG	3,660	4,167	3,768
At Confluence	MG	7,167	7,259	7,427
Treatment Plants				
SVWTP Total	MG	13,662	15,738	15,938
From Calaveras	MG	9,013	8,244	8,068
From San Antonio	MG	1,693	2,628	1,906
From SJPL	MG	2,956	3,329	4,070
From Recapture	MG	0	1,538	1,893
SVWTP Total MGD	MGD	37	43	44
SVWTP Max MGD	MGD	120	158	158
SVWTP Min MGD	MGD	20	20	20

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Table 1-2
Summary of Modeling Results (Part 2/2)

HH/LSM Simulation Results	Units	Baseline		CEQA Alternatives[3]
		Baseline Conditions[1] - Calaveras Constrained	Proposed WSIP	Modified WSIP
Peninsula System				
Reservoirs				
Crystal Springs				
Inflow	MG	3,722	3,722	3,722
From San Andreas	MG	0	0	0
From Pilarcitos and SJPL	MG	8,045	7,643	7,902
Stream	MG	773	325	638
Pump to San Andreas	MG	9,438	9,005	8,958
Pump to Coastside	MG	247	591	576
Evaporation	MG	1,323	1,490	1,471
Reservoir	MG	16,360	18,621	18,384
San Andreas				
Inflow	MG	1,428	1,428	1,428
From other Streams	MG	9,954	9,590	9,508
Stream	MG	0	0	0
To HTWTP	MG	10,851	10,487	10,404
Evaporation	MG	530	531	531
Reservoir	MG	5,892	5,882	5,887
Pilarcitos				
Inflow		1,297	1,297	1,297
To San Andreas	MG	516	584	550
For Stone Diversion	MG	262	280	300
Stream other than Diversion	MG	417	332	349
Evaporation	MG	103	102	101
Reservoir	MG	776	767	752
Stone Dam				
Accretion blw Pilarcitos	MG	167	211	206
Pilarcitos non-diversion Release	MG	417	332	349
Pilarcitos Release for Diversions	MG	584	543	554
Diversion to Coastside	MG	167	211	206
Diversion to Crystal Springs	MG	142	180	157
Spill past Stone	MG	860	695	746
Treatment Plants				
HTWTP Total	MG	10,851	10,487	10,404
HTWTP Total MGD	MGD	30	29	29
HTWTP Max MGD	MGD	149	106	112
HTWTP Min MGD	MGD	20	20	20
Other Facilites				
Westside Basin Net	MG	0	11	11
Desalination Input	MG	0	0	0
Additional Information				
Total Local Reservoir Stream Release	MG	5,842	5,437	5,560
Total Local Reservoir Stream Evaporation	MG	3,991	4,800	4,819
Deliveries				
In-City	MG	29,589	26,686	26,689
South Bay	MG	43,106	52,906	49,876
Crystal Springs	MG	15,120	16,931	16,638
San Andreas	MG	5,400	6,604	6,313
Coastside	MG	675	1,082	1,082
Groveland	MG	365	365	365
Total Deliveries	MG	94,255	104,574	100,963
Total Deliveries	MGD	258	287	277
Storage				
Total Local Storage Begin	MG	49,849	71,363	70,714
Total Local Storage End	MG	43,129	65,197	67,112
Residual Difference during 82-year Simulation	MGD	0.22	0.21	0.12
Westside Storage Begin	MG	0	23,474	23,474
Westside Storage End	MG	0	24,363	24,363
Residual Difference during 82-year Simulation	MGD	0.00	-0.03	-0.03

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Notes for Table 1-1 and Table 1-2

1. Baseline condition represents the existing conditions at the time of NOP publication in September 2005. This is the baseline used to assess WSIP program impacts and impact significance. This setting is indicative of DSOD restrictions on Calaveras and Crystal Springs Reservoirs.

2. N/A

3. These scenarios represent CEQA alternatives that vary from the WSIP on key components in a manner expected to avoid or reduce potentially significant effects of the proposed program.

4. The time horizon for the setting of the scenario. The baseline condition scenario is depicted for recent conditions, while the proposed WSIP, variants, and alternatives are depicted for the future at full buildout and implementation (i.e., conditions in the year 2030).

5. HH/LSM simulation study name.

6. The customer purchase request (demand) information is based on the demand and request studies prepared by the SFPUC in coordination with the wholesale customers. This demand on the regional water system includes both the SFPUC retail customers and wholesale customers. The current (2005) average annual demand is 265 mgd and the projected 2030 average annual demand is 300 mgd, assuming the SFPUC adopts the updated wholesale customer purchase requests as part of renewing the Master Sales Agreement with these customers (due in 2009).

7. Certain scenarios include development of additional water supply from a combination of recycled water projects, groundwater projects, and conservation, utilized every year and not subject to reduction during drought.

8. The average annual demand for supplies from the combination of SFPUC local watershed, Tuolumne River and programs not included in the regional water conservation, recycling, and groundwater programs shown.

9. Modeled results for SFPUC deliveries, with supplies added for regional water conservation, recycling, and groundwater programs. Total deliveries and supply will be less than full customer purchase requests due to rationing in some years.

10. Shows only the features that affect hydrologic results of the system operation simulations. Additional projects are included in the WSIP, variants and alternatives.

11. Illustrates the frequency and severity of water supply action or the severity of systemwide rationing. Only years when variable water supply component is implemented or rationing occurs are shown. "DD" illustrates the shortage results for years included in the prospective drought period of the SFPUC design drought. These years contribute to establishing system operation protocols but are not included in the hydrologic assessment analyses.

12. Rationing policy cap: The SFPUC WSIP level of service goal is to maintain rationing on the regional system at no more than 20% during any one year of the drought. Some alternatives do not achieve this level of service goal. Performance is indicated for the design drought ("DD") sequence and for the "Historical" hydrologic sequence.

13. Water supply elements develop water in different amounts from year-to-year, and in some instances only develop water during dry years. This information is provided to illustrate a comparison between local watershed supplies, Tuolumne River supplies and other identifiable water supplies used to meet system purchase requests. Values are stated in units of average annual quantities during the simulated historical sequence.

14. Results from HH/LSM analysis of each scenario. Values represent the average annual production of each element of supply during the design drought period.

15. Simplified calculation of system deliveries during the SFPUC design drought. The value represents the application of systemwide shortages to the demand level being met with SFPUC local watershed, Tuolumne River, and other developed supplies and does not include supplies from regional water conservation, recycled water or groundwater projects. Average value may be slightly misstated (up to 3 mgd) due to metric of analysis that does not account for differences in residual storage between studies. "Nominal" Firm Yield represents the yield of each scenario after adjustment for minor residual storage differences.

16. Supplemental releases from Calaveras Reservoir for fisheries (1997 CDFG MOU) of up to 6,300 acre-feet per year and the Alameda Creek recapture facility project are tied to implementation of the Calaveras Dam Replacement project (SV-2). When the dam is replaced and capacity restored, the flow release and recapture will both occur. The release requirement is based on supplementing other occurring flows below Calaveras Reservoir, sometimes not requiring the full 6,300 acre-feet.

17. SFPUC actions are assumed to not change MID/TID diversions so as to isolate and possibly overstate the WSIP's effects on the Tuolumne River below La Grange Dam. The Districts' diversions are assumed to be constant among the scenarios to provide comparable results of WSIP-alone effects. The exception is for the Modified WSIP Alternative, in which the MID/TID diversion is reduced by the amount of SFPUC transfer.

18. Participation in the San Joaquin River Agreement is assumed. Although the agreement expires after 2010, it is assumed that a subsequent similar agreement or requirement of the Districts will occur. The HH/LSM does not explicitly model the Districts' participation in the agreement; however, their participation if modeled would result in only minor differences in results and would not change impact conclusions.

19. From HH/LSM results for modeling the SFPUC design drought period.

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2. CEQA Alternative – Modified WSIP

The Modified WSIP Alternative would implement all of the proposed WSIP facility improvement projects, but differs in that it would include measures to reduce or avoid impacts that are associated with implementing the WSIP. The measures being considered are:

- Demand reduction of an additional 10 mgd (all years) through recycled water, groundwater, and conservation projects within the wholesale customer service area
- Restricted reservoir levels at Crystal Springs Reservoir
- Bypass of an amount of flow to Alameda Creek at the Alameda Creek Diversion Dam
- Use of conserved water for the Turlock Irrigation District/Modesto Irrigation District (TID/MID) and/or other water agency transfer to the SFPUC
- Use of Pilarcitos Reservoir storage for maintenance of summer flows below Pilarcitos Dam

There would be an increase in customer demand, from 265 mgd in 2005 to 300 mgd in 2030. With the Modified WSIP Alternative, the increase would be met in part through additional water conservation, water recycling, and groundwater programs beyond those already assumed in the 2030 demand projections. A total of 10 mgd of the demand is assumed to be met through regional recycled water, groundwater, and conservation projects within the regional service area but outside of San Francisco. These projects are in addition to the 10 mgd of groundwater development, recycled water projects, and conservation in San Francisco included in the WSIP and also incorporated into this alternative. This alternative would result in an average annual net demand on the regional system of 280 mgd, compared to a net demand of 290 mgd for the WSIP setting and 265 mgd for the base setting. The net increase in water demand from the regional system would be served through additional Tuolumne River diversions, including a water transfer with the TID/MID similar to the proposed program, increased use of local watershed supplies from restoration of Calaveras Reservoir storage, water associated with restoration of Crystal Springs Reservoir, and implementation of the Westside Basin Groundwater Program.

The restricted operation of Crystal Springs Reservoir involves construction of the dam spillway at elevation 291.8 feet (modeled capacity of 21.15 billion gallons, the same as the proposed program), but operation of the reservoir with a normal maximum water surface elevation of 287.8 feet (modeled capacity of 20.28 billion gallons). The winter operation of the reservoir would provide a 2-billion-gallon storage buffer below the restricted elevation objective. This measure is intended to reduce or avoid inundation impacts of higher reservoir water surface elevations.

The Alameda Creek Diversion Dam (ACDD) bypass measure assumes the passage of up to 10 cfs or inflow, whichever is less, during the months of December through April. It is assumed that this flow to Alameda Creek below the diversion dam would be recaptured from Alameda Creek below the confluence with Calaveras Creek when the flow is utilized to meet 1997 CDFG MOU requirements. The measure is intended to reduce or avoid impacts of reducing winter and spring flows below the ACDD.

It is assumed that the transfer of water to the SFPUC would be developed through water conservation in the service areas of TID/MID and/or other water agency that would in effect reduce the TID/MID diversion of water from Don Pedro Reservoir. The measure is intended to reduce or avoid the impacts of reducing flows in the Tuolumne River below La Grange Dam.

The Pilarcitos Reservoir measure assumes the occasional use (extraction) of water from the reservoir pool below the invert of the spillway outlet at Pilarcitos Dam to maintain flow in Pilarcitos Creek below Pilarcitos Dam during July through September. The release would also maintain deliveries to Coastside CWD from the Pilarcitos Creek watershed during those months. The measure is intended to reduce or avoid the impacts associated with reduced releases to the creek during summer months.

2.1 Water Deliveries and Drought Response Actions

Compared to the WSIP setting, the regional system's sources are required to serve a net 280 mgd demand (300 mgd purchase request less 10 mgd of groundwater development, recycled water projects, and conservation and 10 mgd of programs outside of San Francisco) instead of a net 290 mgd demand.

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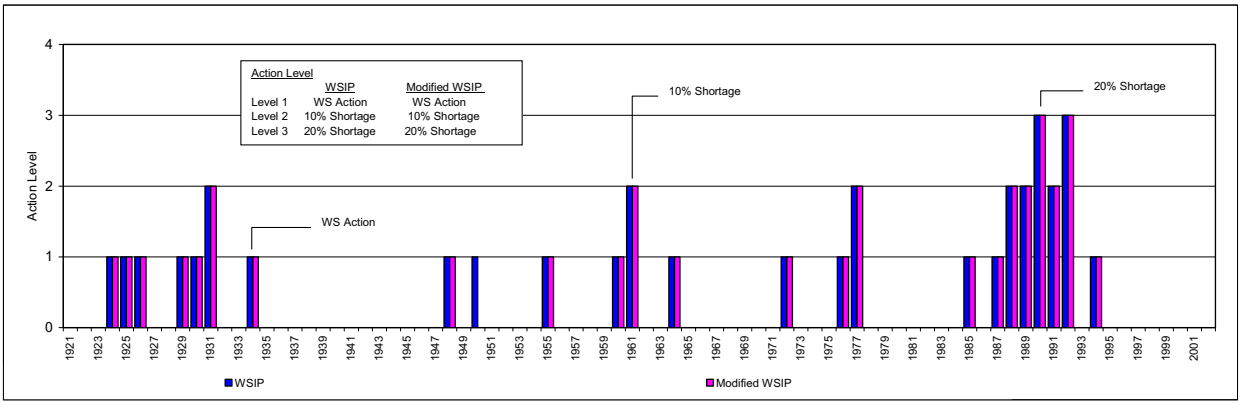
As part of the formulation of this alternative, the water transfer from TID/MID was sized to provide the same frequency and severity of water shortages (percentage-wise) for the alternative as that occurring in the WSIP setting during the design drought, although systemwide water deliveries are a net 280 mgd in the alternative setting as compared to the WSIP setting delivery of a net 290 mgd. This objective required the water transfer to be sized at 19,600 acre-feet per year compared to 29,350 acre-feet per year in the WSIP setting. Factors that change the size of the transfer include the net demand, the change in maximum storage capacity at Crystal Springs Reservoir, and reservoir evaporation. The most substantial factors are net demand and the storage at Crystal Springs Reservoir. With a water supply formulated about comparable to that provided for the WSIP setting (only proportionately smaller for a lesser demand), the implementation of rationing and the severity of rationing from the SFPUC system during drought periods would be the same. Table 1-1 illustrates the comparison of the drought response actions for the proposed program and the alternative. Figure 2.1-1 illustrates the occurrence of drought response actions for the simulated 82-year historical period (1921-2002) for the WSIP and Modified WSIP settings.

Figure 2.1-1
Drought Response Actions – WSIP and Modified WSIP

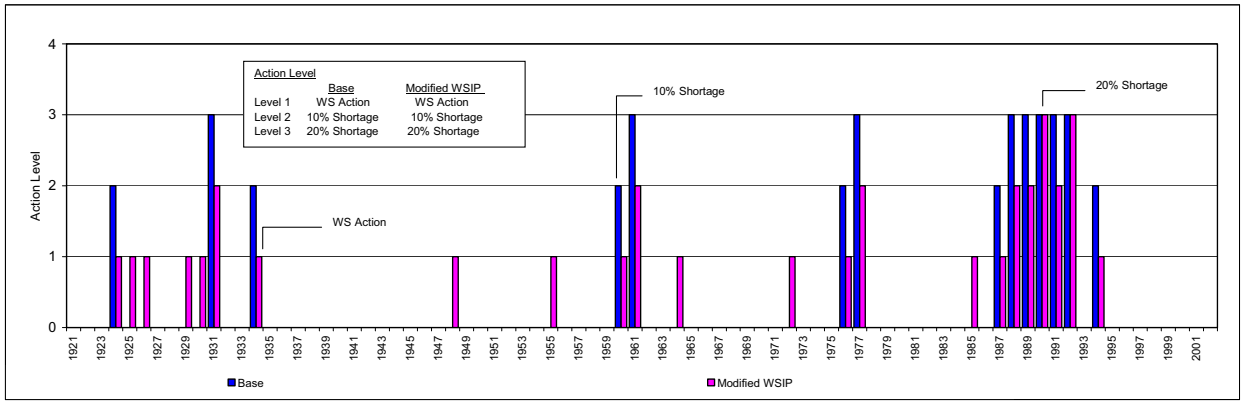


In Figure 2.1-1, years with bars showing a “1” or greater level of action indicate periods when a supplemental water supply action is initiated. In both settings, the water supply action is the use of the Westside Basin Groundwater Program to supplement SFPUC water deliveries. Also occurring in both settings is the water transfer supplemental supply from TID/MID. An action level greater than “1” indicates the imposition of delivery shortages (rationing) for SFPUC customers. SFPUC customers would experience the same frequency and severity of shortages (percentage-wise) during the design drought in both settings, and the frequency of shortage in other drought periods would the same. The triggering of the Westside Basin Groundwater Program supplemental supply occurred in one less year in comparison to the proposed program.

The same form of information is shown in Figure 2.1-2 for the comparison between the alternative and the base settings. There is not a level 1 action in the base setting. Without supplemental resources, the existing system only has delivery shortage measures available to cope with drought. In the base setting, the shortage measure is imposed during level 2 (10 percent) and level 3 (20 percent). These percentages of shortage are applied to both the alternative and the base settings for these action levels. During this simulation period, rationing does not need to exceed 20 percent in either setting; however, in the alternative setting, the occurrence of additional water supplies lessens the frequency and severity of water delivery shortages.

Not illustrated in Figure 2.1-2 but shown in Table 1-1 are the delivery shortages anticipated during the entire SFPUC design drought. During the design drought, the base setting does not have a viable operation without exceeding the 20 percent shortage level. The base setting exceeds the 20 percent shortage level (requires 25 percent rationing) during the last 18 months of the design drought. The alternative would viably provide deliveries without exceeding the 20 percent shortage level.

Figure 2.1-2
Drought Response Actions – Base and Modified WSIP



The difference in water deliveries between the proposed program and the alternative is shown chronologically for the 82-year simulation in Table 2.1-1. There would be less water delivered to the region by the SFPUC in all years, a result of serving a lesser net demand of 280 mgd instead of 290 mgd.

Comparing the alternative setting to the base setting, Table 2.1-2 illustrates the difference in water deliveries between the two settings. The increases in deliveries under the alternative setting occur due to the increase in net demand served by the regional system (280 mgd instead of 265 mgd) and an improvement in water delivery reliability that reduces the severity of water shortages during several drought periods.

2.2 Diversions from the Tuolumne River

The metric for illustrating the SFPUC diversions from the Tuolumne River Basin (Tuolumne) is the flow through the San Joaquin Pipeline (SJPL). Inherent in this alternative is a net water demand that is less than the demand served by the proposed program but greater than the demand served under the base condition. Table 2.2-1 illustrates the difference in diversions to the SJPL between the proposed program and the alternative settings. In both settings, the conveyance capacity of the SJPL is increased compared to the base setting. During the summer, the SJPL would essentially operate at the same maximum rate in both the alternative and WSIP settings to minimize the drawdown of Bay Area reservoir storage. A few exceptions occur during the summer due to differences in operations for the net demand served. Overall, compared to the WSIP setting, the alternative setting would divert less water from the Tuolumne.

Table 2.2-2 illustrates the difference in diversions to the SJPL between the alternative and base settings. Evident in the operation is the increase in summer diversions associated with an increase in the conveyance capacity of the SJPL. As described above, with the increase in SJPL conveyance capacity, summer diversions would increase to retain storage in the Bay Area reservoirs. With the increase in summer diversions to the SJPL and the retention of storage in the Bay Area reservoirs, there would at times be reduced diversions during the late summer and fall as less Tuolumne water would be needed to replenish the Bay Area reservoirs. The differences in December diversions are largely the result of maintenance occurring in the alternative setting (lessening available conveyance capacity) that does not occur in the base setting. The increased diversions during the winter and spring result from the need to replenish Bay Area reservoir storage after the maintenance and then top off Bay Area reservoir storage prior to summer. There would be an overall increase in average annual diversions to the SJPL in the alternative setting associated with the increase in net demand and the improvement in water delivery reliability.

Table 2.2-3 illustrates the average monthly diversions through the SJPL by year type for the 82-year simulation for the proposed program and the alternative settings and the difference between the two settings. Table 2.2-4 shows the same information for the alternative and base settings.

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Table 2.1-1

Difference in Total System-wide Delivery (MG) Modified WSIP minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1922	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1923	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1924	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1925	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1926	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1927	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1928	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1929	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1930	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1931	-322	-252	-208	-183	-193	-260	-300	-360	-390	-369	-360	-318	-3,515
1932	-295	-234	-198	-171	-182	-242	-267	-313	-339	-415	-409	-363	-3,428
1933	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1934	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1935	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1936	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1937	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1938	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1939	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1940	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1941	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1942	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1943	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1944	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1945	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1946	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1947	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1948	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1949	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1950	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1951	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1952	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1953	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1954	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1955	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1956	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1957	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1958	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1959	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1960	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1961	-322	-252	-208	-183	-193	-260	-300	-360	-390	-369	-360	-318	-3,515
1962	-295	-234	-198	-171	-182	-242	-267	-313	-339	-415	-409	-363	-3,428
1963	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1964	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1965	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1966	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1967	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1968	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1969	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1970	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1971	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1972	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1973	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1974	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1975	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1976	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1977	-322	-252	-208	-183	-193	-260	-300	-360	-390	-369	-360	-318	-3,515
1978	-295	-234	-198	-171	-182	-242	-267	-313	-339	-415	-409	-363	-3,428
1979	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1980	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1981	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1982	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1983	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1984	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1985	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1986	-322	-252	9	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,439
1987	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1988	-322	-252	-208	-183	-193	-260	-300	-360	-390	-369	-360	-318	-3,515
1989	-295	-234	-198	-171	-182	-242	-267	-313	-339	-369	-360	-318	-3,287
1990	-295	-234	-198	-171	-182	-242	-267	-313	-339	-329	-319	-282	-3,170
1991	-260	-207	-177	-152	-168	-214	-240	-279	-297	-369	-360	-318	-3,040
1992	-295	-234	-198	-171	-182	-242	-267	-313	-339	-329	-319	-282	-3,170
1993	-260	-207	-177	-152	-168	-214	-240	-279	-297	-415	-409	-363	-3,182
1994	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1995	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1996	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1997	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1998	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
1999	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
2000	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
2001	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
2002	-322	-252	-208	-183	-193	-260	-300	-360	-390	-415	-409	-363	-3,656
Avg (21-02)	-319	-250	-204	-181	-192	-258	-296	-354	-384	-410	-403	-358	-3,608

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Table 2.1-2

Difference in Total System-wide Delivery (MG) Modified WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	488	359	253	191	244	349	427	547	618	730	686	577	5,468
1922	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1923	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1924	488	359	253	191	244	349	427	547	618	1,932	1,853	1,546	8,807
1925	1,305	946	686	512	676	1,017	1,284	1,576	618	730	686	577	10,613
1926	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1927	488	359	253	191	244	349	427	547	618	729	686	577	5,468
1928	488	359	253	191	244	349	427	547	618	729	686	577	5,468
1929	488	359	253	191	244	349	427	547	618	730	686	577	5,468
1930	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1931	488	359	253	191	244	349	427	547	618	1,640	1,587	1,392	8,095
1932	1,253	1,025	876	777	824	1,067	1,212	1,408	1,508	729	686	577	11,943
1933	488	359	253	191	244	349	427	547	618	729	686	577	5,468
1934	488	359	253	191	244	349	427	547	618	1,932	1,853	1,546	8,806
1935	1,305	946	686	512	676	1,017	1,284	1,576	618	729	686	577	10,613
1936	488	359	253	191	244	349	427	547	618	729	686	577	5,468
1937	488	359	253	191	244	349	427	547	618	729	686	577	5,468
1938	488	359	253	191	244	349	427	547	618	730	686	577	5,468
1939	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1940	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1941	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1942	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1943	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1944	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1945	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1946	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1947	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1948	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1949	488	359	253	191	244	349	427	547	618	729	686	577	5,468
1950	488	359	253	191	244	349	427	547	618	730	686	577	5,468
1951	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1952	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1953	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1954	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1955	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1956	488	359	253	191	244	349	427	547	618	729	686	577	5,468
1957	488	359	253	191	244	349	427	547	618	730	686	577	5,468
1958	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1959	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1960	488	359	253	191	244	349	427	547	618	1,932	1,853	1,546	8,807
1961	1,305	946	686	512	676	1,017	1,284	1,576	1,760	1,640	1,587	1,392	14,381
1962	1,253	1,025	876	777	824	1,067	1,212	1,408	1,508	729	686	577	11,943
1963	488	359	253	191	244	349	427	547	618	729	686	577	5,468
1964	488	359	253	191	244	349	427	547	618	730	686	577	5,468
1965	488	359	253	191	244	349	427	547	618	729	686	577	5,468
1966	488	359	253	191	244	349	427	547	618	730	686	577	5,468
1967	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1968	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1969	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1970	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1971	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1972	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1973	488	359	253	191	244	349	427	547	618	729	686	577	5,468
1974	488	359	253	191	244	349	427	547	618	730	686	577	5,468
1975	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1976	488	359	253	191	244	349	427	547	618	1,932	1,853	1,546	8,807
1977	1,305	946	686	512	676	1,017	1,284	1,576	1,760	1,640	1,587	1,392	14,381
1978	1,253	1,025	876	777	824	1,067	1,212	1,408	-602	729	686	577	9,832
1979	488	359	253	191	244	349	427	547	618	729	686	577	5,468
1980	488	359	253	191	244	349	427	547	618	730	686	577	5,468
1981	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1982	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1983	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1984	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1985	488	359	253	191	244	349	427	547	618	730	686	577	5,469
1986	488	359	9	191	244	349	427	547	618	729	686	577	5,224
1987	488	359	253	191	244	349	427	547	618	1,932	1,853	1,546	8,806
1988	1,305	946	686	512	676	1,017	1,284	1,576	1,760	1,640	1,587	1,392	14,381
1989	1,253	1,025	876	777	824	1,067	1,212	1,408	1,508	1,640	1,587	1,392	14,569
1990	1,253	1,025	876	777	824	1,067	1,212	1,408	1,508	556	526	451	11,483
1991	385	302	226	185	213	289	346	430	478	1,640	1,587	1,392	7,473
1992	1,253	1,025	876	777	824	1,067	1,212	1,408	1,508	556	526	451	11,483
1993	385	302	226	185	213	289	346	430	-1,632	729	686	577	2,736
1994	488	359	253	191	244	349	427	547	618	1,932	1,853	1,546	8,806
1995	1,305	946	686	512	676	1,017	427	547	618	729	686	577	8,727
1996	488	359	253	191	244	349	427	547	618	729	686	577	5,468
1997	488	359	253	191	244	349	427	547	618	729	686	577	5,468
1998	488	359	253	191	244	349	427	547	618	729	686	577	5,468
1999	488	359	253	191	244	349	427	547	618	729	686	577	5,468
2000	488	359	253	191	244	349	427	547	618	729	686	577	5,468
2001	488	359	253	191	244	349	427	547	618	730	686	577	5,468
2002	488	359	253	191	244	349	427	547	618	730	686	577	5,469
Avg (21-02)	601	449	327	258	317	449	535	670	670	880	833	704	6,693

APPENDIX O2

Table 2.2-1

Difference in Total San Joaquin Pipeline (Acre-feet) Modified WSIP minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
1921	-952	-1,841	0	0	0	-952	0	0	0	0	0	0	-3,745	-3,745
1922	-5,708	-2,762	-1,903	0	0	0	-5,524	0	0	0	0	0	-15,897	-15,897
1923	-2,854	0	0	0	0	-1,047	-3,038	0	0	0	0	0	-6,939	-6,939
1924	-3,805	-921	-1,902	-1,903	-1,719	0	0	0	0	0	0	0	-10,250	-10,250
1925	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	-3,901	-9,452	0	-4,880	0	0	0	0	-1,197	-19,430	-18,233
1927	-4,757	-1,841	-952	-952	0	-3,805	-3,683	0	0	0	0	0	-15,990	-17,187
1928	-1,047	-921	0	0	0	-3,045	-5,524	0	0	0	0	0	-10,537	-10,537
1929	-1,807	-1,841	0	0	0	0	0	0	0	0	0	0	-3,648	-3,648
1930	-1,237	0	0	0	0	0	0	0	0	0	0	0	-1,237	-1,237
1931	0	-2,854	0	-5,803	-5,242	0	0	0	0	0	0	-4,880	-18,779	-13,899
1932	-5,708	-2,762	-1,903	-1,903	0	-1,902	-2,118	-3,140	-3,038	0	0	0	-22,474	-27,354
1933	476	0	0	-1,902	-1,719	0	0	0	0	0	0	0	-3,145	-3,145
1934	0	0	-2,949	-2,854	-2,578	0	0	0	0	0	0	0	-8,381	-8,381
1935	-1,237	0	0	0	0	0	-1,197	-2,189	-2,118	0	0	0	-6,741	-6,741
1936	-5,043	-4,603	0	-2,854	0	-2,949	-2,118	0	0	0	0	0	-17,567	-17,567
1937	-3,806	-1,841	-1,902	0	0	-951	-4,604	0	0	0	0	0	-13,104	-13,104
1938	-1,903	0	0	-1,903	0	0	-4,603	-1,237	-1,197	0	0	0	-10,843	-10,843
1939	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	-5,328	-5,709	-5,524	-1,237	-1,197	0	0	0	-18,995	-18,995
1941	0	0	0	0	0	0	0	-952	-921	0	0	0	-1,873	-1,873
1942	-1,332	0	-1,712	0	0	0	-5,524	0	0	0	0	0	-8,568	-8,568
1943	-1,903	-1,841	0	0	0	-1,142	-3,867	-1,237	-1,197	0	0	0	-11,187	-11,187
1944	-1,902	0	-952	0	0	-2,949	0	0	0	0	0	0	-5,803	-5,803
1945	-4,281	0	0	0	-4,297	0	0	0	0	0	0	0	-8,578	-8,578
1946	-5,043	-2,762	0	0	0	0	0	0	0	0	0	0	-7,805	-7,805
1947	-5,708	-4,603	-952	-1,903	-1,719	0	0	0	0	0	0	0	-14,885	-14,885
1948	-1,237	-1,013	0	-4,756	-2,578	0	0	0	0	0	0	0	-9,584	-9,584
1949	-2,189	-1,013	-3,806	-1,903	-1,719	-2,854	-2,578	-1,237	-1,197	0	0	0	-18,496	-18,496
1950	-1,903	0	0	0	0	0	0	0	0	0	0	0	-1,903	-1,903
1951	0	-3,683	0	0	0	-4,757	-1,197	-1,237	-1,197	0	0	0	-12,071	-12,071
1952	-2,949	-921	-2,663	0	0	0	-5,524	-1,237	-1,197	0	0	0	-14,491	-14,491
1953	-1,902	0	0	0	0	-2,949	0	-1,237	-1,197	0	0	0	-7,285	-7,285
1954	-2,949	-921	-952	0	-860	-1,047	-2,578	0	0	0	0	0	-9,307	-9,307
1955	-3,805	0	0	0	0	0	0	0	0	0	0	0	-3,805	-3,805
1956	0	0	0	0	0	0	-2,578	-1,237	-1,197	0	0	0	-5,012	-5,012
1957	-1,047	-921	-1,902	-1,903	0	0	0	0	0	0	0	0	-5,773	-5,773
1958	-2,759	-2,762	0	-2,855	0	0	0	-1,047	-1,013	0	0	0	-10,436	-10,436
1959	0	-921	0	0	0	0	0	0	0	0	0	0	-921	-921
1960	-3,140	0	0	0	0	0	0	0	0	0	0	0	-3,140	-3,140
1961	0	0	0	-1,047	-3,523	0	0	0	0	0	0	-4,880	-9,450	-4,570
1962	-6,945	-5,616	-952	-3,805	-1,031	-2,854	-2,118	-3,996	-3,867	0	0	0	-31,184	-36,064
1963	1,807	-1,841	0	0	0	-1,902	-5,524	-1,902	-1,841	0	0	0	-11,203	-11,203
1964	0	-921	0	0	0	0	0	0	0	0	0	0	-921	-921
1965	0	0	0	-5,708	-5,156	0	-8,286	0	0	0	0	0	-19,150	-19,150
1966	-1,047	0	0	-1,903	-1,719	0	0	0	0	0	0	0	-4,669	-4,669
1967	0	-3,775	-4,756	0	0	0	-6,445	-952	-921	0	0	0	-16,849	-16,849
1968	-1,237	0	0	0	0	0	0	0	0	0	0	0	-1,237	-1,237
1969	-3,996	-4,603	-1,903	0	0	-951	-4,880	0	0	0	0	0	-16,333	-16,333
1970	-952	0	0	-1,903	-1,719	-1,047	0	0	0	0	0	0	-5,621	-5,621
1971	-4,281	-1,841	0	0	0	0	0	0	0	0	0	0	-6,122	-6,122
1972	0	-5,616	-4,757	-1,903	-1,719	0	0	0	0	0	0	0	-13,995	-13,995
1973	-1,237	-3,775	0	0	0	0	-4,880	-1,237	-1,197	0	0	0	-12,326	-12,326
1974	0	0	0	0	0	-6,659	-4,603	-1,237	-1,197	0	0	0	-13,696	-13,696
1975	0	0	0	0	-1,719	-1,142	-5,524	-1,237	-1,197	0	0	0	-10,819	-10,819
1976	-952	0	0	0	0	0	0	0	0	0	0	0	-952	-952
1977	0	-1,013	-4,756	-2,855	-2,578	0	0	0	0	1,902	1,902	1,841	-5,557	-11,202
1978	1,902	2,762	0	-3,045	-5,156	-10,464	-7,365	-1,047	-1,013	0	0	0	-23,426	-17,781
1979	0	-921	-1,902	0	0	-1,902	0	0	0	0	0	0	-4,725	-4,725
1980	-3,996	0	0	-2,855	0	-4,947	-2,578	0	0	0	0	0	-14,376	-14,376
1981	-1,902	-921	0	-1,902	-1,718	0	0	0	0	0	0	0	-6,443	-6,443
1982	-5,043	-3,682	-1,902	0	0	0	0	-1,902	-1,841	0	0	0	-14,370	-14,370
1983	0	0	-951	0	0	0	-4,787	-1,903	-1,841	0	0	0	-9,482	-9,482
1984	0	-921	0	0	0	0	0	0	0	0	0	0	-921	-921
1985	-2,189	0	0	0	0	0	0	0	0	0	0	0	-2,189	-2,189
1986	0	0	9	-2,949	-3,437	-7,610	-8,286	-1,237	-1,197	0	0	0	-24,707	-24,707
1987	0	-921	-1,902	0	0	0	0	0	0	0	0	0	-2,823	-2,823
1988	0	-1,013	0	-4,756	-2,578	0	0	0	0	0	0	-4,880	-13,227	-8,347
1989	-1,902	-1,841	-1,903	0	0	0	0	-2,664	-2,578	-1,237	-1,427	0	-13,552	-15,768
1990	0	0	0	0	0	0	0	0	0	-3,996	-2,854	-1,841	-8,691	-2,664
1991	0	-1,841	-523	0	0	-2,854	-4,880	-1,902	-1,841	-1,237	951	921	-13,206	-22,532
1992	1,902	-921	-1,903	0	0	-1,902	-2,118	-3,140	-3,038	-1,047	1,902	1,841	-8,424	-10,485
1993	1,903	-1,841	-523	0	0	0	-5,524	-952	-921	0	0	0	-7,858	-5,162
1994	0	-921	0	-1,903	-1,719	0	0	0	0	0	0	0	-4,543	-4,543
1995	-1,237	0	0	-4,947	-4,468	0	-7,365	-856	-829	0	0	0	-19,702	-19,702
1996	0	-921	0	0	0	0	-2,118	0	0	0	0	0	-3,039	-3,039
1997	-3,805	-921	0	0	0	0	0	0	0	0	0	0	-4,726	-4,726
1998	-3,140	-3,683	0	0	0	-951	-6,444	-1,047	-1,013	0	0	0	-16,278	-16,278
1999	-1,902	0	-952	0	0	-1,903	-7,365	0	0	0	0	0	-12,122	-12,122
2000	-1,902	0	0	0	-860	-2,854	0	0	0	0	0	0	-5,616	-5,616
2001	-3,806	-2,762	0	-952	0	-3,901	0	0	0	0	0	0	-11,421	-11,421
2002	-3,806	-921	-1,903	-1,902	-1,718	0	0	0	0	0	0	0	-10,250	-10,250
Avg (21-02)	-1,600	-1,155	-682	-995	-952	-1,096	-2,046	-542	-524	-68	6	-159	-9,815	-9,815

APPENDIX O2

Table 2.2-2

Difference in Total San Joaquin Pipeline (Acre-feet) Modified WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
1921	-952	-2,762	0	0	0	11,416	2,118	2,189	2,118	2,189	2,189	2,118	20,623	23,385
1922	-4,756	-921	-3,805	952	0	0	1,841	5,043	4,880	2,189	2,189	2,118	9,730	9,730
1923	-2,854	-2,762	0	0	0	14,270	-920	2,189	2,118	2,189	2,189	2,118	18,537	18,537
1924	-4,756	-921	0	-2,855	-2,578	5,803	2,118	2,189	2,118	2,189	2,189	2,118	7,614	7,614
1925	2,189	-19,334	-19,979	5,803	17,272	11,512	2,118	2,189	2,118	2,189	2,189	2,118	10,384	10,384
1926	5,043	5,616	-7,088	1,902	0	15,317	0	2,189	2,118	2,189	2,189	921	30,396	31,593
1927	-2,854	-2,762	-952	3,805	0	2,854	-921	2,189	2,118	2,189	2,189	2,118	9,973	8,776
1928	1,902	-921	-2,331	3,805	4,297	2,663	-921	2,189	2,118	2,189	2,189	2,118	19,297	19,297
1929	2,949	0	1,902	1,902	1,718	5,803	2,118	2,189	2,118	2,189	2,189	2,118	27,195	27,195
1930	952	-19,334	-19,979	5,803	9,538	11,512	2,118	2,189	2,118	2,189	2,189	2,118	1,413	1,413
1931	2,189	2,762	-7,088	0	0	5,803	2,118	2,189	2,118	2,189	2,189	1,841	16,310	16,587
1932	2,854	0	3,805	3,805	0	13,510	2,762	3,805	3,683	2,189	2,189	2,118	40,720	40,443
1933	-475	0	-7,088	5,709	5,156	5,803	2,118	2,189	2,118	2,189	2,189	2,118	22,026	22,026
1934	2,189	5,616	2,854	3,805	3,437	5,803	2,118	2,189	2,118	2,189	2,189	2,118	36,625	36,625
1935	3,806	-19,334	-19,979	19,122	17,272	10,560	8,286	5,708	5,524	2,189	2,189	2,118	37,461	37,461
1936	-2,854	0	-7,088	4,757	0	12,368	0	2,189	2,118	2,189	2,189	2,118	17,986	17,986
1937	0	0	0	3,805	0	0	1,841	5,043	4,880	2,189	2,189	2,118	22,065	22,065
1938	0	0	0	3,805	0	0	921	3,806	3,683	2,189	2,189	2,118	18,711	18,711
1939	-1,902	-921	-2,855	2,854	2,578	5,803	2,118	2,189	2,118	2,189	2,189	2,118	18,478	18,478
1940	2,189	-19,334	-19,979	15,317	2,406	7,610	2,762	3,806	3,683	2,189	2,189	2,118	4,956	4,956
1941	-1,902	-921	0	0	0	0	0	0	0	2,189	2,189	2,118	3,673	3,673
1942	1,047	0	-2,854	0	0	2,663	0	2,854	2,762	2,189	2,189	2,118	12,968	12,968
1943	0	-2,762	-7,088	0	0	2,663	2,854	952	921	2,189	2,189	2,118	4,036	4,036
1944	0	-921	-952	1,902	7,046	12,368	2,118	2,189	2,118	2,189	2,189	2,118	32,364	32,364
1945	-4,756	-19,334	-19,979	5,803	9,452	15,317	2,118	2,189	2,118	2,189	2,189	2,118	-576	-576
1946	0	-921	0	0	0	10,560	2,118	2,189	2,118	2,189	2,189	2,118	22,560	22,560
1947	-4,756	-2,762	-952	-2,855	1,718	10,560	2,118	2,189	2,118	2,189	2,189	2,118	13,874	13,874
1948	952	4,603	-7,088	0	0	5,803	2,118	2,189	2,118	2,189	2,189	2,118	17,191	17,191
1949	0	4,603	-952	-2,855	-2,578	-952	-460	952	921	2,189	2,189	2,118	5,175	5,175
1950	1,902	-19,334	-19,979	16,459	16,413	5,803	2,118	2,189	2,118	2,189	2,189	2,118	14,185	14,185
1951	2,189	3,682	0	0	0	3,805	921	952	921	2,189	2,189	2,118	18,966	18,966
1952	0	-921	-951	0	0	0	3,682	952	921	2,189	2,189	2,118	10,179	10,179
1953	0	-921	0	0	0	12,368	2,118	952	921	2,189	2,189	2,118	21,934	21,934
1954	-4,756	-921	-952	2,854	4,468	9,513	-460	2,189	2,118	2,189	2,189	2,118	20,549	20,549
1955	-4,756	-19,334	-15,222	16,459	14,866	5,803	2,118	2,189	2,118	2,189	2,189	2,118	10,737	10,737
1956	2,189	5,616	0	0	0	2,663	-460	952	921	2,189	2,189	2,118	18,377	18,377
1957	1,902	-921	0	1,902	7,046	10,560	2,118	2,189	2,118	2,189	2,189	2,118	33,410	33,410
1958	-1,807	0	-7,088	6,659	0	0	0	0	0	2,189	2,189	2,118	4,260	4,260
1959	0	-921	0	2,854	0	15,317	2,118	2,189	2,118	2,189	2,189	2,118	30,171	30,171
1960	-951	-19,334	-19,979	5,803	10,398	5,803	2,118	2,189	2,118	2,189	2,189	2,118	-5,339	-5,339
1961	2,189	5,616	-7,088	4,756	6,015	5,803	2,118	2,189	2,118	2,189	5,043	4,603	35,551	30,212
1962	2,854	4,603	3,805	0	2,406	15,221	5,524	3,901	3,775	2,189	2,189	2,118	48,585	53,924
1963	4,756	0	-7,088	0	0	5,708	0	0	0	2,189	2,189	2,118	9,872	9,872
1964	2,189	-921	0	7,611	6,875	5,803	2,118	2,189	2,118	2,189	2,189	2,118	34,478	34,478
1965	2,189	-19,334	-14,270	0	0	11,512	4,603	952	921	2,189	2,189	2,118	-6,931	-6,931
1966	1,902	-2,762	-1,379	7,801	7,046	5,803	2,118	2,189	2,118	2,189	2,189	2,118	31,332	31,332
1967	2,189	1,841	-7,611	0	0	0	0	-952	-921	2,189	2,189	2,118	1,042	1,042
1968	952	0	-7,088	8,562	7,734	5,803	2,118	2,189	2,118	2,189	2,189	2,118	28,884	28,884
1969	-1,807	0	-2,855	0	0	0	2,762	2,189	2,118	2,189	2,189	2,118	8,903	8,903
1970	-952	-19,334	-19,979	10,464	9,452	18,075	2,118	2,189	2,118	2,189	2,189	2,118	10,647	10,647
1971	-1,902	-2,762	0	0	0	10,560	2,118	2,189	2,118	2,189	2,189	2,118	18,817	18,817
1972	2,189	0	-4,757	-2,855	1,718	5,803	2,118	2,189	2,118	2,189	2,189	2,118	15,019	15,019
1973	952	1,841	-7,088	0	0	0	1,841	952	921	2,189	2,189	2,118	5,915	5,915
1974	1,902	0	0	0	0	3,805	0	3,806	3,683	2,189	2,189	2,118	19,692	19,692
1975	-1,902	-19,334	-19,979	11,512	3,437	2,663	2,762	3,806	3,683	2,189	2,189	2,118	-6,856	-6,856
1976	-2,854	-921	-7,088	0	0	5,803	2,118	2,189	2,118	2,189	2,189	2,118	7,861	7,861
1977	5,043	4,603	0	-2,855	-2,578	5,803	2,118	2,189	2,118	-2,854	0	9,206	22,793	22,937
1978	9,513	1,841	-2,854	2,663	0	0	4,787	4,756	4,603	2,189	2,189	2,118	31,805	31,661
1979	-2,854	-921	0	2,854	0	9,514	2,118	2,189	2,118	2,189	2,189	2,118	21,514	21,514
1980	1,047	-19,334	-15,222	10,464	0	2,663	2,302	2,189	2,118	2,189	2,189	2,118	-7,277	-7,277
1981	0	-921	-7,088	5,708	5,156	11,512	2,118	2,189	2,118	2,189	2,189	2,118	27,288	27,288
1982	-2,854	-4,603	-1,902	0	0	0	0	0	0	2,189	2,189	2,118	-2,863	-2,863
1983	1,047	-2,762	0	0	0	0	0	2,854	2,762	2,189	2,189	2,118	10,397	10,397
1984	952	-5,524	0	0	0	5,803	2,118	2,189	2,118	2,189	2,189	2,118	14,152	14,152
1985	0	-19,334	-19,979	10,560	9,538	5,803	2,118	2,189	2,118	2,189	2,189	2,118	-491	-491
1986	2,189	5,616	9	2,854	0	0	-921	3,806	3,683	2,189	2,189	2,118	23,732	23,732
1987	0	-921	0	-952	-859	5,803	2,118	2,189	2,118	2,189	2,189	2,118	15,992	15,992
1988	5,043	4,603	-7,088	5,709	5,156	5,803	2,118	2,189	2,118	2,189	2,189	4,603	34,632	32,147
1989	2,854	0	2,854	2,854	2,578	5,803	2,118	2,379	2,302	3,806	2,379	7,365	37,292	32,723
1990	6,659	-19,334	-15,222	10,560	9,538	5,803	2,118	2,189	2,118	1,047	1,902	4,603	11,981	17,979
1991	3,805	-2,762	-2,854	0	0	7,611	0	952	921	952	4,756	2,762	16,143	15,225
1992	1,902	3,682	1,902	952	2,406	16,173	4,603	3,805	3,683	0	0	3,682	42,790	47,578
1993	3,805	-2,762	-1,902	0	0	0	-921	1,902	1,841	2,189	2,189	2,118	8,459	5,645
1994	-2,854	-921	0	-2,855	8,593	5,803	2,118	2,189	2,118	2,189	2,189	2,118	20,687	20,687
1995	3,806	-19,334	-19,979	2,663	2,406	0	1,841	1,047	1,013	2,189	2,189	2,118	-20,041	-20,041
1996	1,902	-921	-2,331	0	0	0	2,762	5,043	4,880	2,189	2,189	2,118	17,831	17,831
1997	-1,902	-921	0	0	0	10,465	2,118	2,189	2,118	2,189	2,189	2,118	20,563	20,563
1998	-951	-921	-7,088	0	0	0	4,604	2,854	2,762	2,189	2,189	4,880	10,518	7,756
1999	0	-921	-952	6,659	0	6,659	1,841	2,189	2,118	2,189	2,189	2,118	24,089	26,851
2000	0	-19,334	-19,979	15,317	6,874	13,319	2,118	2,189	2,118	2,189	2,189	2,118	9,118	9,118
2001	0	0	-7,088	6,659	8,593	11,416	2,118	2,189	2,118	2,189	2,189	2,118	32,501	32,501
2002	-2,854	-921	-3,805	4,757	4,297	10,560	2,118	2,189	2,118	2,189	2,189	2,118	24,955	24,955
Avg (21-02)	506	-3,677	-5,448	3,311	2,882	6,435	1,818	2,255	2,182	2,092	2,201	2,402	16,958	16,992

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Table 2.2-3

Total San Joaquin Pipeline (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	26,020	15,548	8,898	9,550	6,165	9,318	16,981	25,806	24,973	29,778	29,778	28,817	231,631	229,415
Above Normal	25,166	13,323	8,462	13,566	7,931	14,478	20,888	27,763	26,867	29,778	29,778	28,817	246,816	246,458
Normal	24,159	13,752	9,222	14,824	10,956	20,769	26,901	29,374	28,426	29,778	29,778	28,817	266,755	266,450
Below Normal	25,877	15,007	12,130	19,833	16,852	24,472	28,091	29,140	28,200	29,632	29,493	27,956	286,683	286,598
Dry	25,723	19,115	15,715	18,379	15,516	25,598	28,685	29,582	28,627	28,898	28,832	26,354	291,023	294,014
All Years	25,392	15,320	10,871	15,266	11,506	18,940	24,313	28,336	27,421	29,576	29,534	28,158	264,634	264,634

Total San Joaquin Pipeline (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	27,584	16,762	9,692	11,066	7,304	10,875	21,647	26,722	25,859	29,778	29,778	28,817	245,884	243,146
Above Normal	26,935	14,568	8,898	13,901	8,598	16,352	24,176	28,608	27,685	29,778	29,778	28,817	258,095	258,095
Normal	26,632	15,087	9,698	15,299	11,343	21,935	28,322	29,778	28,817	29,778	29,778	28,817	275,285	275,285
Below Normal	27,567	16,214	13,000	21,070	18,065	25,211	28,817	29,481	28,530	29,778	29,521	27,972	295,227	295,751
Dry	26,210	19,881	16,554	19,818	16,869	25,717	28,817	29,778	28,817	29,094	28,773	27,154	297,481	299,662
All Years	26,992	16,475	11,553	16,261	12,458	20,037	26,359	28,878	27,946	29,645	29,529	28,317	274,450	274,450

Difference in Total San Joaquin Pipeline (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — Modified WSIP minus WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	-1,564	-1,214	-793	-1,516	-1,139	-1,558	-4,667	-916	-886	0	0	0	-14,252	-13,731
Above Normal	-1,768	-1,246	-437	-336	-667	-1,875	-3,287	-845	-818	0	0	0	-11,279	-11,636
Normal	-2,474	-1,335	-476	-476	-387	-1,166	-1,421	-404	-391	0	0	0	-8,529	-8,834
Below Normal	-1,690	-1,208	-870	-1,237	-1,213	-739	-726	-341	-330	-146	-28	-16	-8,544	-9,153
Dry	-488	-765	-838	-1,439	-1,353	-119	-132	-196	-190	-196	59	-800	-6,458	-5,648
All Years	-1,600	-1,155	-682	-995	-952	-1,096	-2,046	-542	-524	-68	6	-159	-9,815	-9,815

Table 2.2-4

Total San Joaquin Pipeline (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	26,020	15,548	8,898	9,550	6,165	9,318	16,981	25,806	24,973	29,778	29,778	28,817	231,631	229,415
Above Normal	25,166	13,323	8,462	13,566	7,931	14,478	20,888	27,763	26,867	29,778	29,778	28,817	246,816	246,458
Normal	24,159	13,752	9,222	14,824	10,956	20,769	26,901	29,374	28,426	29,778	29,778	28,817	266,755	266,450
Below Normal	25,877	15,007	12,130	19,833	16,852	24,472	28,091	29,140	28,200	29,632	29,493	27,956	286,683	286,598
Dry	25,723	19,115	15,715	18,379	15,516	25,598	28,685	29,582	28,627	28,898	28,832	26,354	291,023	294,014
All Years	25,392	15,320	10,871	15,266	11,506	18,940	24,313	28,336	27,421	29,576	29,534	28,158	264,634	264,634

Total San Joaquin Pipeline (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	24,854	19,046	14,449	7,730	6,015	7,611	15,398	23,962	23,189	27,589	27,589	26,526	223,960	222,101
Above Normal	25,015	18,522	14,830	9,346	6,015	8,831	19,117	25,015	24,208	27,589	27,589	26,699	232,776	232,343
Normal	24,616	19,046	14,865	10,691	6,864	11,060	25,145	27,054	26,181	27,589	27,589	26,699	247,400	246,589
Below Normal	25,239	19,334	18,748	15,927	11,585	16,789	26,374	27,085	26,212	27,421	27,141	25,562	267,417	267,585
Dry	24,676	19,046	19,087	15,995	12,621	18,195	26,411	27,292	26,411	27,232	26,757	23,247	266,970	269,749
All Years	24,886	18,997	16,405	11,955	8,624	12,505	22,496	26,081	25,239	27,485	27,334	25,756	247,763	247,729

Difference in Total San Joaquin Pipeline (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — Modified WSIP minus Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	1,166	-3,499	-5,107	1,819	150	1,706	1,582	1,844	1,784	2,189	2,189	2,291	8,115	7,757
Above Normal	151	-5,199	-6,369	4,220	1,916	5,646	1,771	2,748	2,659	2,189	2,189	2,118	14,040	14,115
Normal	-458	-5,294	-5,643	4,132	4,092	9,710	1,755	2,320	2,245	2,189	2,189	2,118	19,355	19,862
Below Normal	638	-4,327	-6,618	3,906	5,267	7,683	1,717	2,055	1,988	2,211	2,351	2,394	19,266	19,014
Dry	1,047	69	-3,372	2,384	2,895	7,403	2,273	2,290	2,216	1,666	2,076	3,107	24,053	24,265
All Years	506	-3,677	-5,448	3,311	2,882	6,435	1,818	2,255	2,182	2,092	2,201	2,402	16,958	16,992

2.3 Hetch Hetchy Reservoir and Releases

Compared to the WSIP setting, the alternative setting draws less water from the Tuolumne due to the lesser demand. This circumstance leads to less draw from Hetch Hetchy Reservoir in the alternative setting in all years. Figure 2.3-1 illustrates a chronological trace of the simulation of Hetch Hetchy Reservoir storage and stream releases. Shown in Figure 2.3-1 are the results for the WSIP, Modified WSIP, and base settings. Supplementing the Figure 2.3-1 representation of Hetch Hetchy Reservoir storage are Table 2.3-1, Hetch Hetchy Reservoir Storage (Modified WSIP); Table 2.3-2, Hetch Hetchy Reservoir Storage (WSIP); and Table 2.3-3, Difference in Hetch Hetchy Reservoir Storage (Modified WSIP minus WSIP). Table 2.3-4 is provided to illustrate the difference in Hetch Hetchy Reservoir storage between the base and alternative settings.

Table 2.3-3 shows that, by the end of summer, storage in Hetch Hetchy Reservoir associated with the alternative setting would at times (about 20 percent of the years) be greater than the storage in the WSIP setting, albeit typically less than 5,000 acre-feet more in two-thirds of those years. In about one-third of the years, storage would be greater by 5,000 acre-feet or more. The relatively minor increases in storage are attributable to years when summer diversions would be the same in both settings (SJPL operating at maximum capacity) but less water would be diverted in the fall due to the lesser water demand. The larger increases in storage are associated with drought periods during which the differences in underlying demand and water delivery shortages between the WSIP and alternative settings are greater.

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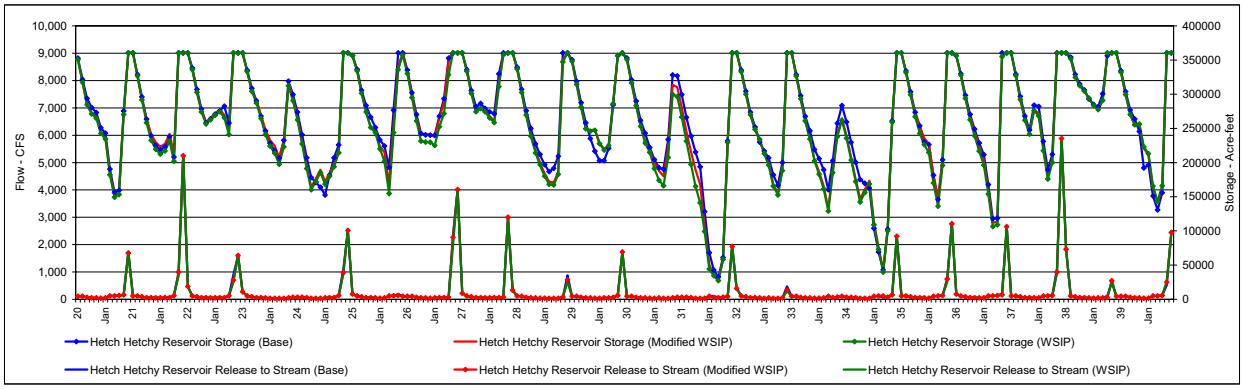
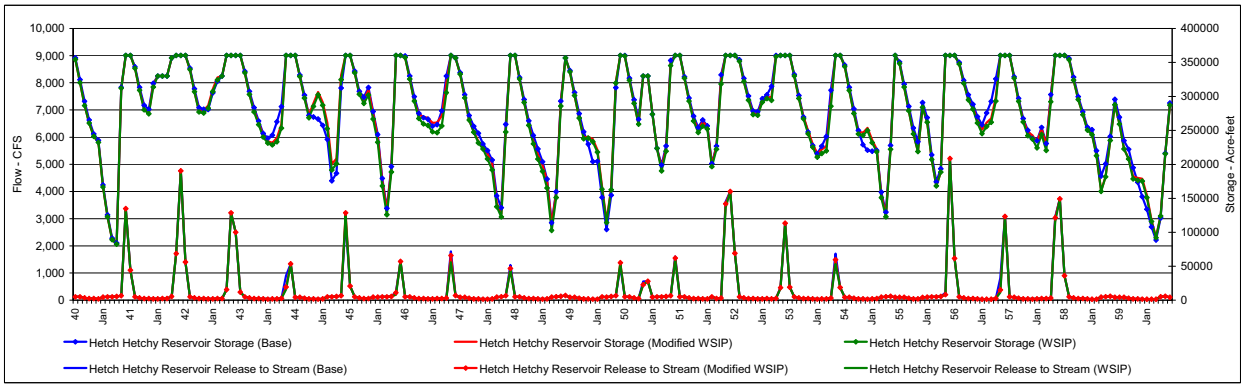
Figure 2.3-1
Hetch Hetchy Reservoir Storage and Stream Release

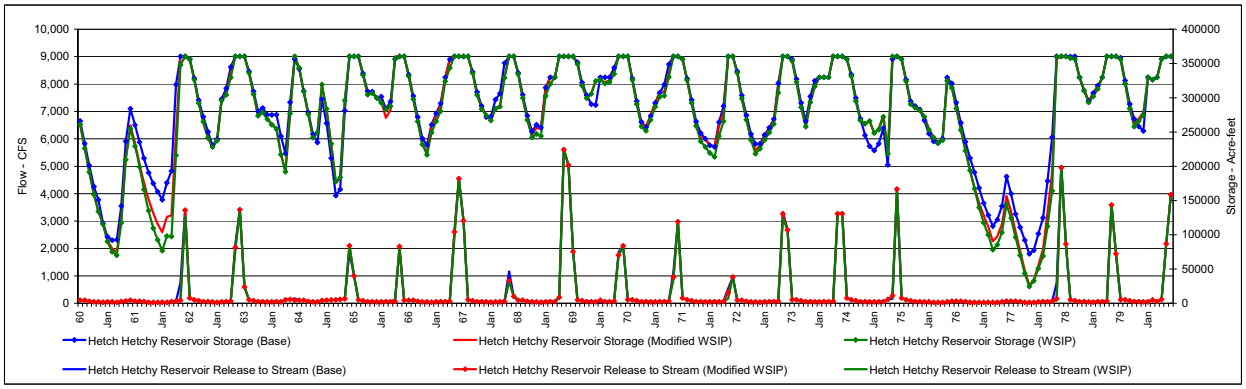
1920 - 1939



1940 - 1959



1960 - 1979



1980 - 2002

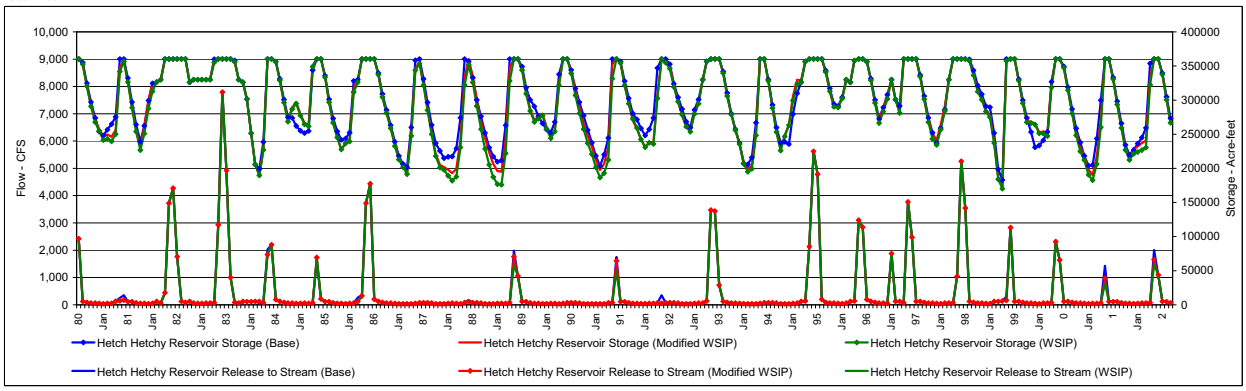


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Table 2.3-1

Hetch Hetchy Reservoir Storage (Acre-feet) Modified WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	272,117	267,600	245,425	237,477	184,880	151,635	155,378	272,083	360,400	360,400	326,811	291,828
1922	264,009	240,850	229,925	222,889	227,355	241,931	212,244	360,400	360,400	360,400	336,082	302,853
1923	276,771	259,318	265,395	272,108	277,250	269,581	244,936	360,400	360,400	360,400	333,186	304,241
1924	291,045	269,331	247,848	232,772	224,247	207,679	230,953	316,199	294,455	266,511	231,247	195,381
1925	164,353	176,388	189,425	172,356	183,982	197,973	217,942	360,400	360,400	356,465	334,210	301,427
1926	274,085	251,427	243,883	223,816	215,011	167,920	254,870	341,671	360,400	333,232	297,804	265,052
1927	240,402	240,834	241,471	237,633	265,210	288,103	348,469	360,400	360,400	360,400	333,718	301,231
1928	275,534	281,108	276,467	267,489	260,490	315,995	360,400	360,400	360,400	337,096	302,689	269,444
1929	240,564	217,758	200,750	183,877	171,934	170,901	186,458	350,991	360,400	348,102	314,426	281,237
1930	250,730	247,160	248,490	228,984	219,554	226,031	287,394	356,465	360,400	350,768	316,726	283,424
1931	252,998	231,531	217,838	200,068	188,024	180,141	221,426	313,697	310,427	280,515	245,249	215,920
1932	189,694	168,170	107,849	50,958	34,482	27,308	58,255	229,674	360,400	360,400	333,089	299,918
1933	269,682	248,173	233,407	214,696	199,250	168,700	155,172	190,490	360,400	360,400	326,593	293,382
1934	260,961	234,344	203,627	187,022	165,494	132,277	188,731	241,241	265,046	238,814	206,804	175,554
1935	146,803	160,526	173,314	112,695	76,273	42,113	101,853	260,501	360,400	360,400	331,788	299,322
1936	272,128	252,344	235,929	227,373	182,196	146,688	204,673	360,400	360,400	356,465	327,853	294,110
1937	266,299	244,805	224,465	203,469	160,719	111,931	113,680	358,909	360,400	360,400	327,212	292,471
1938	263,822	243,421	277,700	271,790	220,879	179,376	203,214	360,400	360,400	360,400	352,029	324,714
1939	312,466	304,668	294,282	283,636	277,502	290,985	360,400	360,400	360,400	332,157	299,492	270,327
1940	255,209	256,245	221,050	210,272	163,190	141,158	164,479	360,400	360,400	354,451	320,313	286,310
1941	260,678	241,118	232,444	166,634	122,924	89,103	82,492	312,086	360,400	360,400	341,291	309,048
1942	281,577	275,798	316,735	330,000	330,000	330,000	356,592	360,400	360,400	360,400	339,529	306,962
1943	279,067	279,524	286,435	310,865	327,956	330,000	360,400	360,400	360,400	360,400	334,820	303,090
1944	279,144	260,348	243,060	234,243	231,461	239,086	259,161	360,400	360,400	360,400	329,290	297,445
1945	272,731	289,623	306,527	291,374	261,135	200,352	208,439	331,150	360,400	360,400	334,928	303,168
1946	294,621	309,813	274,380	240,447	175,982	132,453	194,360	360,400	360,400	357,267	325,581	293,235
1947	273,292	269,800	268,501	261,131	261,603	271,410	320,357	360,400	356,592	332,847	297,991	265,329
1948	248,495	233,768	224,880	215,217	201,484	142,832	127,092	251,309	360,400	360,400	325,774	291,062
1949	259,625	233,526	214,785	198,641	175,769	111,718	158,012	291,712	356,592	336,040	301,328	268,173
1950	239,630	240,600	237,275	221,334	166,741	117,129	164,953	321,680	360,400	359,600	323,849	289,929
1951	259,038	330,000	330,000	273,739	223,537	195,259	223,591	349,555	360,400	360,400	326,780	293,203
1952	266,669	250,901	262,778	255,361	199,922	225,629	326,959	360,400	360,400	360,400	351,651	322,211
1953	296,329	275,128	274,206	293,261	298,723	298,998	360,400	360,400	360,400	360,400	330,136	297,172
1954	269,967	248,958	230,167	215,472	221,810	226,543	294,921	360,400	360,400	343,956	308,827	274,943
1955	248,389	246,440	253,658	235,826	222,104	154,790	126,043	224,815	360,400	348,498	313,738	278,863
1956	244,816	218,801	283,964	261,892	207,063	168,360	188,550	360,400	360,400	360,400	347,791	319,290
1957	296,127	283,218	264,874	251,129	261,402	267,702	298,964	360,400	360,400	360,400	326,823	292,697
1958	265,056	247,735	242,715	232,722	252,235	228,728	300,531	360,400	360,400	360,400	353,900	323,910
1959	295,427	273,939	251,438	244,519	213,789	161,220	182,310	235,602	288,072	259,627	223,044	208,219
1960	182,150	179,994	178,838	154,435	117,972	92,922	124,515	215,838	287,602	261,361	226,158	191,940
1961	159,106	134,295	115,531	91,188	79,972	74,855	121,896	214,131	259,832	233,750	203,767	175,689
1962	151,614	131,596	115,495	103,774	126,062	128,199	248,844	360,400	360,400	356,465	326,379	292,131
1963	263,237	241,315	228,196	237,544	296,171	306,227	337,046	360,400	360,400	360,400	336,396	305,026
1964	273,668	279,416	269,775	261,624	255,213	217,991	192,707	277,310	360,400	343,750	309,409	275,896
1965	241,813	249,120	317,459	282,122	231,160	175,820	182,106	294,713	360,400	360,400	360,400	333,188
1966	305,400	307,762	300,466	294,821	270,870	282,135	360,400	360,400	360,400	331,450	297,972	265,321
1967	231,906	220,533	257,784	274,012	288,947	330,000	355,978	360,400	360,400	360,400	360,400	335,768
1968	305,290	284,733	275,763	268,094	285,055	288,111	330,318	360,400	360,400	334,325	299,837	267,451
1969	246,142	255,844	254,565	312,954	330,000	330,000	360,400	360,400	360,400	360,400	349,426	317,777
1970	300,247	306,610	325,386	326,065	322,564	325,562	337,435	360,400	360,400	360,400	326,016	290,760
1971	262,245	257,685	273,909	292,784	307,506	309,059	336,451	360,400	360,400	356,465	325,764	292,446
1972	258,839	241,986	238,534	231,634	227,827	258,038	279,502	360,400	360,400	336,426	299,001	267,965
1973	239,426	223,220	230,637	243,487	254,169	266,817	317,146	360,400	360,400	353,990	322,828	286,127
1974	257,794	293,500	316,503	330,000	330,000	330,000	360,400	360,400	360,400	356,465	331,550	295,187
1975	266,912	262,126	266,128	248,443	254,951	274,815	221,223	360,400	360,400	356,465	324,162	290,479
1976	286,336	282,468	273,429	254,167	243,006	234,707	239,057	325,890	315,337	285,266	253,563	223,665
1977	194,726	169,242	146,459	127,236	111,968	90,372	97,632	115,367	156,470	134,474	104,623	76,248
1978	47,981	26,093	34,215	55,672	78,891	132,593	191,898	356,465	360,400	360,400	357,869	356,406
1979	329,957	311,201	295,960	304,862	315,745	330,000	360,400	360,400	360,400	356,097	320,734	284,314
1980	261,721	269,873	278,531	330,000	326,446	330,000	356,592	360,400	360,400	360,400	352,729	320,413
1981	292,699	270,564	257,688	246,138	249,541	246,043	256,667	348,346	357,910	327,697	290,144	255,269
1982	233,101	260,819	299,676	324,807	326,446	330,000	360,400	360,400	360,400	360,400	360,400	360,400
1983	326,065	330,000	330,000	330,000	330,000	330,000	359,897	360,400	360,400	360,400	360,400	355,970
1984	330,000	326,192	301,515	251,330	205,725	189,676	227,004	360,400	360,400	356,465	328,962	296,457
1985	270,560	289,092	297,165	279,546	266,664	263,877	351,018	360,400	360,400	333,535	296,865	266,723
1986	245,402	227,652	236,474	242,290	318,179	328,413	360,400	360,400	360,400	360,400	337,490	304,597
1987	281,194	259,670	235,533	215,773	204,621	194,313	250,463	346,631	356,070	324,438	287,928	252,729
1988	220,942	205,017	201,762	197,791	193,001	199,093	241,954	333,447	360,400	334,539	299,756	270,997
1989	243,894	222,400	206,450	196,014	195,062	241,083	347,606	360,400	360,400	345,211	312,004	286,902
1990	270,594	275,314	280,094	260,723	246,741	256,550	324,250	360,400	360,400	343,158	313,975	289,321
1991	266,124	247,271	231,814	212,668	197,662	206,866	231,107	352,428	360,400	355,666	321,999	294,243
1992	270,096	257,535	242,695	231,201	237,833	238,182	306,823	360,400	358,060	350,325	321,621	298,034
1993	277,178	261,430	254,452	280,385	295,700	330,000	356,592	360,400	360,400	360,400	339,684	305,994
1994	278,714	256,620	236,501	209,680	199,537	203,831	252,688	360,400	360,400	328,106	288,504	253,299
1995	227,345	247,933	264,532	305,772	330,000	329,098	356,592	360,400	360,400	360,400	360,400	341,235
1996	313,102	291,101	290,319	303,304	330,000	326,065	357,776	360,400	360,400	356,465	329,269	295,808
1997	270,191	287,926	306,502	330,000	300,695	281,114	360,400	360,400	360,400	360,400	334,509	301,549
1998	270,887	249,933	241,331	263,526	290,769	330,000	360,400	360,400	360,400	360,400	357,575	336,363
1999	314,282	302,448	286,043	277,753	239,946	186,761	172,767	359,716	360,400	360,400	328,523	295,405
2000	269,417	268,330	265,806	253,104	253,852	253,003	324,308	360,400	360,400	347,257	314,429	280,432
2001	252,172	231,383	218,839	198,018	190,076	217,611	271,582	360,400	360,186	330,828	293,698	259,268
2002	230,712	217,058	227,783	232,464	236,893	240,595	332,813	360,400	360,400	337,536	300,566	266,784
Avg (21-02)	258,433	250,236	247,365	239,541	231,061	224,148	259,518	335,006	351,584	341,888	314,659	284,123

APPENDIX O2

Table 2.3-2

Hetch Hetchy Reservoir Storage (Acre-feet) WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	271,165	264,808	242,632	234,683	182,084	149,183	153,305	270,347	360,400	360,400	326,811	291,828
1922	258,301	232,379	219,552	212,511	216,970	231,546	201,859	360,400	360,400	360,400	336,082	302,853
1923	273,916	256,464	262,541	269,252	274,392	265,677	241,032	360,400	360,400	360,400	333,186	304,241
1924	287,239	264,605	241,219	224,237	213,989	197,420	222,900	312,177	290,436	262,497	227,241	191,379
1925	160,353	172,388	185,426	168,354	179,977	193,968	214,415	360,400	360,400	356,465	334,210	301,427
1926	274,085	251,427	243,883	219,916	201,778	154,687	243,705	336,096	357,554	330,389	294,965	261,018
1927	231,614	230,204	229,890	225,094	252,663	271,751	328,434	360,400	360,400	360,400	333,718	301,231
1928	274,488	279,141	274,500	265,521	258,520	310,981	357,818	360,400	360,400	337,096	302,689	269,444
1929	238,756	214,109	197,101	180,226	168,280	167,248	182,805	347,340	360,400	348,102	314,426	281,237
1930	249,493	245,923	247,253	227,747	218,315	224,793	286,156	356,465	360,400	350,768	316,726	283,424
1931	252,998	228,677	214,984	191,409	174,118	166,236	207,521	299,800	296,541	266,646	231,402	197,210
1932	165,286	141,000	99,154	44,357	34,477	27,305	58,254	229,673	360,400	360,400	333,089	299,918
1933	270,157	248,649	233,883	213,269	196,104	165,553	152,529	188,275	360,400	360,400	326,593	293,382
1934	260,961	234,344	202,598	182,895	161,604	129,002	185,456	237,968	261,776	235,550	203,546	172,300
1935	142,314	156,037	168,825	108,936	73,089	39,750	100,334	259,346	360,400	360,400	331,788	299,322
1936	267,086	242,699	226,345	214,884	170,029	136,212	195,836	360,400	360,400	356,465	327,853	294,110
1937	262,493	239,158	216,925	195,925	154,023	106,324	109,133	355,146	360,400	360,400	327,212	292,471
1938	261,919	241,518	276,115	268,301	217,388	175,924	200,166	360,400	360,400	360,400	352,029	324,714
1939	312,466	304,668	294,282	283,636	277,502	290,985	360,400	360,400	360,400	332,157	299,492	270,327
1940	255,209	256,245	222,760	213,012	165,616	143,200	166,203	360,400	360,400	354,451	320,313	286,310
1941	260,678	241,118	232,444	166,634	122,924	89,103	82,492	312,086	360,400	360,400	341,291	309,048
1942	280,245	274,466	313,690	330,000	330,000	330,000	356,592	360,400	360,400	360,400	339,529	306,962
1943	277,164	275,780	282,691	307,119	324,209	330,000	360,400	360,400	360,400	360,400	334,820	303,090
1944	277,241	258,445	240,206	231,387	228,604	233,279	253,354	360,400	360,400	360,400	329,290	297,445
1945	268,450	285,342	302,246	287,091	252,554	191,770	200,884	324,552	360,400	360,400	334,928	303,168
1946	289,579	302,009	266,576	232,638	168,168	125,876	188,823	360,400	360,400	357,267	325,581	293,235
1947	267,584	259,488	257,238	247,959	246,704	256,512	305,459	360,400	356,592	332,847	297,991	265,329
1948	247,258	231,519	222,630	208,209	191,894	137,570	122,657	247,597	360,400	360,400	325,774	291,062
1949	257,437	230,325	207,779	189,698	165,102	102,768	150,930	285,781	356,592	336,040	301,328	268,173
1950	237,728	238,697	233,120	217,888	163,294	114,244	162,551	319,659	360,400	359,600	323,849	289,929
1951	259,038	330,000	330,000	273,739	223,537	190,502	219,413	345,379	360,400	360,400	326,780	293,203
1952	263,719	247,031	256,244	252,090	196,649	222,356	318,163	360,400	360,400	360,400	351,651	322,211
1953	294,426	273,225	272,304	291,357	296,819	294,144	358,469	360,400	360,400	360,400	330,136	297,172
1954	267,018	245,088	225,346	210,648	216,124	219,810	285,610	360,400	360,400	343,956	308,827	274,943
1955	244,584	242,635	249,852	232,018	218,294	150,980	122,826	222,121	360,400	348,498	313,738	278,863
1956	244,816	218,801	283,964	261,892	207,063	168,360	188,550	360,400	360,400	360,400	347,791	319,290
1957	295,080	281,251	261,004	245,354	255,623	261,924	293,186	360,400	360,400	360,400	326,823	292,697
1958	262,298	242,214	237,194	224,344	243,852	220,345	292,148	360,400	360,400	360,400	353,900	323,910
1959	295,427	273,019	250,518	243,597	212,867	160,299	181,528	235,211	287,682	259,237	222,655	207,831
1960	178,623	176,466	175,310	150,905	115,966	92,114	123,900	215,531	287,296	261,055	225,853	191,635
1961	158,801	133,990	115,379	89,989	75,248	70,132	117,173	209,414	255,120	229,047	199,072	166,120
1962	135,106	109,472	92,419	76,863	98,093	97,377	215,903	347,784	360,400	356,465	326,379	292,131
1963	265,044	241,281	228,162	237,510	296,137	304,290	329,586	360,400	360,400	360,400	336,396	305,026
1964	273,668	278,495	268,855	260,703	254,291	217,069	191,863	276,888	360,400	343,750	309,409	275,896
1965	241,813	249,120	319,261	283,925	232,964	177,623	183,699	296,108	360,400	360,400	360,400	333,188
1966	304,353	306,716	299,942	292,395	282,814	287,628	356,592	360,400	360,400	331,450	297,972	265,321
1967	231,906	216,758	249,252	265,475	280,406	324,014	343,546	360,400	360,400	360,400	360,400	335,768
1968	304,053	283,496	274,527	266,857	283,817	286,873	329,080	360,400	360,400	334,325	299,837	267,451
1969	242,147	247,245	244,063	302,446	320,114	330,000	360,400	360,400	360,400	360,400	349,426	317,777
1970	299,296	305,659	324,435	326,065	320,846	322,797	334,670	360,400	360,400	360,400	326,016	290,760
1971	257,964	251,563	267,786	286,658	301,378	302,930	330,322	360,400	360,400	356,465	325,764	292,446
1972	258,839	236,370	228,162	219,353	213,819	244,031	265,495	360,400	360,400	336,426	299,001	267,965
1973	238,190	218,208	225,626	238,473	249,151	261,799	307,249	360,400	360,400	353,990	322,828	286,127
1974	257,794	293,500	316,503	330,000	330,000	330,000	360,400	360,400	360,400	356,465	331,550	295,187
1975	266,912	262,126	266,128	248,443	253,233	271,955	218,363	360,400	360,400	356,465	324,162	290,479
1976	285,385	281,517	272,478	253,215	242,054	233,754	238,104	324,938	314,385	284,316	252,614	222,717
1977	193,779	167,282	139,742	117,657	99,799	78,202	85,462	103,210	144,346	124,287	96,380	69,868
1978	43,507	24,382	32,503	50,915	68,975	112,212	164,152	360,400	360,400	360,400	357,869	356,406
1979	329,957	310,280	293,137	302,038	312,919	330,000	360,400	360,400	360,400	356,097	320,734	284,314
1980	257,725	265,877	274,536	330,000	326,446	330,000	356,592	360,400	360,400	360,400	352,729	320,413
1981	290,796	267,741	254,865	241,410	243,092	239,594	250,218	341,900	356,592	326,381	288,829	253,955
1982	226,746	250,781	287,735	312,861	326,446	330,000	360,400	360,400	360,400	360,400	360,400	360,400
1983	326,065	330,000	330,000	330,000	330,000	330,000	355,110	360,400	360,400	360,400	360,400	355,970
1984	330,000	326,192	301,515	251,330	205,725	189,676	227,004	360,400	360,400	356,465	328,962	296,457
1985	268,372	286,904	294,977	277,357	264,474	261,687	348,828	360,400	360,400	333,535	296,865	266,723
1986	245,402	227,652	236,474	239,341	311,791	326,065	360,400	360,400	360,400	360,400	337,490	304,597
1987	281,194	258,749	232,710	212,948	201,794	191,486	247,637	343,806	353,248	321,619	285,112	249,916
1988	218,130	201,193	197,937	189,208	181,835	187,927	230,788	322,288	351,731	325,880	291,107	257,476
1989	228,478	205,142	187,290	176,843	175,880	221,901	328,424	360,400	360,400	343,974	309,341	284,242
1990	267,935	272,656	277,435	258,063	244,079	253,888	321,588	360,400	360,400	339,162	307,130	280,640
1991	257,447	236,752	220,773	201,620	186,608	192,958	212,319	331,748	360,400	354,429	321,715	294,880
1992	272,636	259,154	242,411	230,916	237,549	235,995	302,519	360,400	355,022	346,244	319,447	297,703
1993	278,750	261,161	253,660	279,592	294,907	330,000	356,592	360,400	360,400	360,400	339,684	305,994
1994	278,714	255,699	235,580	206,856	194,993	199,287	248,143	360,400	360,400	328,106	288,504	253,299
1995	226,108	246,696	263,295	299,588	323,326	326,065	356,592	360,400	360,400	360,400	360,400	341,235
1996	313,102	290,180	289,399	302,383	330,000	326,065	357,776	360,400	360,400	356,465	329,269	295,808
1997	266,385	283,200	301,776	330,000	300,695	281,114	360,400	360,400	360,400	360,400	334,509	301,549
1998	267,747	243,111	234,508	256,700	283,939	330,000	360,400	360,400	360,400	360,400	357,575	336,363
1999	312,379	300,546	283,189	274,898	237,089	183,904	170,253	357,615	360,400	360,400	328,523	295,405
2000	267,514	266,427	263,903	251,200	251,088	247,384	318,690	360,400	360,400	347,257	314,429	280,432
2001	248,366	224,815	212,272	190,495	182,549	206,184	260,155	360,400	360,186	330,828	293,698	259,268
2002	226,907	212,332	221,154	223,929	226,634	230,337	322,554	360,400	360,400	337,536	300,566	266,784
Avg (21-02)	255,904	246,607	243,366	234,942	226,197	219,194	254,171	333,374	350,872	341,109	313,888	283,193

APPENDIX O2

Table 2.3-3

Difference in Hetch Hetchy Reservoir Storage (Acre-feet) Modified WSIP minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	952	2,792	2,793	2,794	2,796	2,452	2,073	1,736	0	0	0	0
1922	5,708	8,471	10,373	10,378	10,385	10,385	10,385	0	0	0	0	0
1923	2,855	2,854	2,854	2,856	2,858	3,904	3,904	0	0	0	0	0
1924	3,806	4,726	6,629	8,535	10,258	10,259	8,053	4,022	4,019	4,014	4,006	4,002
1925	4,000	4,000	3,999	4,002	4,005	4,005	3,527	0	0	0	0	0
1926	0	0	0	3,900	13,233	13,233	11,165	5,575	2,846	2,843	2,839	4,034
1927	8,788	10,630	11,581	12,539	12,547	16,352	20,035	0	0	0	0	0
1928	1,046	1,967	1,967	1,968	1,970	5,014	2,582	0	0	0	0	0
1929	1,808	3,649	3,649	3,651	3,654	3,653	3,653	3,651	0	0	0	0
1930	1,237	1,237	1,237	1,237	1,239	1,238	1,238	0	0	0	0	0
1931	0	2,854	2,854	8,659	13,906	13,905	13,905	13,897	13,886	13,869	13,847	18,710
1932	24,408	27,170	8,695	6,601	5	3	1	1	0	0	0	0
1933	-475	-476	-476	1,427	3,146	3,147	2,643	2,215	0	0	0	0
1934	0	0	1,029	4,127	3,890	3,275	3,275	3,273	3,270	3,264	3,258	3,254
1935	4,489	4,489	4,489	3,759	3,184	2,363	1,519	1,155	0	0	0	0
1936	5,042	9,645	9,584	12,489	12,167	10,476	8,837	0	0	0	0	0
1937	3,806	5,647	7,540	7,544	6,696	5,607	4,547	3,763	0	0	0	0
1938	1,903	1,903	1,585	3,489	3,491	3,452	3,048	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	-1,710	-2,740	-2,426	-2,042	-1,724	0	0	0	0	0
1941	0	0	0	0	0	0	0	0	0	0	0	0
1942	1,332	1,332	3,045	0	0	0	0	0	0	0	0	0
1943	1,903	3,744	3,744	3,746	3,747	0	0	0	0	0	0	0
1944	1,903	1,903	2,854	2,856	2,857	5,807	5,807	0	0	0	0	0
1945	4,281	4,281	4,281	4,283	8,581	8,582	7,555	6,598	0	0	0	0
1946	5,042	7,804	7,804	7,809	7,814	6,577	5,537	0	0	0	0	0
1947	5,708	10,312	11,263	13,172	14,899	14,898	14,898	0	0	0	0	0
1948	1,237	2,249	2,250	7,008	9,590	5,262	4,435	3,712	0	0	0	0
1949	2,188	3,201	7,006	8,943	10,667	8,950	7,082	5,931	0	0	0	0
1950	1,902	1,903	4,155	3,446	3,447	2,885	2,402	2,021	0	0	0	0
1951	0	0	0	0	0	4,757	4,178	4,176	0	0	0	0
1952	2,950	3,870	6,534	3,271	3,273	3,273	8,796	0	0	0	0	0
1953	1,903	1,903	1,902	1,904	1,904	4,854	1,931	0	0	0	0	0
1954	2,949	3,870	4,821	4,824	5,686	6,733	9,311	0	0	0	0	0
1955	3,805	3,805	3,806	3,808	3,810	3,810	3,217	2,694	0	0	0	0
1956	0	0	0	0	0	0	0	0	0	0	0	0
1957	1,047	1,967	3,870	5,775	5,779	5,778	5,778	0	0	0	0	0
1958	2,758	5,521	5,521	8,378	8,383	8,383	8,383	0	0	0	0	0
1959	0	920	920	922	922	921	782	391	390	390	389	388
1960	3,527	3,528	3,528	3,530	2,006	808	615	307	306	306	305	305
1961	305	305	152	1,199	4,724	4,723	4,723	4,717	4,712	4,703	4,695	9,569
1962	16,508	22,124	23,076	26,911	27,969	30,822	32,941	12,616	0	0	0	0
1963	-1,807	34	34	34	34	1,937	7,460	0	0	0	0	0
1964	0	921	920	921	922	922	844	422	0	0	0	0
1965	0	0	-1,802	-1,803	-1,804	-1,803	-1,593	-1,395	0	0	0	0
1966	1,047	1,046	524	2,426	-11,944	-5,493	3,808	0	0	0	0	0
1967	0	3,775	8,532	8,537	8,541	5,986	12,432	0	0	0	0	0
1968	1,237	1,237	1,236	1,237	1,238	1,238	1,238	0	0	0	0	0
1969	3,995	8,599	10,502	10,508	9,886	0	0	0	0	0	0	0
1970	951	951	951	0	1,718	2,765	2,765	0	0	0	0	0
1971	4,281	6,122	6,123	6,126	6,128	6,129	6,129	0	0	0	0	0
1972	0	5,616	10,372	12,281	14,008	14,007	14,007	0	0	0	0	0
1973	1,236	5,012	5,011	5,014	5,018	5,018	9,897	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	1,718	2,860	2,860	0	0	0	0	0
1976	951	951	951	952	952	953	953	952	952	950	949	948
1977	947	1,960	6,717	9,579	12,169	12,170	12,170	12,157	12,124	10,187	8,243	6,380
1978	4,474	1,711	1,712	4,757	9,916	20,381	27,746	-3,935	0	0	0	0
1979	0	921	2,823	2,824	2,826	0	0	0	0	0	0	0
1980	3,996	3,996	3,995	0	0	0	0	0	0	0	0	0
1981	1,903	2,823	2,823	4,728	6,449	6,449	6,449	6,446	1,318	1,316	1,315	1,314
1982	6,355	10,038	11,941	11,946	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	4,787	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0
1985	2,188	2,188	2,188	2,189	2,190	2,190	2,190	0	0	0	0	0
1986	0	0	9	2,949	6,388	2,348	0	0	0	0	0	0
1987	0	921	2,823	2,825	2,827	2,827	2,826	2,825	2,822	2,819	2,816	2,813
1988	2,812	3,824	3,825	8,583	11,166	11,166	11,166	11,159	8,669	8,659	8,649	13,521
1989	15,416	17,258	19,160	19,171	19,182	19,182	19,182	0	0	1,237	2,663	2,660
1990	2,659	2,658	2,659	2,660	2,662	2,662	2,662	0	0	3,996	6,845	8,681
1991	8,677	10,519	11,041	11,048	11,054	13,908	18,788	20,680	0	1,237	284	-637
1992	-2,540	-1,619	284	285	284	2,187	4,304	0	3,038	4,081	2,174	331
1993	-1,572	269	792	793	793	0	0	0	0	0	0	0
1994	0	921	921	2,824	4,544	4,544	4,545	0	0	0	0	0
1995	1,237	1,237	1,237	6,184	6,674	3,033	0	0	0	0	0	0
1996	0	921	920	921	0	0	0	0	0	0	0	0
1997	3,806	4,726	4,726	0	0	0	0	0	0	0	0	0
1998	3,140	6,822	6,823	6,826	6,830	0	0	0	0	0	0	0
1999	1,903	1,902	2,854	2,855	2,857	2,857	2,514	2,101	0	0	0	0
2000	1,903	1,903	1,903	1,904	2,764	5,619	5,618	0	0	0	0	0
2001	3,806	6,568	6,567	7,523	7,527	11,427	11,427	0	0	0	0	0
2002	3,805	4,726	6,629	8,535	10,259	10,258	10,259	0	0	0	0	0
Avg (21-02)	2,530	3,629	3,999	4,599	4,864	4,954	5,347	1,632	712	779	772	930

APPENDIX O2

Table 2.3-4

Difference in Hetch Hetchy Reservoir Storage (Acre-feet) Modified WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	-8,294	-5,533	-5,532	-5,535	-5,538	-4,849	-4,092	-3,420	0	0	-2,188	-4,304
1922	455	1,376	5,181	4,232	4,235	4,235	4,235	0	0	0	-2,188	-4,304
1923	-1,448	1,314	1,314	1,315	1,316	-12,955	-12,955	0	0	0	-2,188	-4,304
1924	455	1,375	1,375	4,230	6,810	1,007	-1,614	-2,994	-5,109	-7,291	-9,466	-11,573
1925	-13,755	5,579	25,557	19,771	2,515	-8,996	-7,900	0	0	0	-2,188	-4,304
1926	-9,344	-14,961	-7,378	-9,285	-9,215	-25,108	-21,829	-18,729	0	-2,188	-4,374	-5,291
1927	-2,434	328	1,280	-2,525	-2,526	-5,381	-4,459	0	0	0	-2,188	-4,304
1928	-6,205	-5,285	-2,953	-6,760	-11,060	-13,724	0	0	0	-2,188	-4,373	-6,487
1929	-9,433	-9,434	-11,336	-13,245	-14,971	-20,775	-22,892	-9,409	0	-2,188	-4,374	-6,488
1930	-7,436	11,898	31,876	26,091	16,569	5,057	2,939	0	0	-2,188	-4,373	-6,488
1931	-8,673	-11,435	-4,348	-4,350	-4,352	-10,156	-12,273	-14,454	-16,560	-18,728	-20,891	-22,708
1932	-25,549	-25,549	-20,473	-17,041	-8,349	-5,112	-2,830	-2,046	0	0	-2,188	-4,304
1933	-3,826	-3,827	3,261	-2,445	-7,603	-13,405	-11,571	-9,691	0	0	-2,188	-4,304
1934	-6,490	-12,107	-15,365	-18,739	-24,113	-27,951	-14,010	-16,190	-18,288	-20,447	-22,600	-24,692
1935	-28,483	-9,149	10,830	8,685	7,072	-978	-636	-483	0	0	-2,188	-4,304
1936	-1,448	-1,448	5,685	894	895	786	664	0	0	0	-2,188	-4,304
1937	-4,302	-4,302	-4,302	-8,110	-7,189	-6,035	-5,027	-1,491	0	0	-2,188	-4,304
1938	-4,302	-4,302	-6,331	-10,139	-10,144	-10,145	-8,931	0	0	0	-2,188	-4,304
1939	-2,399	-1,479	1,375	-1,478	-4,057	-9,861	3,808	0	0	-2,188	-4,373	-6,488
1940	-8,672	10,662	29,005	13,704	12,156	10,199	8,612	0	0	-2,188	-4,374	-6,488
1941	-4,582	-3,661	-3,051	-3,053	-2,610	-2,189	-1,670	-1,249	0	0	-2,188	-4,304
1942	-5,349	-5,349	-2,494	0	0	0	0	0	0	0	-2,188	-4,304
1943	-4,302	-1,540	5,547	5,550	5,552	0	0	0	0	0	-2,188	-4,304
1944	-4,302	-3,381	-2,430	-4,334	-11,383	-23,750	-25,868	0	0	0	-2,188	-4,304
1945	455	19,789	39,767	33,983	24,548	24,549	21,607	18,887	0	0	-2,188	-4,304
1946	-4,302	-3,381	-3,382	-3,383	-3,385	-2,974	-2,520	0	0	-2,188	-4,374	-6,487
1947	-1,728	1,034	1,985	4,840	3,125	-7,436	-9,553	0	0	-2,188	-4,374	-6,487
1948	-7,435	-12,039	-4,951	-4,953	-4,956	-10,760	-9,091	-7,614	0	0	-2,188	-4,304
1949	-4,303	-8,905	-7,954	-5,080	-2,505	-2,202	-1,836	-1,533	0	-2,188	-4,374	-6,488
1950	-8,387	10,947	33,308	16,918	15,382	12,899	10,469	8,780	0	-800	-2,988	-5,103
1951	-7,289	0	0	0	0	-3,806	-3,349	-3,347	0	0	-2,188	-4,304
1952	-4,302	-3,381	-2,430	-1,216	-1,217	-1,217	-4,900	0	0	0	-2,188	-4,304
1953	-4,302	-3,381	-3,382	-3,383	-3,385	-15,752	0	0	0	0	-2,188	-4,304
1954	454	1,376	2,327	-526	-4,995	-14,508	-14,048	0	0	-2,188	-4,373	-6,487
1955	-1,728	17,606	32,828	16,389	1,532	-4,271	-3,598	-3,006	0	-2,188	-4,374	-6,488
1956	-8,673	-14,289	-6,886	-6,890	-6,894	-6,002	-5,052	0	0	0	-2,188	-4,304
1957	-6,205	-5,284	-5,284	-7,190	-14,240	-24,801	-26,918	0	0	0	-2,188	-4,304
1958	-2,495	-2,495	4,593	-2,064	-2,065	-2,065	-2,065	0	0	0	-2,188	-4,304
1959	-4,302	-3,382	-3,382	-6,237	-6,241	-21,558	-18,478	-5,383	-7,495	-9,672	-11,844	-13,948
1960	-12,988	6,346	26,325	20,542	10,165	4,457	3,400	-493	-2,610	-4,794	-6,974	-9,084
1961	-11,267	-16,883	-1,354	-6,112	-12,134	-17,938	-20,055	-22,217	-24,309	-26,458	-31,454	-36,022
1962	-38,855	-43,459	-47,263	-47,317	-49,784	-65,006	-70,529	0	0	0	-2,188	-4,304
1963	-9,059	-9,059	-1,971	-1,972	-1,973	-7,681	-7,682	0	0	0	-2,188	-4,304
1964	-6,490	-5,569	-5,570	-13,184	-20,065	-25,869	-25,869	-16,063	3,808	1,616	-574	-2,692
1965	-4,878	14,456	19,521	19,529	19,539	18,739	15,829	13,518	0	0	0	-2,118
1966	-4,019	-1,258	751	-7,050	-13,021	-12,373	3,808	0	0	-2,188	-4,373	-6,488
1967	-8,672	-10,513	-2,902	-2,904	-2,906	0	0	0	0	0	0	-2,118
1968	-3,068	-3,068	4,019	-4,541	-12,276	-18,080	-20,198	0	0	-2,188	-4,374	-6,488
1969	-4,677	-4,676	-1,822	-1,823	0	0	0	0	0	0	-2,188	-4,304
1970	-3,351	15,983	35,961	-3,935	-7,436	-4,438	-6,555	0	0	0	-2,188	-4,304
1971	-2,400	363	363	363	363	-10,197	-12,315	0	0	0	-2,188	-4,304
1972	-6,490	-6,490	-1,734	1,119	-598	-6,402	-8,519	0	0	-2,188	-4,373	-6,487
1973	-7,435	-9,276	-2,189	-2,191	-2,191	-2,191	-4,033	0	0	-2,188	-4,374	-6,487
1974	-8,388	-8,387	-8,388	0	0	0	0	0	0	0	-2,188	-4,304
1975	-2,400	16,935	36,914	25,423	22,001	19,337	19,337	3,935	0	0	-2,188	-4,304
1976	-1,448	-527	6,560	6,565	6,568	765	-1,352	-3,540	-5,654	-7,836	-10,013	-12,119
1977	-17,155	-21,758	-21,757	-18,921	-16,367	-22,170	-24,288	-26,442	-28,490	-25,577	-25,498	-34,635
1978	-44,111	-45,953	-43,099	-45,790	-45,825	-45,825	-50,612	-3,935	0	0	-2,188	-3,994
1979	-43	878	877	-1,976	-1,977	0	0	0	0	-2,188	-4,373	-6,488
1980	-7,531	11,803	27,024	0	0	0	0	0	0	0	-2,188	-4,304
1981	-4,302	-3,382	3,706	-2,000	-7,157	-18,669	-18,668	-12,054	-2,490	-4,676	-6,858	-8,970
1982	-6,110	-1,507	396	396	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	-2,118
1984	0	0	0	0	0	-9,738	-11,659	0	0	0	-2,188	-4,304
1985	-4,302	15,032	35,010	24,468	14,943	9,141	7,023	0	0	-2,188	-4,374	-6,487
1986	-8,672	-14,288	9	-10,059	-10,064	-1,587	0	0	0	0	-2,188	-4,304
1987	-4,302	-3,382	-3,382	-2,432	-1,574	-7,377	-9,495	-11,677	-4,330	-6,513	-8,693	-10,803
1988	-15,839	-20,442	-13,354	-19,071	-24,236	-30,040	-32,158	-26,953	3,808	1,616	-574	-5,177
1989	-8,028	-8,028	-10,882	-13,743	-16,328	-22,131	-12,794	0	0	-3,805	-6,179	-13,540
1990	-20,193	-860	14,363	3,810	-5,725	-11,529	-13,647	0	0	-1,046	-2,948	-7,549
1991	-11,351	-8,589	-5,735	-5,738	-5,742	-13,353	-13,352	-7,972	0	-951	-5,707	-8,465
1992	-10,364	-14,046	-15,949	-16,909	-19,326	-35,498	-40,102	0	-2,340	-2,337	-2,334	-6,015
1993	-9,818	-7,056	-5,153	-5,156	-5,159	0	0	0	0	0	-2,188	-4,304
1994	-1,448	-527	-527	2,326	-6,265	-12,068	-14,186	0	0	-2,188	-4,374	-6,487
1995	-10,289	9,046	29,024	26,377	20,001	3,033	0	0	0	0	0	-2,118
1996	-4,020	-3,099	-768	-769	0	0	0	0	0	0	-2,188	-4,304
1997	-2,399	-1,478	-1,479	0	0	-10,465	0	0	0	0	-2,188	-4,304
1998	-3,350	-2,430	4,658	4,660	4,663	0	0	0	0	0	-2,188	-7,066
1999	-7,063	-6,143	-5,191	-11,853	-11,858	-11,859	-10,426	-684	0	0	-2,188	-4,304
2000	-4,302	15,032	35,011	19,714	12,851	-468	-2,586	0	0	-2,188	-4,373	-6,488
2001	-6,484	-6,484	603	-6,056	-14,652	-26,069	-28,186	0	-214	-2,402	-4,587	-6,701
2002	-3,843	-2,922	883	-3,873	-8,171	-18,732	-20,850	0	0	-2,188	-4,374	-6,488
Avg (21-02)	-7,145	-3,435	2,378	-1,115	-3,451	-8,198	-7,785	-2,292	-1,345	-2,242	-4,305	-6,672

APPENDIX O2

Through the fall and winter, storage in Hetch Hetchy Reservoir would be the same or higher under the alternative setting as compared to the WSIP setting. Hetch Hetchy Reservoir would fill by the end of May or June during approximately 80 percent of the years, which would prevent any difference in storage from affecting the next summer's reservoir storage. Figure 2.3-2 illustrates the difference in reservoir storage, averaged by year type, between the alternative and the WSIP settings. Also shown is the average difference in storage for the two settings during the 82-year simulation.

Table 2.3-4 illustrates the difference in Hetch Hetchy Reservoir storage between the alternative and base settings. Immediately after filling Hetch Hetchy Reservoir (May or June, and then continuing through July), there would only be occasional differences in storage at the reservoir, typically a decrease of less than 10,000 acre-feet. This is indicative of the same amount of water being passed through the reservoir regardless of the size of the conveyance capacity of the SJPL. Water not diverted to the SJPL would return to the Tuolumne River and flow to Don Pedro Reservoir. In the late summer and early fall, there would consistently be a slight difference (lower) in storage levels between the two settings, as additional diversions to the SJPL would retain Bay Area reservoir storage and serve a slightly greater demand. Some of this additional Hetch Hetchy Reservoir storage depletion would be ameliorated later in the fall and into winter as SJPL diversions are reduced due to less Bay Area reservoir replenishment needs and conveyance system maintenance. Average storage is incidentally about the same in November and December for the alternative and base settings due to the assumed systemwide maintenance that would occur in the alternative setting but not in the base setting. After December, the storage gain occurring in the alternative setting would again be affected as replenishment of Bay Area reservoir storage resumes. In non-wet years, there is a difference in storage between the alternative and base settings; the alternative setting results in a lower storage in the reservoir by the end of April. Figure 2.3-3 illustrates the difference in reservoir storage, averaged by year type, between the alternative and base settings. Also shown is the average difference in storage for the two settings during the 82-year simulation. Figure 2.3-4 illustrates the average monthly storage in Hetch Hetchy Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and base settings.

The difference in storage in Hetch Hetchy Reservoir attributed to the diversion effects of the alternative would manifest in differences in releases from O'Shaughnessy Dam to the stream. A different amount of available reservoir space in the winter and spring due to the alternative would lead to a different ability to regulate inflow, thus potentially changing the amount of water released to the stream that is in excess of minimum release requirements. Figure 2.3-1 illustrates the stream release from O'Shaughnessy Dam for the WSIP, alternative, and base settings. Table 2.3-5 illustrates the difference in stream releases between the alternative and WSIP settings. Compared to the WSIP setting, the alternative exhibits an incrementally greater stream release, predominately during May or June, which is reflective of the months when releases to the stream are made in excess of minimum release requirements in anticipation of filling the reservoir. The few exceptions to this circumstance, during which incremental reductions in releases to the stream occur, are considered anomalous within the modeling and are simply the result of shifting releases from one month to the next. The increase in releases is the result of a less-depleted reservoir to replenish, which is the result of lesser SFPUC demands (and Tuolumne River diversions) between the settings.

Table 2.3-6 illustrates the difference in stream releases between the alternative and base settings. In this comparison, releases would be predominately less than depicted for the base setting, and these differences would typically occur during May or June. Generally, Hetch Hetchy Reservoir storage would be slightly lower during non-wet years, leading to a reduction in stream releases during non-wet years if a release occurs. The few instances of stream flow increases are a result of a coincidence of several operational parameters affecting the release of water from the reservoir, including systemwide water demands, conveyance capacity and maintenance assumptions, and the watershed's hydrology.

Table 2.3-5 illustrates the difference in stream releases between the alternative and WSIP settings, expressed in terms of a monthly volume (acre-feet) of flow. Table 2.3-7 illustrates the same information and the average monthly stream releases for the alternative and WSIP settings, expressed in average monthly flow (cfs). Table 2.3-5 shows an increase in monthly flow below O'Shaughnessy Dam of up to approximately 20,000 acre-feet. Considering the manner in which releases are determined and made to the stream, it is not always meaningful to quantify the effect of these changes in terms of

APPENDIX O2

Figure 2.3-2

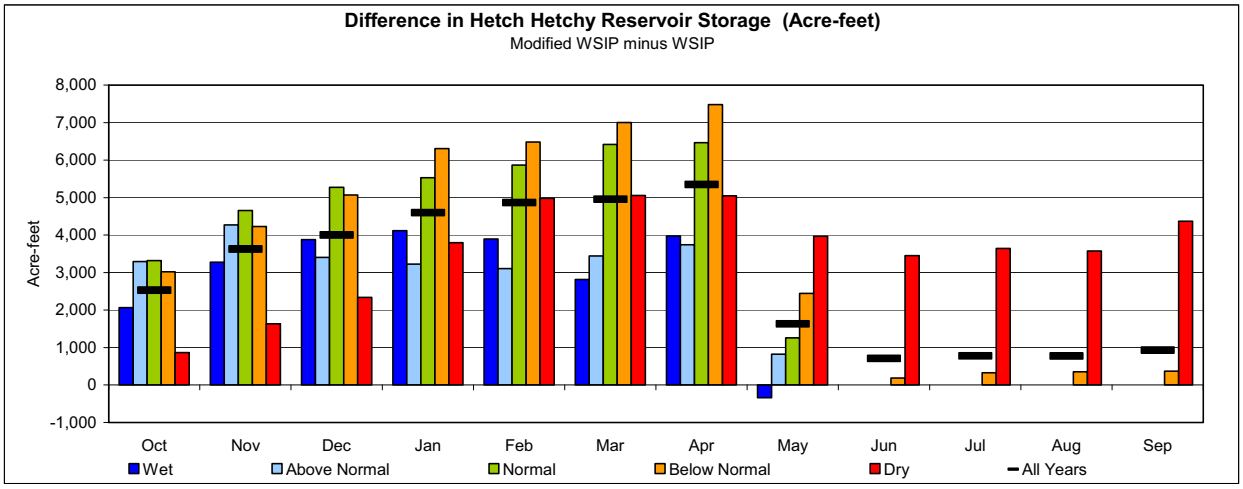


Figure 2.3-3

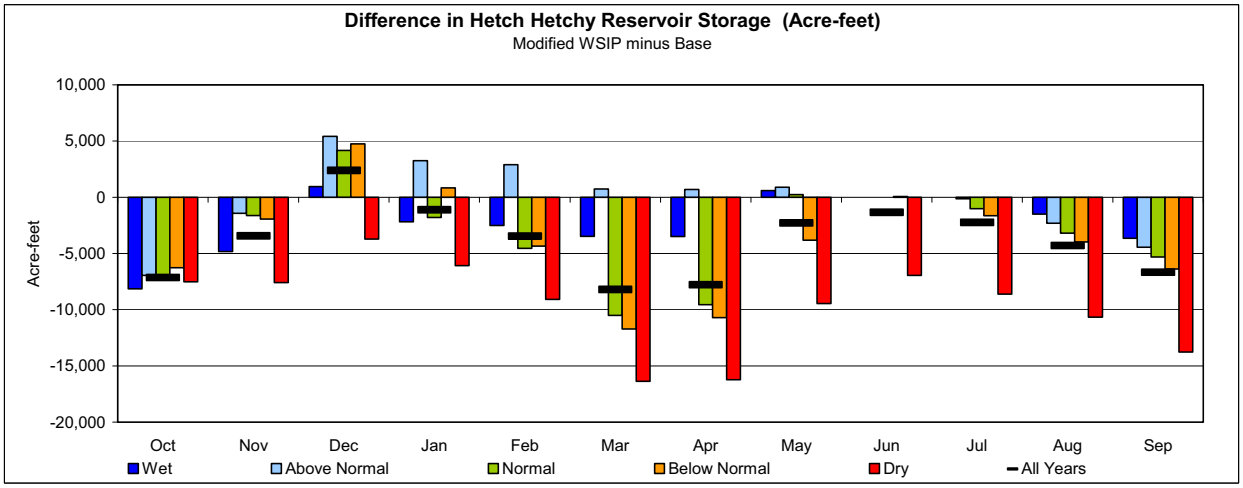
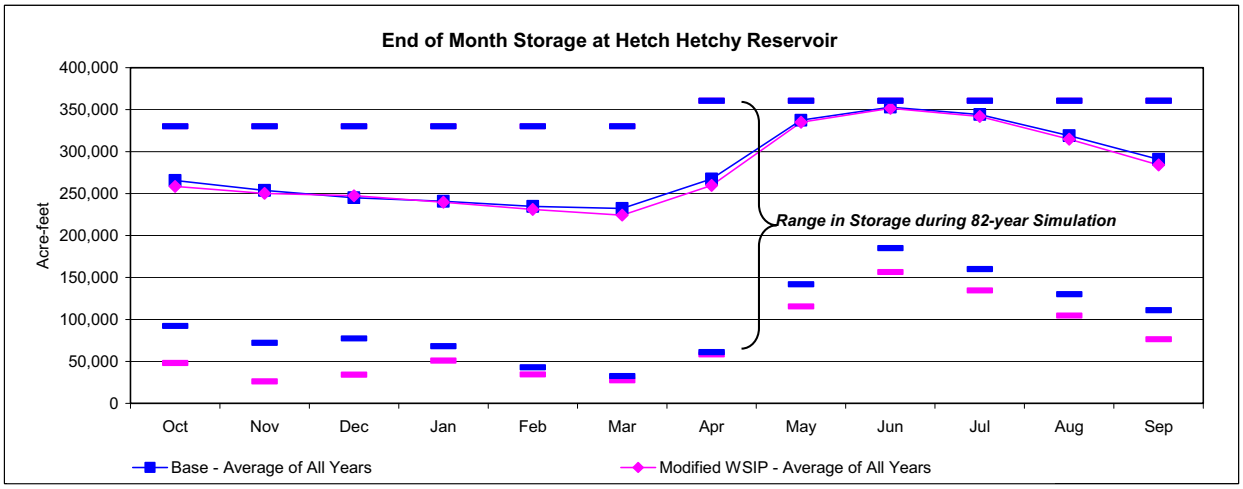


Figure 2.3-4



APPENDIX O2

Table 2.3-5

Difference in Hetch Hetchy Reservoir Release to Stream (Acre-feet) Modified WSIP minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	1,735	0	0	0	1,735
1922	0	0	0	0	0	0	0	9,066	0	0	0	0	9,066
1923	0	0	0	0	0	0	0	3,901	0	0	0	0	3,901
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	3,099	0	0	0	0	3,099
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	20,335	0	0	0	0	20,335
1928	0	0	0	0	0	0	0	2,741	0	0	0	0	2,741
1929	0	0	0	0	0	0	0	0	3,887	0	0	0	3,887
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	1	0	0	0	1
1933	0	0	0	0	0	0	0	0	1,944	0	0	0	1,944
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	1,153	0	0	0	1,153
1936	0	0	0	0	0	0	0	7,725	0	0	0	0	7,725
1937	0	0	0	0	0	0	0	0	3,992	0	0	0	3,992
1938	0	0	0	0	0	0	0	2,663	0	0	0	0	2,663
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	0	0	-1,449	0	0	0	0	-1,449
1941	0	0	0	0	0	0	0	0	0	0	0	0	0
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	5,804	0	0	0	0	5,804
1945	0	0	0	0	0	0	0	0	6,593	0	0	0	6,593
1946	0	0	0	0	0	0	0	4,837	0	0	0	0	4,837
1947	0	0	0	0	0	0	0	14,892	0	0	0	0	14,892
1948	0	0	0	0	0	0	0	0	3,707	0	0	0	3,707
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	2,020	0	0	0	2,020
1951	0	0	0	0	0	0	0	0	4,451	0	0	0	4,451
1952	0	0	0	0	0	0	0	8,793	0	0	0	0	8,793
1953	0	0	0	0	0	0	0	2,049	0	0	0	0	2,049
1954	0	0	0	0	0	0	0	9,306	0	0	0	0	9,306
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	5,776	0	0	0	0	5,776
1958	0	0	0	0	0	0	0	8,379	0	0	0	0	8,379
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	13,398	0	0	0	13,398
1963	0	0	0	0	0	0	0	7,458	0	0	0	0	7,458
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	-1,394	0	0	0	-1,394
1966	0	0	0	0	0	0	-3,808	4,045	0	0	0	0	237
1967	0	0	0	0	0	0	0	13,229	0	0	0	0	13,229
1968	0	0	0	0	0	0	0	1,237	0	0	0	0	1,237
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	2,764	0	0	0	0	2,764
1971	0	0	0	0	0	0	0	6,127	0	0	0	0	6,127
1972	0	0	0	0	0	0	0	14,000	0	0	0	0	14,000
1973	0	0	0	0	0	0	0	9,893	0	0	0	0	9,893
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	2,858	0	0	0	0	2,858
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	3,935	-4,171	0	0	0	-236
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	5,090	0	0	0	0	5,090
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	2,336	0	0	0	0	2,336
1986	0	0	9	0	0	0	2,349	0	0	0	0	0	2,358
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	19,424	0	0	0	0	19,424
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	21,217	0	0	0	21,217
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	4,728	0	0	0	0	0	0	0	0	4,728
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	2,228	0	0	0	2,228
2000	0	0	0	0	0	0	0	5,616	0	0	0	0	5,616
2001	0	0	0	0	0	0	0	11,421	0	0	0	0	11,421
2002	0	0	0	0	0	0	0	10,254	0	0	0	0	10,254
Avg (21-02)	0	0	0	58	0	0	-18	2,776	741	0	0	0	3,557

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Table 2.3-6

Difference in Hetch Hetchy Reservoir Release to Stream (Acre-feet) Modified WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	-3,416	0	0	0	-3,416
1922	0	0	0	0	0	0	0	3,696	0	0	0	0	3,696
1923	0	0	0	0	0	0	0	-12,948	0	0	0	0	-12,948
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	-7,896	0	0	0	0	-7,896
1926	0	0	0	0	0	0	0	-2,913	0	0	0	0	-2,913
1927	0	0	0	0	0	0	0	-4,755	0	0	0	0	-4,755
1928	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	-9,985	0	0	0	-9,985
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	-3,554	0	0	0	-2,044	0	0	0	-5,598
1933	0	0	0	0	0	0	0	0	-8,509	0	0	0	-8,509
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	3,935	0	0	-483	0	0	0	3,452
1936	0	0	0	0	0	0	0	580	0	0	0	0	580
1937	0	0	0	0	0	0	0	-2,659	-1,578	0	0	0	-4,237
1938	0	0	0	0	0	0	0	-7,797	0	0	0	0	-7,797
1939	0	0	0	0	0	0	-3,808	4,045	0	0	0	0	237
1940	0	0	0	0	0	0	0	7,223	0	0	0	0	7,223
1941	0	0	0	0	0	0	0	0	-1,248	0	0	0	-1,248
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	-25,854	0	0	0	0	-25,854
1945	0	0	0	0	0	0	0	0	18,872	0	0	0	18,872
1946	0	0	0	0	0	0	0	-2,208	0	0	0	0	-2,208
1947	0	0	0	0	0	0	0	-9,549	0	0	0	0	-9,549
1948	0	0	0	0	0	0	0	0	-7,605	0	0	0	-7,605
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	8,772	0	0	0	8,772
1951	0	-7,289	0	0	0	0	0	0	-3,559	0	0	0	-10,848
1952	0	0	0	0	0	0	0	-4,898	0	0	0	0	-4,898
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	-14,042	0	0	0	0	-14,042
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	-4,412	0	0	0	0	-4,412
1957	0	0	0	0	0	0	0	-26,907	0	0	0	0	-26,907
1958	0	0	0	0	0	0	0	-2,064	0	0	0	0	-2,064
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	-39,538	0	0	0	0	-39,538
1963	0	0	0	0	0	0	0	-7,727	0	0	0	0	-7,727
1964	0	0	0	0	0	0	0	0	-3,808	0	0	0	-3,808
1965	0	0	0	0	0	0	0	0	13,506	0	0	0	13,506
1966	0	0	0	0	0	0	-3,808	4,045	0	0	0	0	237
1967	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	-20,636	0	0	0	0	-20,636
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	3,935	0	0	0	-6,553	0	0	0	0	-2,618
1971	0	0	0	0	0	0	0	-12,638	0	0	0	0	-12,638
1972	0	0	0	0	0	0	0	-8,515	0	0	0	0	-8,515
1973	0	0	0	0	0	0	0	-4,031	0	0	0	0	-4,031
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	6,881	4,171	0	0	0	11,052
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	-35,170	-4,171	0	0	-310	-39,651
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	-6,603	-10,310	0	0	0	-16,913
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	3,935	0	-11,653	0	0	0	0	-7,718
1985	0	0	0	0	0	0	0	7,499	0	0	0	0	7,499
1986	0	0	9	0	0	-8,478	-1,586	0	0	0	0	0	-10,055
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	-3,808	0	0	0	-3,808
1989	0	0	0	0	0	0	0	-13,620	0	0	0	0	-13,620
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	-8,458	0	0	0	-8,458
1992	0	0	0	0	0	0	0	-18,433	0	0	0	0	-18,433
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	-1,480	0	0	0	0	0	0	0	0	-1,480
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	-8,369	-722	0	0	0	-9,091
2000	0	0	0	0	0	0	0	-2,585	0	0	0	0	-2,585
2001	0	0	0	0	0	0	0	-28,173	0	0	0	0	-28,173
2002	0	0	0	0	0	0	0	-21,494	0	0	0	0	-21,494
Avg (21-02)	0	-89	0	30	-43	-7	-112	-4,155	-297	0	0	-4	-4,677

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Table 2.3-7

Hetch Hetchy Reservoir Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	55	51	51	171	89	84	146	2,455	4,544	2,034	184	89
Above Normal	55	89	88	66	89	94	131	1,236	3,107	379	125	89
Normal	54	54	50	55	74	74	98	1,315	1,912	167	122	86
Below Normal	55	55	46	43	51	63	88	624	735	113	111	73
Dry	53	53	44	40	44	50	56	157	143	86	86	65
All Years	54	61	56	74	70	73	104	1,152	2,084	548	125	81

Hetch Hetchy Reservoir Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	55	51	51	167	89	84	144	2,412	4,550	2,034	184	89
Above Normal	55	89	88	66	89	94	131	1,192	3,093	379	125	89
Normal	54	54	50	55	74	74	98	1,253	1,890	167	122	86
Below Normal	55	55	46	43	51	63	91	550	709	113	111	73
Dry	53	53	44	40	44	50	56	156	139	86	86	65
All Years	54	61	56	73	70	73	104	1,107	2,072	548	125	81

Difference in Hetch Hetchy Reservoir Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — Modified WSIP minus WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	1	5	0	0	2	43	-6	0	0	0
Above Normal	0	0	0	0	0	0	0	44	14	0	0	0
Normal	0	0	0	0	0	0	0	62	22	0	0	0
Below Normal	0	0	0	0	0	0	-4	74	27	0	0	0
Dry	0	0	0	0	0	0	0	1	4	0	0	0
All Years	0	0	0	1	0	0	0	45	12	0	0	0

average monthly flow (cfs).[1] When comparing the alternative to the WSIP setting, a change in the volume of release from O'Shaughnessy Dam to the stream would likely result in the release being delayed or initiated earlier by a matter of days. Typical springtime releases, when initiated, amount to a release of up to 3,000 cfs (approximately 6,000 acre-feet over the span of a day). Using the assumption that a change in release volume equates to a delay or an earlier initiation of releasing 6,000 acre-feet per day means that the difference in stream release between the alternative and WSIP would be up to an added three days of release. Normally, this change in release would not affect the peak stream release rate during a year. Table 2.3-8 illustrates the average monthly stream release for the alternative and base settings, and the differences, expressed in average monthly flow (cfs). Table 2.3-6 illustrates that the difference in monthly flow below O'Shaughnessy Dam between the alternative and base settings could range from an increase of approximately 18,000 acre-feet to a decrease of approximately 39,000 acre-feet. Using the same metric as described above to estimate the delay or addition in the number days of release to the stream, the alternative could lead to an effect ranging from an increase of three days of release to a decrease of up to seven days compared to the base setting.

Table 2.3-8

Hetch Hetchy Reservoir Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	55	51	51	171	89	84	146	2,455	4,544	2,034	184	89
Above Normal	55	89	88	66	89	94	131	1,236	3,107	379	125	89
Normal	54	54	50	55	74	74	98	1,315	1,912	167	122	86
Below Normal	55	55	46	43	51	63	88	624	735	113	111	73
Dry	53	53	44	40	44	50	56	157	143	86	86	65
All Years	54	61	56	74	70	73	104	1,152	2,084	548	125	81

Hetch Hetchy Reservoir Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	55	51	51	173	89	93	148	2,510	4,534	2,034	184	90
Above Normal	55	96	88	66	93	86	131	1,249	3,092	379	125	89
Normal	54	54	50	51	74	74	98	1,443	1,909	167	122	86
Below Normal	55	55	46	43	51	63	91	723	763	113	111	73
Dry	53	53	44	40	44	50	60	199	168	86	86	65
All Years	54	62	56	74	70	73	106	1,219	2,089	548	125	81

Difference in Hetch Hetchy Reservoir Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — Modified WSIP minus Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	1	-2	0	-9	-2	-55	10	0	0	0
Above Normal	0	-7	0	0	-4	8	0	-14	15	0	0	0
Normal	0	0	0	4	0	0	0	-129	4	0	0	0
Below Normal	0	0	0	0	0	0	-4	-99	-28	0	0	0
Dry	0	0	0	0	0	0	-4	-42	-25	0	0	0
All Years	0	-1	0	0	-1	0	-2	-68	-5	0	0	0

[1] See *Estimated Affect of WSIP on Daily Releases below Hetch Hetchy Reservoir*, Memorandum by Daniel B. Steiner, December 31, 2006.

APPENDIX O2

2.4 Lake Lloyd and Lake Eleanor

Compared to the operation of the WSIP, the operation of Lake Lloyd and Lake Eleanor are simulated to be only slightly different for the alternative. Figure 2.4-1 illustrates a chronological trace of the simulation of Lake Lloyd storage and stream releases. Shown in Figure 2.4-1 are the results for the WSIP, alternative, and base settings. The operation resulting from the alternative is essentially the same as the WSIP setting, including during drought. The level of delivery between the alternative and base settings is larger during the 1987-1992 drought, and water delivery reliability has been improved in the alternative setting; as a result, the drawdown of Lake Lloyd during this period looks similar to that in the WSIP setting. Although there is less water delivered during this period in the alternative setting compared to the WSIP setting, more water is delivered in the alternative setting than in the base setting. The additional draw of water reduced the amount of water released from Hetch Hetchy Reservoir to Don Pedro Reservoir in the alternative setting, which, in order to satisfy TID/MID entitlements to inflow, was met with additional releases from Lake Lloyd, similar to the WSIP setting. The additional release from Lake Lloyd associated with the alternative appears to be approximately the same as in the WSIP setting in this instance, which is partially a factor of modeling discretion in that the HH/LSM makes release decisions in the form of block amounts of releases. Additional refinement of modeling assumptions would likely produce a result that places Lake Lloyd storage during this drought period between the base setting and WSIP setting results. Otherwise, the results for Lake Lloyd storage are essentially the same between the WSIP and alternative settings.

Figure 2.4-2 illustrates the almost identical operation of Lake Eleanor for the alternative and WSIP settings. Also shown in Figure 2.4-2 is the operation for the base setting. Any difference in the Lake Eleanor operation would be caused by a small change in operation at Lake Lloyd that would affect the operation of the Cherry-Eleanor Tunnel between the two watersheds. Any difference that occurs in the simulations is more likely the result of modeling discretion as opposed to any substantive difference in operation.

Supplementing the Figure 2.4-1 representation of Lake Lloyd stream releases is Table 2.4-1, which illustrates releases for the alternative and WSIP settings, and the difference in releases between the two settings. Table 2.4-2 provides the same form of information for the alternative and base settings. With essentially no change in reservoir operations, stream releases will not be different.

2.5 Don Pedro Reservoir and La Grange Releases

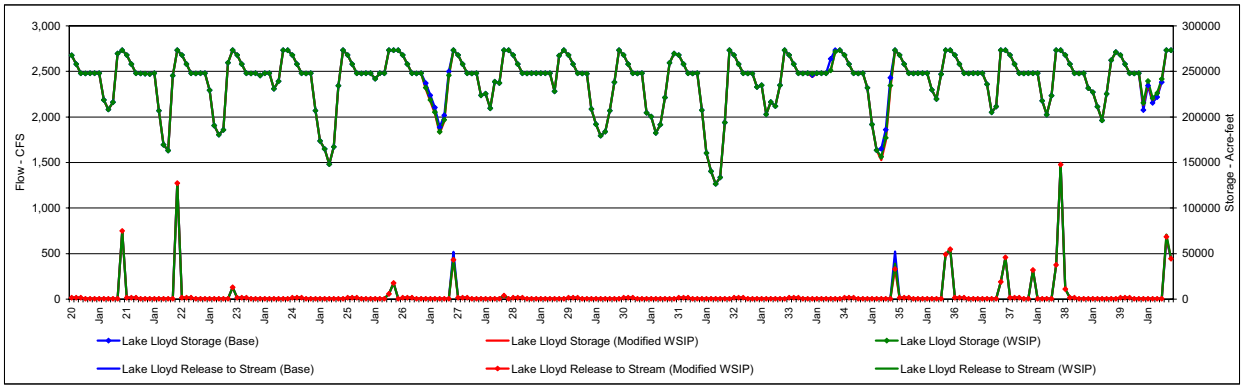
A change in Don Pedro Reservoir operation is caused by changes in inflow to the reservoir and the releases from the reservoir. The changes in inflow to the reservoir are the result of net changes within the operation of the upstream SFPUC facilities described previously, and other changes in SFPUC operations associated with diversions to the Holm, Kirkwood, and Moccasin Powerhouses. Figure 2.5-1 illustrates a chronological trace of the simulation of Don Pedro Reservoir storage and Tuolumne River stream releases from La Grange Dam. Shown in Figure 2.5-1 are the results for the WSIP, alternative, and base settings. Supplementing the Figure 2.5-1 representation of Don Pedro Reservoir storage are Table 2.5-1, Don Pedro Reservoir Storage (Modified WSIP); Table 2.5-2, Don Pedro Reservoir Storage (WSIP); and Table 2.5-3, Difference in Don Pedro Reservoir Storage (Modified WSIP minus WSIP). Table 2.5-4 is provided to illustrate the difference in Don Pedro Reservoir storage between the base and alternative settings.

Table 2.5-3 shows that, throughout many years, the storage in Don Pedro Reservoir associated with the alternative setting would differ from the storage in the WSIP setting, and this difference would almost always be more storage. Table 2.5-4 illustrates that Don Pedro Reservoir storage for the alternative is close to the storage depicted for the base setting; storage is either higher or lower, but is typically higher than in the base setting. Compared to the WSIP setting, the differences in storage are indicative of the increase in inflow to Don Pedro Reservoir that is due to lesser SFPUC demands and SJPL diversions in the alternative setting. The increases in storage are also due to a decrease in TID/MID canal diversions from the assumption that conserved water would be developed for the SFPUC transfer. Compared to the base setting, the alternative would result in typically less inflow to Don Pedro Reservoir during non-wet years and particularly during drought periods when more water is diverted

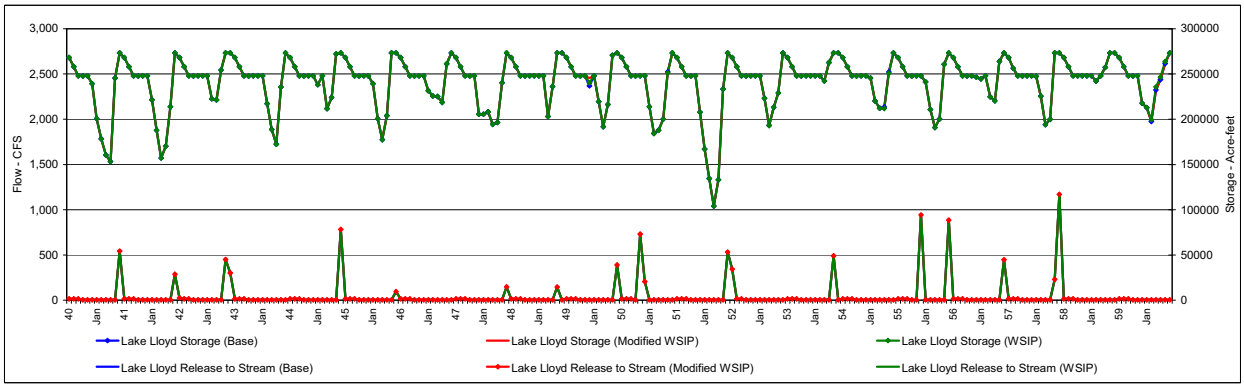
APPENDIX O2

Figure 2.4-1
Lake Lloyd Storage and Stream Release

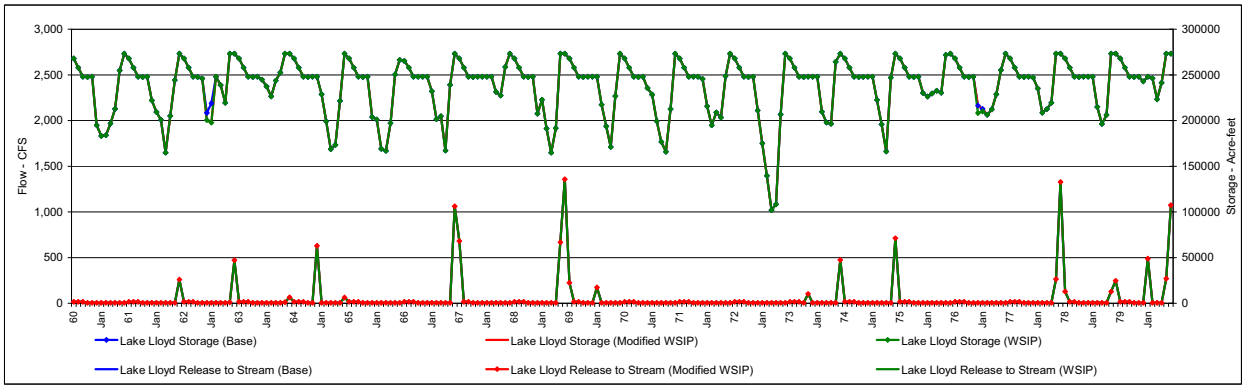
1920 - 1939



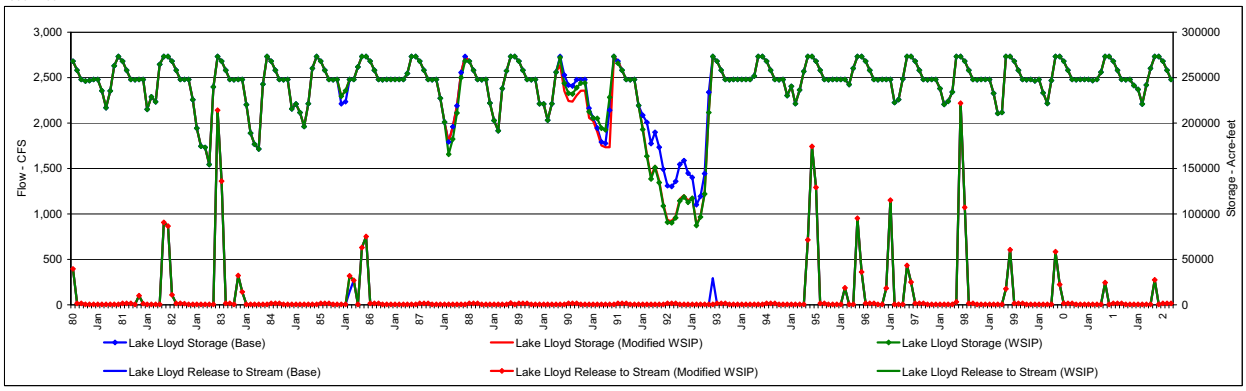
1940 - 1959



1960 - 1979



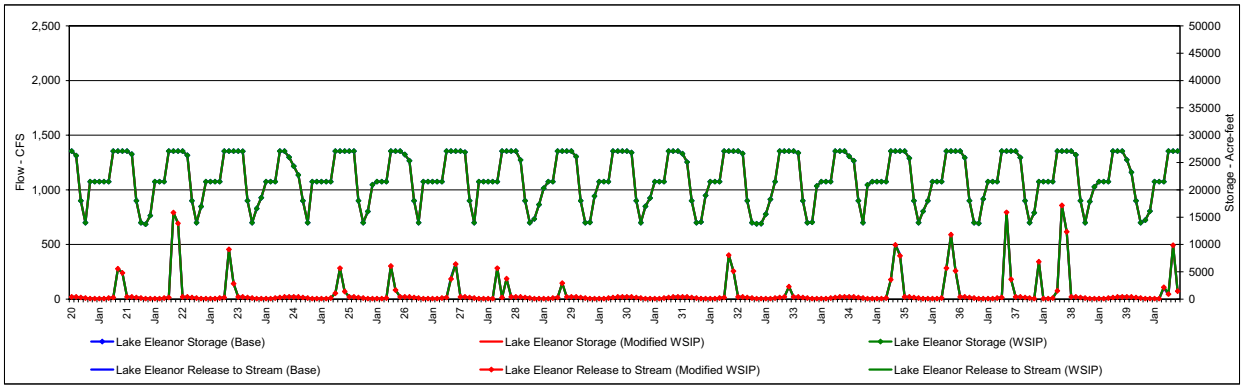
1980 - 2002



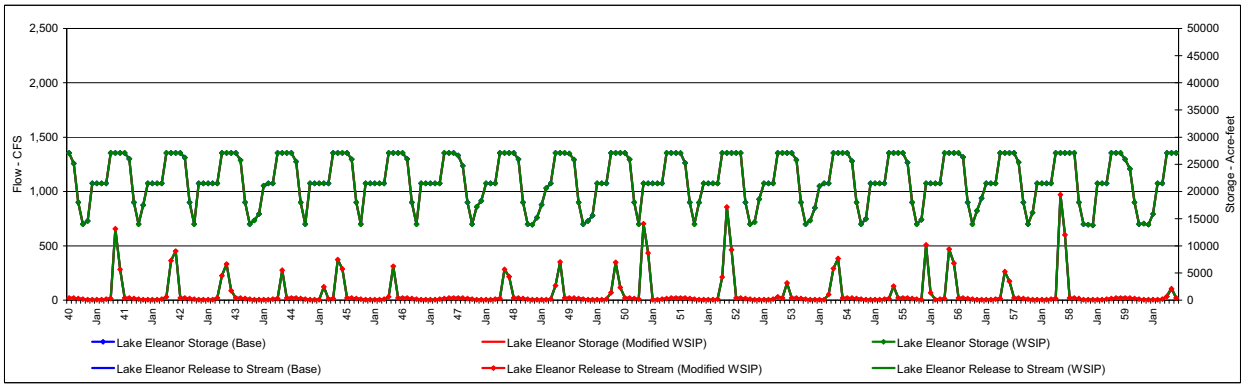
APPENDIX O2

Figure 2.4-2
Lake Eleanor Storage and Stream Release

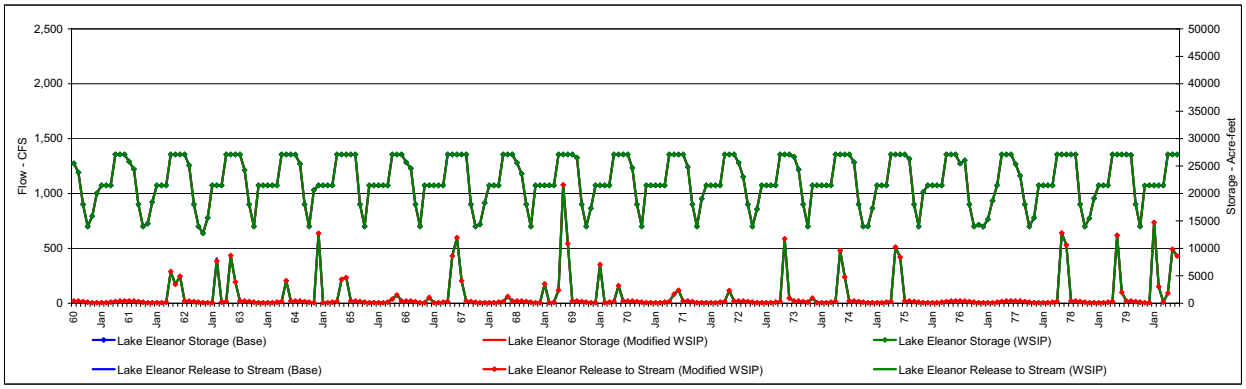
1920 - 1939



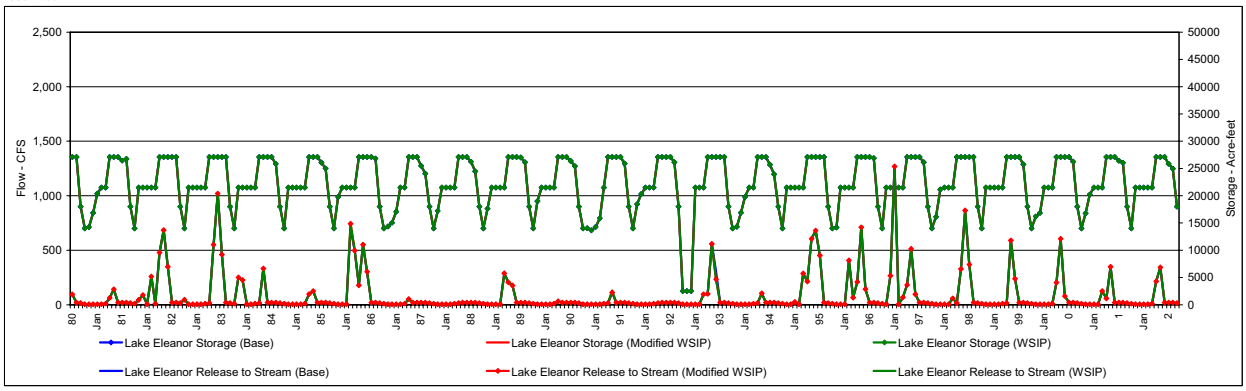
1940 - 1959



1960 - 1979



1980 - 2002



APPENDIX O2

Table 2.4-1

Lake Lloyd Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	25	21	5	284	1,058	363	15	15
Above Normal	5	72	25	5	16	5	5	166	446	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	15	15	15
Dry	5	5	5	5	5	5	5	5	5	16	15	15
All Years	5	20	34	27	11	8	6	120	340	83	15	15

Lake Lloyd Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	25	21	5	284	1,058	363	15	15
Above Normal	5	72	25	5	16	5	5	167	451	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	16	15	15
Dry	5	5	5	5	5	5	5	5	5	16	15	15
All Years	5	20	34	27	11	8	6	121	341	83	15	15

Difference in Lake Lloyd Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — Modified WSIP minus WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	1	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	-1	-5	0	0	0
Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	0	0	0	0	0	-1	0	0	0

Table 2.4-2

Lake Lloyd Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	25	21	5	284	1,058	363	15	15
Above Normal	5	72	25	5	16	5	5	166	446	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	15	15	15
Dry	5	5	5	5	5	5	5	5	5	16	15	15
All Years	5	20	34	27	11	8	6	120	340	83	15	15

Lake Lloyd Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	14	21	5	284	1,076	363	15	15
Above Normal	5	72	25	5	16	5	5	164	462	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	15	15	15
Dry	5	5	5	5	5	5	5	5	5	16	15	15
All Years	5	20	34	27	9	8	6	120	347	83	15	15

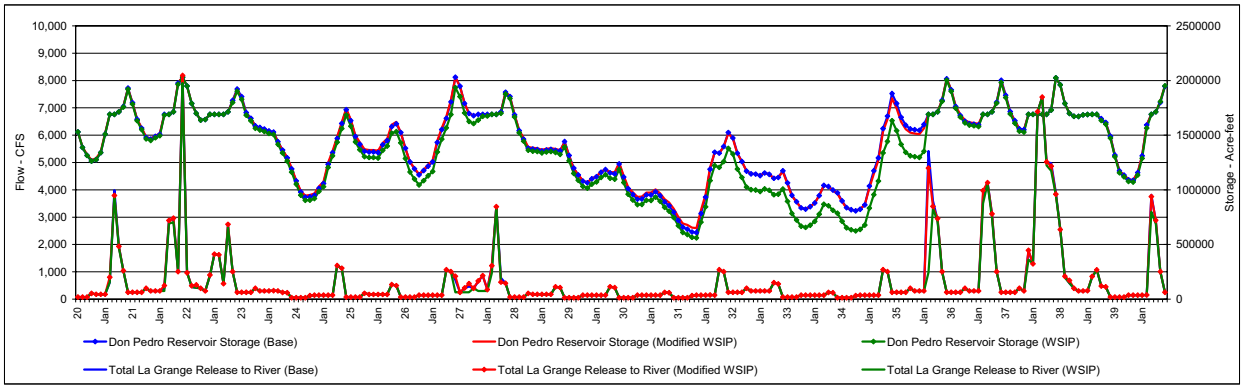
Difference in Lake Lloyd Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — Modified WSIP minus Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	1	0	11	0	0	0	-18	0	0	0
Above Normal	0	0	0	0	0	0	0	2	-16	0	0	0
Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	0	2	0	0	0	-7	0	0	0

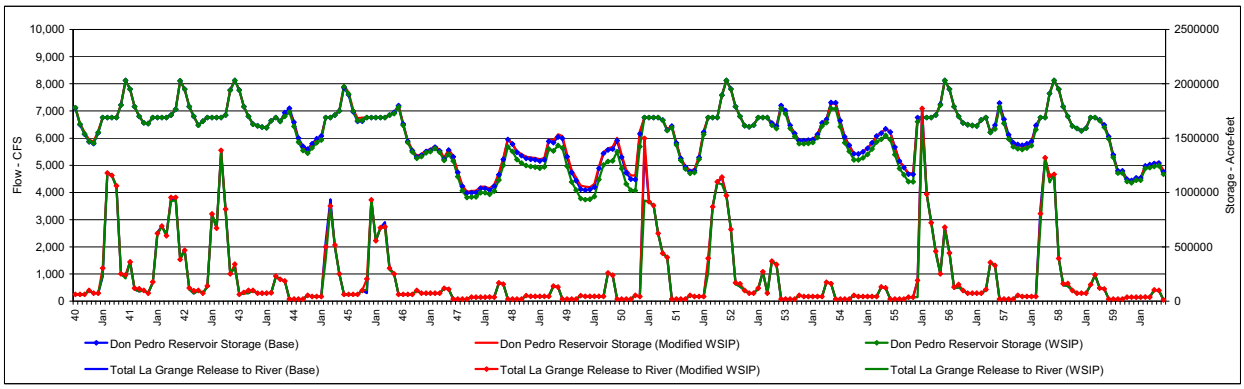
APPENDIX O2

Figure 2.5-1
Don Pedro Reservoir Storage and Release below La Grange Dam

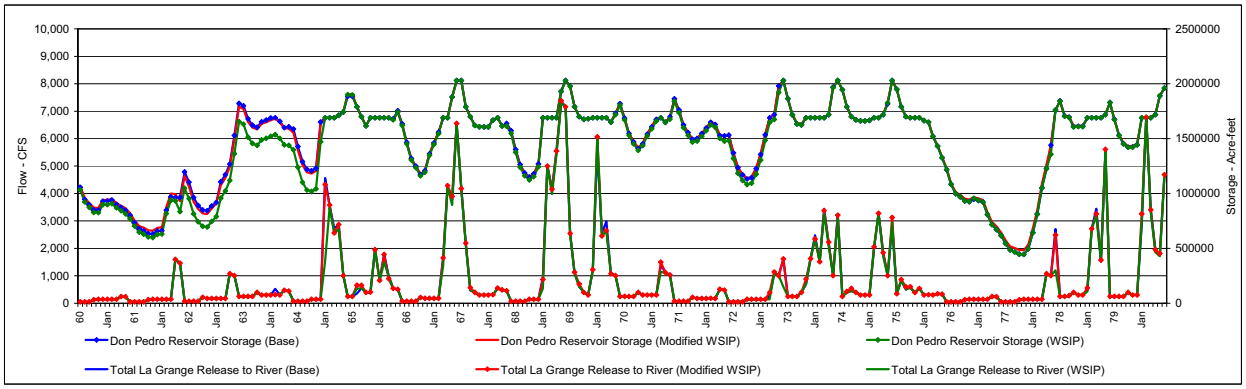
1920 - 1939



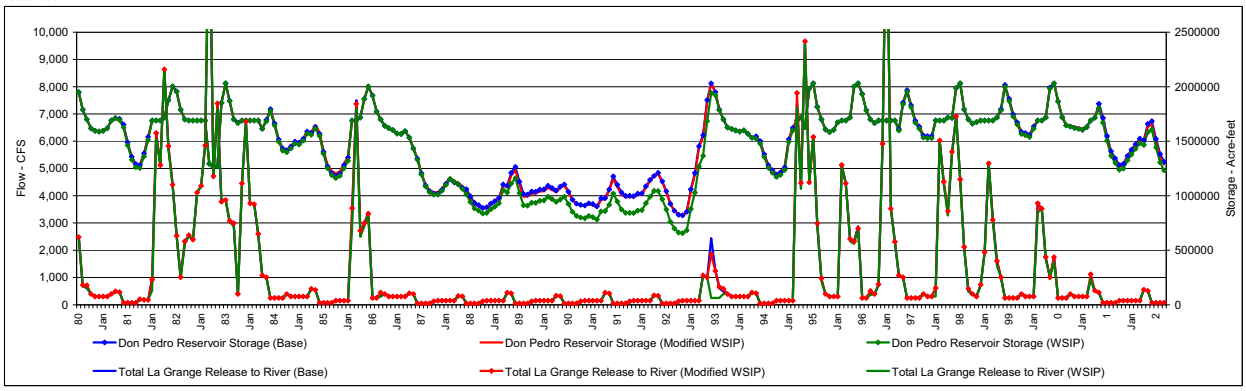
1940 - 1959



1960 - 1979



1980 - 2002



APPENDIX O2

Table 2.5-1

Don Pedro Reservoir Storage (Acre-feet) Modified WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	1,273,412	1,287,911	1,350,890	1,519,425	1,689,999	1,690,000	1,713,000	1,764,582	1,928,125	1,793,382	1,644,164	1,568,714
1922	1,484,928	1,470,112	1,494,406	1,514,575	1,690,000	1,690,000	1,713,000	1,981,594	2,030,000	1,950,094	1,790,033	1,700,025
1923	1,639,636	1,644,971	1,689,999	1,689,989	1,689,997	1,690,000	1,713,000	1,809,253	1,910,823	1,838,683	1,696,213	1,651,084
1924	1,583,443	1,568,106	1,554,088	1,535,685	1,526,277	1,437,824	1,363,847	1,297,999	1,197,407	1,087,616	989,798	947,967
1925	952,090	966,360	1,030,353	1,074,067	1,250,556	1,356,951	1,485,177	1,618,665	1,742,482	1,639,854	1,499,304	1,433,545
1926	1,371,735	1,363,673	1,364,112	1,358,048	1,428,833	1,467,778	1,595,835	1,621,402	1,521,608	1,378,176	1,256,173	1,198,503
1927	1,145,218	1,184,820	1,231,334	1,270,916	1,448,838	1,565,441	1,672,669	1,819,245	2,030,000	1,945,826	1,790,022	1,700,030
1928	1,680,577	1,690,000	1,689,999	1,690,000	1,689,998	1,690,000	1,712,101	1,896,779	1,854,866	1,687,028	1,544,734	1,473,242
1929	1,391,853	1,383,515	1,380,623	1,367,418	1,376,273	1,380,772	1,374,189	1,362,189	1,434,565	1,308,348	1,195,598	1,138,139
1930	1,084,099	1,068,449	1,103,964	1,123,960	1,164,849	1,190,498	1,162,317	1,160,244	1,248,631	1,128,688	1,024,759	978,260
1931	935,689	938,016	975,453	973,637	1,005,166	968,076	914,045	885,107	826,891	750,869	692,570	679,280
1932	655,003	649,851	813,996	958,339	1,204,535	1,343,718	1,332,766	1,394,846	1,517,130	1,465,392	1,329,693	1,259,078
1933	1,172,142	1,147,661	1,145,363	1,130,844	1,155,499	1,142,807	1,105,300	1,116,128	1,165,377	1,051,880	941,733	888,942
1934	833,523	822,259	848,250	879,054	948,498	1,039,816	1,028,627	992,475	965,223	890,844	832,166	819,771
1935	811,181	824,799	864,347	1,019,351	1,143,970	1,272,214	1,534,838	1,647,473	1,837,424	1,744,595	1,621,500	1,553,835
1936	1,522,978	1,514,901	1,509,433	1,563,410	1,689,991	1,690,000	1,713,000	1,823,753	2,017,860	1,915,294	1,765,512	1,689,256
1937	1,638,138	1,617,428	1,610,904	1,604,838	1,689,993	1,690,000	1,713,000	1,799,600	1,992,600	1,853,772	1,707,841	1,629,580
1938	1,557,660	1,549,094	1,689,998	1,689,992	1,689,987	1,690,000	1,690,000	1,730,000	2,025,000	1,959,369	1,790,080	1,700,041
1939	1,673,850	1,673,416	1,687,280	1,690,000	1,689,999	1,690,000	1,637,628	1,610,682	1,482,662	1,310,729	1,169,238	1,137,009
1940	1,097,004	1,090,067	1,158,149	1,313,069	1,595,012	1,690,000	1,713,000	1,811,854	1,955,548	1,785,694	1,635,678	1,553,678
1941	1,485,284	1,469,925	1,569,238	1,689,992	1,689,991	1,690,000	1,690,000	1,811,177	2,030,000	1,950,157	1,790,031	1,700,020
1942	1,643,070	1,635,778	1,690,000	1,689,982	1,689,995	1,690,000	1,713,000	1,765,000	2,027,000	1,950,170	1,790,032	1,700,013
1943	1,620,906	1,658,587	1,690,000	1,689,976	1,689,995	1,690,000	1,713,000	1,947,467	2,030,000	1,940,444	1,790,010	1,700,014
1944	1,629,260	1,616,113	1,604,369	1,597,321	1,661,304	1,690,000	1,657,800	1,715,388	1,753,568	1,622,786	1,481,321	1,410,518
1945	1,387,471	1,435,493	1,481,929	1,508,224	1,689,996	1,690,000	1,713,000	1,757,322	1,987,173	1,919,912	1,765,899	1,684,461
1946	1,688,208	1,690,000	1,689,996	1,689,984	1,689,995	1,690,000	1,713,000	1,737,850	1,797,783	1,629,442	1,474,028	1,394,084
1947	1,336,463	1,352,894	1,386,221	1,398,442	1,427,043	1,392,425	1,320,321	1,397,004	1,334,287	1,190,101	1,065,324	1,008,455
1948	1,014,064	1,015,321	1,053,944	1,053,075	1,039,190	1,073,338	1,177,714	1,321,022	1,493,664	1,450,965	1,379,025	1,353,038
1949	1,330,876	1,322,122	1,317,291	1,306,186	1,317,882	1,487,841	1,477,877	1,535,687	1,519,017	1,351,872	1,208,426	1,139,539
1950	1,063,390	1,053,556	1,049,430	1,079,544	1,236,869	1,370,886	1,406,190	1,418,984	1,503,885	1,349,683	1,209,026	1,156,651
1951	1,155,283	1,563,365	1,689,992	1,689,971	1,689,993	1,690,000	1,668,858	1,582,375	1,613,633	1,456,033	1,316,416	1,243,518
1952	1,204,083	1,211,785	1,333,378	1,564,867	1,689,997	1,690,000	1,690,000	1,895,000	2,030,000	1,951,049	1,790,058	1,700,037
1953	1,616,383	1,606,458	1,620,797	1,689,998	1,689,998	1,688,681	1,625,138	1,603,392	1,789,870	1,740,950	1,608,274	1,539,909
1954	1,476,329	1,475,526	1,479,169	1,485,971	1,532,414	1,638,358	1,673,331	1,818,250	1,813,990	1,649,762	1,503,995	1,432,008
1955	1,354,810	1,354,555	1,372,840	1,405,420	1,455,692	1,519,360	1,546,240	1,589,483	1,553,915	1,414,809	1,290,280	1,238,000
1956	1,177,169	1,175,791	1,689,999	1,689,942	1,689,993	1,690,000	1,713,000	1,811,926	2,030,000	1,950,170	1,790,037	1,700,034
1957	1,641,432	1,626,099	1,618,146	1,612,587	1,670,021	1,690,000	1,556,123	1,598,826	1,801,403	1,649,993	1,510,292	1,443,072
1958	1,428,625	1,421,397	1,434,106	1,457,068	1,603,639	1,690,000	1,690,000	1,910,000	2,030,000	1,950,170	1,790,053	1,700,038
1959	1,612,670	1,591,335	1,569,440	1,593,880	1,689,999	1,690,000	1,665,544	1,609,991	1,502,961	1,333,683	1,190,553	1,196,778
1960	1,121,093	1,110,287	1,133,514	1,133,204	1,243,879	1,254,530	1,268,532	1,280,002	1,200,080	1,065,928	957,818	915,107
1961	869,350	868,557	939,907	941,603	950,674	912,300	887,613	865,631	820,251	753,646	701,666	688,684
1962	664,649	659,559	687,294	691,239	878,339	999,447	994,968	929,139	1,157,964	1,062,988	926,294	859,987
1963	819,092	813,366	863,687	908,751	1,075,936	1,141,590	1,240,769	1,499,645	1,792,271	1,769,028	1,653,355	1,600,932
1964	1,584,033	1,633,568	1,649,236	1,667,358	1,681,876	1,648,645	1,593,074	1,593,847	1,552,228	1,393,083	1,258,097	1,193,529
1965	1,182,155	1,205,439	1,636,940	1,689,965	1,689,993	1,690,000	1,713,000	1,749,649	1,905,253	1,903,314	1,790,055	1,700,038
1966	1,617,344	1,690,000	1,689,998	1,689,996	1,689,997	1,690,000	1,664,434	1,745,959	1,624,177	1,456,019	1,312,631	1,248,525
1967	1,174,839	1,208,370	1,362,062	1,461,077	1,558,910	1,690,000	1,690,000	1,880,000	2,030,000	2,030,000	1,790,258	1,700,030
1968	1,621,428	1,609,232	1,607,367	1,607,567	1,670,478	1,690,000	1,617,394	1,624,530	1,557,318	1,386,116	1,251,069	1,179,846
1969	1,145,315	1,174,626	1,264,108	1,689,994	1,689,990	1,690,000	1,690,000	1,930,000	2,030,000	1,975,279	1,790,118	1,700,043
1970	1,677,722	1,683,160	1,689,999	1,689,952	1,689,996	1,690,000	1,652,690	1,729,821	1,816,669	1,682,496	1,545,668	1,474,011
1971	1,416,196	1,459,106	1,546,155	1,612,064	1,681,258	1,690,000	1,650,942	1,691,959	1,855,325	1,751,026	1,617,643	1,554,674
1972	1,494,665	1,503,209	1,546,806	1,597,278	1,650,736	1,628,676	1,529,989	1,524,210	1,528,926	1,366,957	1,235,721	1,175,469
1973	1,138,955	1,151,949	1,234,020	1,362,823	1,542,441	1,690,000	1,717,600	1,980,895	2,030,000	1,863,873	1,719,884	1,643,118
1974	1,635,668	1,690,000	1,689,998	1,689,983	1,689,998	1,690,000	1,717,600	1,971,412	2,030,000	1,943,894	1,790,025	1,700,028
1975	1,673,228	1,663,339	1,661,792	1,667,126	1,689,996	1,690,000	1,717,600	1,834,937	2,030,000	1,950,013	1,790,083	1,700,033
1976	1,690,000	1,690,000	1,690,000	1,664,706	1,649,459	1,519,032	1,435,154	1,335,053	1,225,747	1,094,002	1,010,365	986,545
1977	952,025	944,903	966,794	954,865	939,669	827,221	739,953	700,254	644,360	572,116	516,939	504,316
1978	485,812	483,545	535,831	680,933	849,823	1,088,674	1,268,395	1,435,989	1,761,000	1,841,159	1,707,412	1,700,003
1979	1,614,939	1,618,013	1,617,070	1,689,998	1,689,995	1,690,000	1,690,000	1,717,600	1,827,795	1,673,824	1,530,035	1,459,925
1980	1,430,456	1,433,169	1,453,204	1,689,974	1,689,987	1,690,000	1,717,600	1,890,400	1,960,200	1,950,171	1,790,064	1,700,044
1981	1,619,550	1,597,811	1,590,013	1,597,563	1,621,214	1,690,000	1,713,313	1,703,065	1,640,497	1,475,345	1,347,046	1,285,338
1982	1,278,056	1,384,964	1,535,708	1,689,994	1,689,988	1,690,000	1,717,600	1,876,400	2,002,900	1,954,718	1,790,104	1,700,116
1983	1,690,000	1,690,000	1,689,995	1,689,966	1,689,989	1,294,700	1,264,000	1,270,800	1,851,400	2,030,000	1,869,137	1,700,118
1984	1,668,518	1,690,000	1,689,992	1,689,971	1,689,993	1,690,000	1,617,070	1,691,312	1,787,159	1,655,182	1,508,819	1,431,891
1985	1,418,471	1,453,581	1,497,960	1,488,549	1,523,603	1,589,731	1,581,163	1,647,192	1,580,941	1,416,347	1,284,966	1,227,694
1986	1,202,637	1,223,827	1,295,413	1,360,422	1,689,993	1,690,000	1,717,600	1,888,300	2,001,400	1,917,776	1,773,743	1,700,019
1987	1,642,834	1,621,459	1,602,910	1,571,788	1,567,853	1,594,481	1,537,756	1,443,801	1,341,141	1,206,495	1,098,820	1,051,988
1988	1,031,411	1,030,512	1,066,696	1,120,513	1,162,412	1,135,649	1,119,724	1,087,355	1,039,228	975,497	919,189	903,638
1989	878,958	886,458	919,139	942,795	972,353	1,094,012	1,074,919	1,183,810	1,235,848	1,099,998	990,733	992,068
1990	1,020,252	1,018,894	1,038,950	1,041,663	1,074,254	1,053,596	1,032,349	1,069,546	1,094,915	1,028,120	958,167	926,695
1991	912,484	907,187	925,968	911,152	888,346	962,970	967,443	1,049,028	1,155,267	1,079,363	1,011,649	986,032
1992	987,759	985,230	1,007,389	1,011,985	1,075,318	1,134,604	1,186,520	1,201,189	1,124,146	1,031,185	920,084	862,293
1993	827,714	821,296	847,126	1,044,089	1,193,886	1,434,056	1,540,529	1,866,198	2,030,000	1,950,131	1,790,055	1,700,032
1994	1,628,791	1,614,584	1,600,767	1,590,811	1,600,873	1,569,297	1,536,516	1,538,815	1,493,989	1,371,490	1,274,649	1,235,078
1995	1,197,556	1,217,352	1,262,134	1,519,656	1,628,511	1,690,000	1,717,600	1,629,700	1,982,800	2,030,000	1,814,001	1,700,068
1996	1,609,687	1,584,700	1,606,017	1,674,181	1,689,990	1,690,000	1,717,600	2,002,400	2,030,000	1,930,383	1,785,378	1,700,025
1997	1,668,811	1,690,000	1,689,993	1,689,874	1,689,994	1,690,000	1,601,187	1,848,971	1,960,531	1,819,845	1,680,717	1,632,944
1998	1,553,232	1,546,836	1,548,242	1,689,997	1,689,989	1,690,000	1,717,600	1,714,000	1,987,500	2,030,000	1,790,249	1,700,032
1999	1,663,622	1,676,910	1,689,999	1,689,986	1,689,990	1,690,000	1,717,600	1,787,654	2,006,930	1,876,953	1,738,151	1,670,125
2000	1,585,402	1,573,740	1,558,095	1,634,018	1,689,993	1,690,000	1,717,600	1,993,453	2,030,000	1,864,407	1,722,358	1,653,656
2001	1,645,283	1,632,780	1,624,256	1,616,244	1,639,607	1,690,000	1,717,600	1,819,469	1,686,681	1,522,115	1,386,270	1,326,789
2002	1,266,578	1,278,195	1,351,669	1,407,102	1,459,267	1,509,791	1,497,578	1,630,986	1,653,740	1,490,489	1,355,084	1,288,277
Avg (21-02)	1,333,860	1,343,308	1,385,822	1,430,632	1,489,306	1,513,290	1,518,362	1,595,419	1,675,890	1,575,354	1,440,908	1,376,829

APPENDIX O2

Table 2.5-2

Don Pedro Reservoir Storage (Acre-feet) WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	1,262,860	1,277,365	1,340,344	1,508,876	1,689,999	1,690,000	1,713,000	1,758,255	1,920,087	1,785,379	1,633,202	1,551,799
1922	1,466,449	1,451,643	1,475,936	1,496,100	1,682,686	1,690,000	1,713,000	1,965,236	2,030,000	1,950,094	1,790,026	1,700,016
1923	1,638,028	1,643,364	1,689,999	1,689,989	1,689,997	1,690,000	1,713,000	1,799,363	1,900,966	1,828,869	1,683,448	1,632,370
1924	1,563,169	1,547,842	1,533,824	1,515,415	1,506,005	1,417,560	1,338,399	1,262,605	1,162,134	1,052,503	951,855	904,167
1925	906,788	921,085	985,076	1,028,777	1,205,262	1,311,674	1,436,468	1,560,568	1,684,578	1,582,202	1,438,920	1,367,376
1926	1,304,106	1,296,082	1,296,519	1,290,435	1,361,093	1,400,064	1,518,241	1,532,438	1,430,226	1,287,212	1,162,635	1,099,288
1927	1,044,610	1,084,270	1,129,224	1,168,777	1,346,690	1,463,332	1,567,658	1,688,723	1,936,134	1,852,362	1,703,718	1,627,130
1928	1,606,224	1,637,560	1,672,026	1,675,150	1,689,999	1,690,000	1,701,151	1,877,285	1,835,437	1,667,682	1,522,481	1,445,074
1929	1,362,145	1,353,824	1,350,930	1,337,716	1,346,569	1,351,080	1,341,527	1,323,621	1,392,489	1,266,466	1,150,912	1,087,613
1930	1,032,080	1,016,460	1,051,972	1,071,954	1,112,838	1,138,506	1,107,377	1,098,218	1,186,818	1,067,154	960,515	908,251
1931	864,235	866,605	904,039	902,201	933,725	896,662	839,706	804,980	747,051	671,410	610,497	591,503
1932	565,821	560,723	704,485	844,787	1,084,372	1,221,695	1,205,745	1,259,030	1,378,752	1,327,642	1,189,590	1,113,456
1933	1,025,224	1,000,826	998,521	983,959	1,008,603	995,965	955,100	959,906	1,007,489	894,719	782,336	724,120
1934	667,461	656,295	676,788	711,356	777,968	868,739	854,724	813,053	786,448	712,923	652,109	634,358
1935	624,570	638,297	677,837	832,051	956,075	1,079,921	1,337,695	1,442,297	1,633,298	1,541,356	1,416,179	1,343,212
1936	1,311,194	1,303,236	1,297,699	1,351,659	1,689,999	1,690,000	1,713,000	1,808,939	2,003,094	1,900,592	1,747,881	1,665,690
1937	1,613,022	1,592,326	1,585,791	1,579,717	1,689,994	1,690,000	1,713,000	1,792,830	1,982,099	1,843,316	1,694,437	1,610,230
1938	1,536,751	1,528,196	1,689,998	1,689,992	1,689,987	1,690,000	1,690,000	1,730,000	2,025,000	1,959,369	1,790,073	1,700,032
1939	1,672,242	1,671,809	1,685,673	1,689,024	1,689,999	1,690,000	1,634,629	1,601,698	1,473,709	1,301,817	1,157,373	1,119,194
1940	1,077,628	1,070,702	1,134,704	1,288,559	1,565,488	1,690,000	1,713,000	1,808,008	1,950,520	1,780,688	1,627,700	1,539,737
1941	1,469,773	1,454,423	1,553,735	1,689,994	1,689,991	1,690,000	1,690,000	1,804,234	2,030,000	1,950,157	1,790,024	1,700,010
1942	1,641,462	1,634,171	1,689,999	1,689,982	1,689,995	1,690,000	1,713,000	1,765,000	2,027,000	1,950,170	1,790,025	1,700,004
1943	1,619,298	1,656,980	1,690,000	1,689,976	1,689,995	1,690,000	1,713,000	1,940,240	2,030,000	1,940,444	1,790,004	1,700,004
1944	1,627,652	1,614,506	1,602,762	1,595,713	1,659,696	1,690,000	1,654,802	1,700,608	1,738,836	1,608,117	1,463,726	1,386,992
1945	1,362,396	1,410,433	1,456,868	1,483,156	1,689,997	1,690,000	1,713,000	1,750,377	1,973,670	1,906,466	1,749,519	1,662,142
1946	1,664,336	1,690,000	1,689,996	1,689,984	1,689,995	1,690,000	1,713,000	1,726,331	1,786,301	1,618,009	1,459,654	1,373,770
1947	1,314,592	1,331,036	1,364,362	1,376,577	1,405,177	1,370,566	1,295,486	1,351,369	1,288,812	1,144,830	1,017,268	954,574
1948	958,700	959,989	998,610	997,725	983,836	1,013,678	1,114,286	1,251,048	1,420,232	1,377,867	1,303,272	1,271,554
1949	1,247,966	1,239,259	1,234,425	1,223,326	1,235,015	1,400,436	1,383,115	1,432,798	1,409,371	1,242,728	1,096,786	1,022,286
1950	944,784	935,019	938,337	962,506	1,119,822	1,253,320	1,285,258	1,291,998	1,375,323	1,221,712	1,078,645	1,020,719
1951	1,018,036	1,422,514	1,689,995	1,689,971	1,689,993	1,690,000	1,664,085	1,570,386	1,596,323	1,438,802	1,296,271	1,217,452
1952	1,176,472	1,184,189	1,305,781	1,533,995	1,689,998	1,690,000	1,690,000	1,895,000	2,030,000	1,951,049	1,790,051	1,700,027
1953	1,614,775	1,604,850	1,619,190	1,689,999	1,689,998	1,688,681	1,619,217	1,588,332	1,773,663	1,724,813	1,589,215	1,514,922
1954	1,449,795	1,449,008	1,452,649	1,459,444	1,505,884	1,611,838	1,643,837	1,773,541	1,769,428	1,605,391	1,456,830	1,379,013
1955	1,300,328	1,300,104	1,318,386	1,350,951	1,401,218	1,464,906	1,489,052	1,525,796	1,487,090	1,348,288	1,221,076	1,163,037
1956	1,100,763	1,099,427	1,651,474	1,689,947	1,689,993	1,690,000	1,713,000	1,804,698	2,030,000	1,950,170	1,790,030	1,700,025
1957	1,639,825	1,624,492	1,616,539	1,610,979	1,668,413	1,690,000	1,553,124	1,584,074	1,786,699	1,635,352	1,492,723	1,419,571
1958	1,403,575	1,396,361	1,409,069	1,432,024	1,578,593	1,690,000	1,690,000	1,910,000	2,030,000	1,950,170	1,790,046	1,700,029
1959	1,611,062	1,589,728	1,567,833	1,592,273	1,689,999	1,690,000	1,662,406	1,600,478	1,493,480	1,324,246	1,178,165	1,178,441
1960	1,101,196	1,090,401	1,113,627	1,113,311	1,220,539	1,228,588	1,240,002	1,245,830	1,168,185	1,034,178	923,226	874,650
1961	827,383	826,615	897,810	899,493	908,561	870,204	842,562	814,709	769,512	703,148	648,423	629,635
1962	604,125	599,069	626,802	630,729	817,825	938,956	931,539	835,624	1,048,335	953,860	814,699	742,797
1963	700,558	694,902	745,217	790,246	957,421	1,023,119	1,119,414	1,363,268	1,654,516	1,631,866	1,513,806	1,455,856
1964	1,437,657	1,487,272	1,502,934	1,521,014	1,535,522	1,502,343	1,443,836	1,438,577	1,397,068	1,238,632	1,101,362	1,031,330
1965	1,018,694	1,042,070	1,471,762	1,689,988	1,689,993	1,690,000	1,713,000	1,743,852	1,900,867	1,898,947	1,790,038	1,700,028
1966	1,615,736	1,690,000	1,689,998	1,689,996	1,689,998	1,690,000	1,670,732	1,742,447	1,620,676	1,452,534	1,306,169	1,236,095
1967	1,160,837	1,194,375	1,348,066	1,447,078	1,544,910	1,690,000	1,690,000	1,880,000	2,030,000	2,030,000	1,790,252	1,700,021
1968	1,619,820	1,607,624	1,605,760	1,605,959	1,668,870	1,690,000	1,614,396	1,614,311	1,547,133	1,375,977	1,237,984	1,160,815
1969	1,124,725	1,154,047	1,243,529	1,689,996	1,689,990	1,690,000	1,690,000	1,930,000	2,030,000	1,975,279	1,790,111	1,700,033
1970	1,676,114	1,681,553	1,689,999	1,689,952	1,689,996	1,690,000	1,649,691	1,718,076	1,804,962	1,670,839	1,531,070	1,453,473
1971	1,394,102	1,437,025	1,524,073	1,589,976	1,659,167	1,690,000	1,647,943	1,676,856	1,840,272	1,736,038	1,599,726	1,530,826
1972	1,469,268	1,477,826	1,521,421	1,571,887	1,625,342	1,603,292	1,501,630	1,475,950	1,480,830	1,319,081	1,185,074	1,119,002
1973	1,081,006	1,094,033	1,176,102	1,304,888	1,484,502	1,646,959	1,675,219	1,921,511	2,030,000	1,863,873	1,716,891	1,634,144
1974	1,625,114	1,690,000	1,689,998	1,689,983	1,689,998	1,690,000	1,717,600	1,964,185	2,030,000	1,943,894	1,790,018	1,700,018
1975	1,671,620	1,661,732	1,660,185	1,665,519	1,689,996	1,690,000	1,717,600	1,824,854	2,030,000	1,950,013	1,790,077	1,700,024
1976	1,690,000	1,690,000	1,690,000	1,664,706	1,649,459	1,519,032	1,432,156	1,326,070	1,216,796	1,085,092	998,502	968,734
1977	932,654	925,543	955,652	938,503	920,299	807,858	717,610	671,981	616,184	544,084	486,059	467,586
1978	447,583	445,345	497,628	642,718	811,604	1,050,470	1,227,230	1,356,274	1,761,000	1,841,159	1,704,419	1,692,926
1979	1,606,278	1,609,357	1,608,413	1,689,999	1,689,995	1,690,000	1,690,000	1,717,600	1,827,795	1,673,824	1,527,042	1,450,952
1980	1,419,903	1,422,622	1,442,656	1,689,977	1,689,987	1,690,000	1,717,600	1,890,400	1,960,200	1,950,171	1,790,057	1,700,035
1981	1,617,942	1,596,204	1,588,406	1,595,955	1,619,607	1,690,000	1,710,315	1,694,081	1,626,429	1,461,340	1,330,112	1,262,473
1982	1,253,640	1,360,563	1,511,306	1,689,997	1,689,988	1,690,000	1,717,600	1,876,400	2,002,900	1,954,717	1,790,097	1,700,116
1983	1,690,000	1,690,000	1,689,995	1,689,966	1,689,989	1,294,700	1,264,000	1,270,800	1,851,400	2,030,000	1,869,137	1,700,118
1984	1,666,919	1,690,000	1,689,992	1,689,972	1,689,993	1,690,000	1,614,072	1,682,328	1,778,205	1,646,266	1,496,949	1,414,071
1985	1,399,091	1,434,211	1,478,590	1,469,173	1,504,226	1,570,360	1,558,812	1,616,719	1,550,570	1,386,112	1,251,881	1,188,728
1986	1,162,153	1,183,366	1,254,950	1,319,946	1,689,994	1,690,000	1,717,600	1,888,300	2,001,400	1,917,776	1,770,749	1,700,004
1987	1,641,221	1,619,848	1,601,298	1,570,175	1,566,241	1,592,870	1,533,147	1,433,211	1,330,588	1,195,991	1,085,371	1,032,594
1988	1,010,460	1,009,573	1,045,756	1,099,567	1,155,125	1,128,364	1,103,870	1,063,204	1,011,973	943,381	884,236	862,821
1989	836,632	844,157	876,836	900,479	930,034	1,051,709	1,029,659	1,110,864	1,160,578	1,025,069	913,162	908,781
1990	935,547	934,238	954,290	956,979	989,562	968,936	944,775	965,169	990,902	924,588	852,141	815,058
1991	799,492	794,262	814,409	803,540	782,227	856,893	858,476	917,797	1,020,071	946,830	874,711	843,590
1992	844,030	841,586	863,738	868,291	931,612	990,953	1,044,352	1,043,659	967,160	874,930	761,589	698,367
1993	662,549	656,233	682,056	877,956	1,027,740	1,267,172	1,365,280	1,684,448	1,941,790	1,923,275	1,785,144	1,700,014
1994	1,627,176	1,612,969	1,599,152	1,589,196	1,599,258	1,567,682	1,531,904	1,523,687	1,478,913	1,356,482	1,256,718	1,211,217
1995	1,172,146	1,191,956	1,236,737	1,494,252	1,599,122	1,690,000	1,717,600	1,629,700	1,982,800	2,030,000	1,814,001	1,700,059
1996	1,608,079	1,583,093	1,604,410	1,672,573	1,689,990	1,690,000	1,717,600	2,002,400	2,030,000	1,930,383	1,782,384	1,700,010
1997	1,667,198	1,690,000	1,689,993	1,689,875	1,689,994	1,690,000	1,598,189	1,839,987	1,951,576	1,810,929	1,668,846	1,615,122
1998	1,533,848	1,527,463	1,528,868	1,690,000	1,689,989	1,690,000	1,717,600	1,714,000	1,987,500	2,030,000	1,790,242	1,700,022
1999	1,662,014	1,675,303	1,690,000	1,689,986	1,689,990	1,690,000	1,717,600	1,781,250	1,998,452	1,868,511	1,726,752	1,652,772
2000	1,566,486	1,554,834	1,539,188	1,615,107	1,689,994	1,690,000	1,717,600	1,981,851	2,030,000	1,864,407	1,719,364	1,644,682
2001	1,634,728	1,622,232	1,613,706	1,605,692	1,629,054	1,690,000	1,716,911	1,801,382	1,668,653	1,504,167	1,365,411	1,300,012
2002	1,238,260	1,249,893	1,323,366	1,378,790	1,430,954	1,481,487	1,466,303	1,583,557	1,606,470	1,443,430	1,305,249	1,232,624
Avg (21-02)	1,289,807	1,299,980	1,345,245	1,393,639	1,456,995	1,482,690	1,485,599	1,553,787	1,637,503	1,537,849	1,401,689	1,333,676

APPENDIX O2

Table 2.5-3

Difference in Don Pedro Reservoir Storage (Acre-feet) Modified WSIP minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	10,552	10,546	10,546	10,549	0	0	0	6,327	8,038	8,003	10,962	16,915
1922	18,479	18,469	18,470	18,475	7,314	0	0	16,358	0	0	7	9
1923	1,608	1,607	0	0	0	0	0	9,890	9,857	9,814	12,765	18,714
1924	20,274	20,264	20,264	20,270	20,272	20,264	25,448	35,394	35,273	35,113	37,943	43,800
1925	45,302	45,275	45,277	45,290	45,294	45,277	48,709	58,097	57,904	57,652	60,384	66,169
1926	67,629	67,591	67,593	67,613	67,740	67,714	77,594	88,964	91,382	90,964	93,538	99,215
1927	100,608	100,550	102,110	102,139	102,148	102,109	105,011	130,522	93,866	93,464	86,304	72,900
1928	74,353	52,440	17,973	14,850	-1	0	10,950	19,494	19,429	19,346	22,253	28,168
1929	29,708	29,691	29,693	29,702	29,704	29,692	32,662	38,568	42,076	41,882	44,686	50,526
1930	52,019	51,989	51,992	52,006	52,011	51,992	54,940	62,026	61,813	61,534	64,244	70,009
1931	71,454	71,411	71,414	71,436	71,441	71,414	74,339	80,127	79,840	79,459	82,073	87,777
1932	89,182	89,128	109,511	113,552	120,163	122,023	127,021	135,816	138,378	137,750	140,103	145,622
1933	146,918	146,835	146,842	146,885	146,896	146,842	150,200	156,222	157,888	157,161	159,397	164,822
1934	166,062	165,964	171,462	167,698	170,530	171,077	173,903	179,422	178,775	177,921	180,057	185,413
1935	186,611	186,502	186,510	187,300	187,895	192,293	197,143	205,176	204,126	203,239	205,321	210,623
1936	211,784	211,665	211,734	211,751	-8	0	0	14,814	14,766	14,702	17,631	23,566
1937	25,116	25,102	25,113	25,121	-1	0	0	6,770	10,501	10,456	13,404	19,350
1938	20,909	20,898	0	0	0	0	0	0	0	0	7	9
1939	1,608	1,607	1,607	976	0	0	2,999	8,984	8,953	8,912	11,865	17,815
1940	19,376	19,365	23,445	24,510	29,524	0	0	3,846	5,028	5,006	7,978	13,941
1941	15,511	15,502	15,503	-2	0	0	0	6,943	0	0	7	10
1942	1,608	1,607	1	0	0	0	0	0	0	0	7	9
1943	1,608	1,607	0	0	0	0	0	7,227	0	0	6	10
1944	1,608	1,607	1,607	1,608	1,608	0	2,998	14,780	14,732	14,669	17,595	23,526
1945	25,075	25,060	25,061	25,068	-1	0	0	6,945	13,503	13,446	16,380	22,319
1946	23,872	0	0	0	0	0	0	11,519	11,482	11,433	14,374	20,314
1947	21,871	21,858	21,859	21,865	21,866	21,859	24,835	45,635	45,475	45,271	48,056	53,881
1948	55,364	55,332	55,334	55,350	55,354	59,660	63,428	69,974	73,432	73,098	75,753	81,484
1949	82,910	82,863	82,866	82,860	82,867	87,405	94,762	102,889	109,646	109,144	111,640	117,253
1950	118,606	118,537	111,093	117,038	117,047	117,566	120,932	126,986	128,562	127,971	130,381	135,932
1951	137,247	140,851	-3	0	0	0	4,773	11,989	17,310	17,231	20,145	26,066
1952	27,611	27,596	27,597	30,872	-1	0	0	0	0	0	7	10
1953	1,608	1,608	1,607	-1	0	0	5,921	15,060	16,207	16,137	19,059	24,987
1954	26,534	26,518	26,520	26,527	26,530	26,520	29,494	44,709	44,562	44,371	47,165	52,995
1955	54,482	54,451	54,454	54,469	54,474	54,454	57,188	63,687	66,825	66,521	69,204	74,963
1956	76,406	76,364	38,525	-5	0	0	0	7,228	0	0	7	9
1957	1,607	1,607	1,607	1,608	1,608	0	2,999	14,752	14,704	14,641	17,569	23,501
1958	25,050	25,036	25,037	25,044	25,046	0	0	0	0	0	7	9
1959	1,608	1,607	1,607	1,607	0	0	3,138	9,513	9,481	9,437	12,388	18,337
1960	19,897	19,886	19,887	19,893	23,340	25,942	28,530	34,172	31,895	31,750	34,592	40,457
1961	41,967	41,942	42,097	42,110	42,113	42,096	45,051	50,922	50,739	50,498	53,243	59,049
1962	60,524	60,490	60,492	60,510	60,514	60,491	63,429	93,515	109,629	109,128	111,595	117,190
1963	118,534	118,464	118,470	118,505	118,515	118,471	121,355	136,377	137,755	137,162	139,549	145,076
1964	146,376	146,296	146,302	146,344	146,354	146,302	149,238	155,270	155,160	154,451	156,735	162,199
1965	163,461	163,369	165,178	-23	0	0	0	5,797	4,386	4,367	17	10
1966	1,608	0	0	0	-1	0	-6,298	3,512	3,501	3,485	6,462	12,430
1967	14,002	13,995	13,996	13,999	14,000	0	0	0	0	0	6	9
1968	1,608	1,608	1,607	1,608	1,608	0	2,998	10,219	10,185	10,139	13,085	19,031
1969	20,590	20,579	20,579	-2	0	0	0	0	0	0	7	10
1970	1,608	1,607	0	0	0	0	2,999	11,745	11,707	11,657	14,598	20,538
1971	22,094	22,081	22,082	22,088	22,091	0	2,999	15,103	15,053	14,988	17,917	23,848
1972	25,397	25,383	25,385	25,391	25,394	25,384	28,359	48,260	48,096	47,876	50,647	56,467
1973	57,949	57,916	57,918	57,935	57,939	43,041	42,381	59,384	0	0	2,993	8,974
1974	10,554	0	0	0	0	0	0	7,227	0	0	7	10
1975	1,608	1,607	1,607	1,607	0	0	0	10,083	0	0	6	9
1976	0	0	0	0	0	0	2,998	8,983	8,951	8,910	11,863	17,811
1977	19,371	19,360	11,142	16,362	19,370	19,363	22,343	28,273	28,176	28,032	30,880	36,730
1978	38,229	38,200	38,203	38,215	38,219	38,204	41,165	79,715	0	0	2,993	7,077
1979	8,661	8,656	8,657	-1	0	0	0	0	0	0	2,993	8,973
1980	10,553	10,547	10,548	-3	0	0	0	0	0	0	7	9
1981	1,608	1,607	1,607	1,608	1,607	0	2,998	8,984	14,068	14,005	16,934	22,865
1982	24,416	24,401	24,402	-3	0	0	0	0	0	1	7	0
1983	0	0	0	0	0	0	0	0	0	0	0	0
1984	1,599	0	0	-1	0	0	2,998	8,984	8,954	8,916	11,870	17,820
1985	19,380	19,370	19,370	19,376	19,377	19,371	22,351	30,473	30,371	30,235	33,085	38,966
1986	40,484	40,461	9	40,476	-1	0	0	0	0	0	2,994	15
1987	1,613	1,611	1,612	1,613	1,612	1,611	4,609	10,590	10,553	10,504	13,449	19,394
1988	20,951	20,939	20,940	20,946	7,287	7,285	15,854	24,151	27,255	32,116	34,953	40,817
1989	42,326	42,301	42,303	42,316	42,319	42,303	45,260	72,946	75,270	74,929	77,571	83,287
1990	84,705	84,656	84,660	84,684	84,692	84,660	87,574	104,377	104,013	103,532	106,026	111,637
1991	112,992	112,925	111,559	107,612	106,119	106,077	108,967	131,231	135,196	132,533	136,938	142,442
1992	143,729	143,644	143,651	143,694	143,706	143,651	142,168	157,530	156,986	156,255	158,495	163,926
1993	165,165	165,063	165,070	166,133	166,146	166,884	175,249	181,750	88,210	26,856	4,911	18
1994	1,615	1,615	1,615	1,615	1,615	1,615	4,612	15,128	15,076	15,008	17,931	23,861
1995	25,410	25,396	25,397	25,404	29,389	0	0	0	0	0	0	9
1996	1,608	1,607	1,607	1,608	0	0	0	0	0	0	2,994	15
1997	1,613	0	0	-1	0	0	2,998	8,984	8,955	8,916	11,871	17,822
1998	19,384	19,373	19,374	-3	0	0	0	0	0	0	7	10
1999	1,608	1,607	-1	0	0	0	0	6,404	8,478	8,442	11,399	17,353
2000	18,916	18,906	18,907	18,911	-1	0	0	11,602	0	0	2,994	8,974
2001	10,555	10,548	10,550	10,552	10,553	0	689	18,087	18,028	17,948	20,859	26,777
2002	28,318	28,302	28,303	28,312	28,313	28,304	31,275	47,429	47,270	47,059	49,835	55,653
Avg (21-02)	44,053	43,327	40,084	36,993	32,311	30,600	32,763	41,632	38,387	37,505	39,219	43,153

APPENDIX O2

Table 2.5-4

Difference in Don Pedro Reservoir Storage (Acre-feet) Modified WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	10,552	10,546	10,546	10,549	0	0	0	3,139	-2,395	-4,568	-1,554	4,440
1922	6,030	6,026	6,027	6,029	0	0	0	5,184	0	-5	7	9
1923	1,608	1,607	0	0	0	0	0	-9,124	-11,208	-13,343	-10,291	-4,268
1924	-2,661	-2,660	-2,660	-2,661	-2,661	-2,660	764	5,875	5,784	5,674	8,573	14,491
1925	16,055	16,044	16,043	16,041	16,041	16,026	15,797	11,678	9,526	7,302	10,262	16,218
1926	17,783	17,773	17,278	17,283	17,209	17,778	17,484	18,161	-2,695	-2,684	322	6,311
1927	7,897	7,891	14,492	14,496	14,498	14,492	17,477	15,725	0	-2,184	2	9
1928	1,609	0	0	0	0	0	-899	2,911	787	784	3,774	9,750
1929	11,328	11,322	11,323	11,326	11,327	11,322	14,310	4,627	-6,889	-6,858	-3,833	2,170
1930	3,764	3,761	3,762	3,762	3,763	3,762	6,757	13,480	11,320	11,270	14,211	20,151
1931	21,706	21,692	21,693	21,700	21,702	21,694	24,670	30,593	30,483	30,339	33,182	39,058
1932	40,576	40,553	31,674	24,416	15,716	-1,032	-3,076	-1,657	-7,367	-9,517	-6,480	-468
1933	1,131	1,130	1,131	1,130	1,130	1,131	177	2,115	-9,670	-11,809	-8,760	-2,740
1934	-1,135	-1,135	1,150	-1,171	755	-1,211	-1,530	-6,447	-8,222	-8,183	-5,150	857
1935	2,453	2,452	2,452	-14,519	-30,168	-20,129	-25,734	-25,796	-43,945	-45,937	-42,745	-36,614
1936	-34,940	-34,921	-34,969	-34,941	1	0	0	4,470	2,341	148	3,140	9,121
1937	10,701	10,695	10,696	10,699	0	0	0	-2,568	-8,918	-11,064	-8,021	-2,006
1938	-404	-402	0	0	0	0	0	0	0	-2,183	2	9
1939	1,608	1,607	1,607	976	0	0	-12,780	-5,138	-7,235	-7,202	-4,176	1,827
1940	3,422	3,420	-502	2,277	1,426	0	0	12,724	9,006	8,966	11,921	17,872
1941	19,434	19,422	18,813	-3	0	0	0	5,573	0	-4	7	10
1942	1,608	1,607	1	1	0	0	0	0	0	0	7	9
1943	1,608	1,607	0	0	0	0	0	5,042	0	-2,183	2	10
1944	1,608	1,607	1,607	1,608	1,608	0	2,998	-19,024	-21,076	-23,169	-20,072	-14,015
1945	-12,387	-12,381	-12,381	-12,385	0	0	0	6,512	23,217	20,934	23,835	29,751
1946	31,289	106	0	0	0	0	0	1,291	-827	-823	2,173	8,155
1947	9,737	9,732	9,732	9,734	9,735	9,732	12,721	6,957	4,819	4,798	7,769	13,733
1948	15,301	15,293	15,293	15,297	15,299	15,293	14,531	16,879	7,186	5,052	8,089	14,092
1949	15,678	15,673	15,675	15,657	15,660	16,321	19,398	24,089	21,559	21,461	24,354	30,262
1950	31,798	31,779	20,780	29,360	14,494	11,170	14,470	19,919	26,493	24,987	27,865	33,761
1951	35,290	24,301	-1	0	0	0	1,622	7,921	2,378	184	3,176	9,155
1952	10,735	10,728	10,729	9,517	-1	0	0	0	0	-2,184	2	10
1953	1,608	1,608	1,607	-1	0	0	-14,862	-9,783	-10,670	-12,808	-9,760	-3,737
1954	-2,131	-2,130	-2,130	-2,131	-2,130	-2,130	871	-9,349	-11,433	-11,384	-8,339	-2,321
1955	-718	-718	-718	-718	-718	-717	216	3,316	-2,408	-2,398	607	6,594
1956	8,179	8,175	0	1	1	0	0	-1	0	0	7	9
1957	1,607	1,607	1,607	1,608	1,608	0	2,999	-20,075	-22,124	-24,212	-21,111	-15,050
1958	-13,421	-13,413	-13,413	-13,418	-13,419	0	0	0	0	0	7	9
1959	1,608	1,607	1,607	1,607	0	0	-2,197	-11,452	-11,414	-11,362	-8,316	-2,298
1960	-695	-694	-695	-694	-695	-789	1,150	8,837	8,808	8,767	11,719	17,666
1961	19,225	19,214	10,773	10,777	10,777	10,773	13,760	19,715	19,644	19,551	22,448	28,357
1962	29,897	29,880	29,882	29,890	29,893	29,881	32,850	-35,543	-39,188	-41,193	-38,008	-31,883
1963	-30,216	-30,197	-22,272	-8,960	-30,220	-30,209	-27,182	-28,787	-28,692	-30,750	-27,623	-21,543
1964	-19,901	-19,890	-19,891	-19,896	-8,124	-8,120	-7,231	-13,185	-35,078	-34,920	-31,764	-25,668
1965	-24,017	-24,003	-14,799	2	0	0	0	7,340	19,881	17,611	41	10
1966	1,608	0	0	0	0	0	-15,292	-7,644	-9,734	-9,690	-6,652	-639
1967	960	960	960	960	960	0	0	0	0	0	1	9
1968	1,608	1,608	1,607	1,608	1,608	0	2,998	-13,367	-15,436	-15,366	-12,301	-6,271
1969	-4,659	-4,656	-4,657	1	0	0	0	0	0	-2,184	2	10
1970	1,608	1,607	0	-4	0	0	2,999	254	-1,861	-4,036	-1,025	4,968
1971	6,557	6,552	6,553	6,554	6,556	0	2,999	-5,496	-7,593	-9,742	-6,707	-694
1972	905	905	905	904	905	905	3,902	-804	-2,916	-2,903	104	6,093
1973	7,679	7,675	7,675	7,677	7,678	0	0	1,016	0	0	2,993	8,974
1974	10,554	0	0	1	0	0	0	2,191	0	-2,184	2	10
1975	1,608	1,607	1,607	1,607	0	0	0	17,564	0	-4	6	9
1976	0	0	0	0	0	0	2,998	8,983	8,951	8,910	11,863	17,811
1977	19,371	19,360	19,360	19,366	19,367	19,360	22,339	28,269	28,172	28,028	30,876	36,726
1978	38,225	38,196	38,199	38,211	38,215	38,200	41,161	-4,293	0	-2,183	819	4,600
1979	5,095	5,092	5,092	-1	0	0	0	0	-2,114	-2,105	897	6,885
1980	8,468	8,464	8,465	-4	0	0	0	0	0	0	7	9
1981	1,608	1,607	1,607	1,608	1,607	0	882	-1,908	-13,555	-13,495	-10,440	-4,414
1982	-2,806	-2,805	-2,805	1	0	0	0	0	0	-2,183	-2	0
1983	0	0	0	0	0	0	0	0	0	0	-2,183	0
1984	-1,466	0	0	-1	0	0	2,802	-5,035	-7,133	-9,286	-6,251	-241
1985	1,358	1,357	1,357	1,358	1,357	1,358	4,355	15,162	12,997	12,939	15,871	21,809
1986	23,362	23,349	9	11,298	-1	0	0	0	0	-2,184	820	11
1987	1,610	1,608	1,609	1,609	1,609	1,608	4,606	10,587	1,110	1,104	4,092	10,068
1988	11,646	11,639	11,639	11,643	11,643	11,639	14,627	13,217	-19,630	-19,539	-16,454	-10,405
1989	-8,784	-8,779	-8,779	-8,782	-8,783	-8,780	-17,222	-26,333	-28,541	-28,412	-25,289	-19,211
1990	-17,572	-17,562	-17,563	-17,569	-17,569	-17,563	-14,547	-14,730	-8,961	-8,920	-5,885	125
1991	-3,473	-3,471	-4,843	-12,641	-14,145	-14,140	-11,143	-8,906	-21,810	-21,733	-18,658	-12,615
1992	-10,993	-10,988	-10,988	-10,992	-10,993	-10,990	4,598	-9,035	-9,042	-9,045	-6,047	-58
1993	1,526	1,524	-6,413	-14,665	-14,667	-19,965	-16,145	-12,014	0	-5	7	10
1994	1,608	1,607	1,607	1,608	1,608	1,607	4,604	-5,760	-7,855	-7,818	-4,789	1,217
1995	2,812	2,812	2,811	2,812	6,795	0	0	0	0	0	-2,184	6
1996	1,605	1,604	1,604	1,605	0	0	0	0	0	-2,183	820	11
1997	1,610	0	0	0	0	0	-9,578	-5,747	-7,843	-9,992	-6,955	-942
1998	658	658	658	0	0	0	0	0	0	0	7	10
1999	1,608	1,607	-1	0	0	0	0	-5,917	-8,693	-10,839	-7,799	-1,783
2000	-182	-181	-181	-182	0	0	0	1,226	0	0	2,994	8,974
2001	10,555	10,548	10,550	10,553	10,553	0	689	-23,644	-25,468	-25,355	-22,247	-16,182
2002	-14,549	-14,541	-14,542	-14,545	-14,547	-14,541	-11,529	-28,508	-30,526	-30,391	-27,258	-21,175
Avg (21-02)	4,307	3,621	2,642	2,388	1,759	1,233	1,715	-177	-3,240	-4,096	-1,896	2,500

to the SJPL in the alternative setting. Less inflow leads to less reservoir storage. Figure 2.5-1 illustrates that during drought sequences, a reduction to inflow to Don Pedro Reservoir can accumulate from year to year, particularly in the comparison of the WSIP and base settings. Compared to the base setting, storage in Don Pedro Reservoir in the alternative setting would be nearly the same. Figure 2.5-2 illustrates the difference in reservoir storage averaged by year type for the alternative and WSIP settings. Also shown is the average difference in storage for the two settings during the 82-year simulation. Figure 2.5-3 illustrates the same information for the alternative and base settings.

Figure 2.5-2

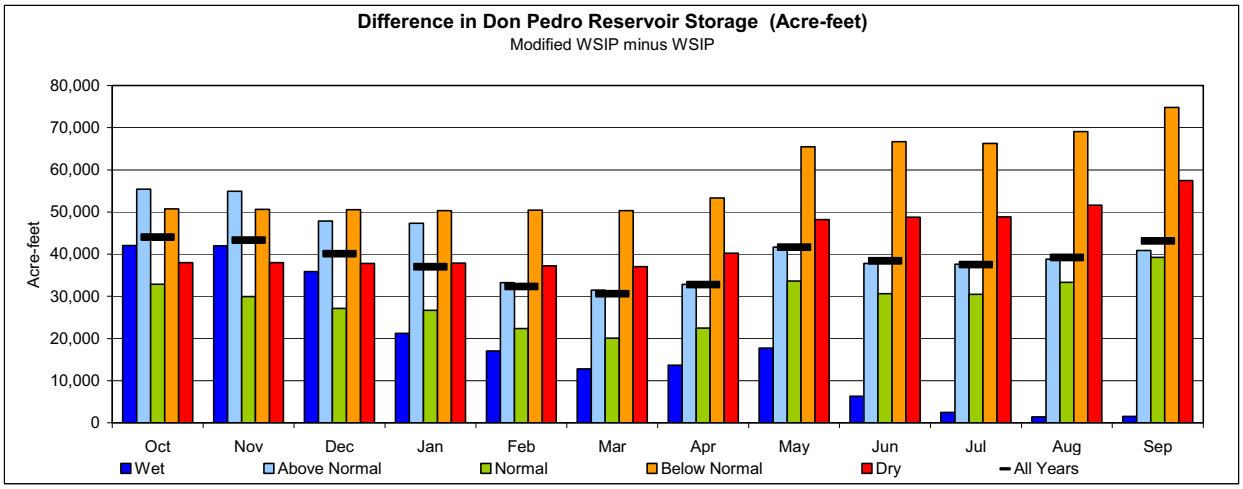


Figure 2.5-3

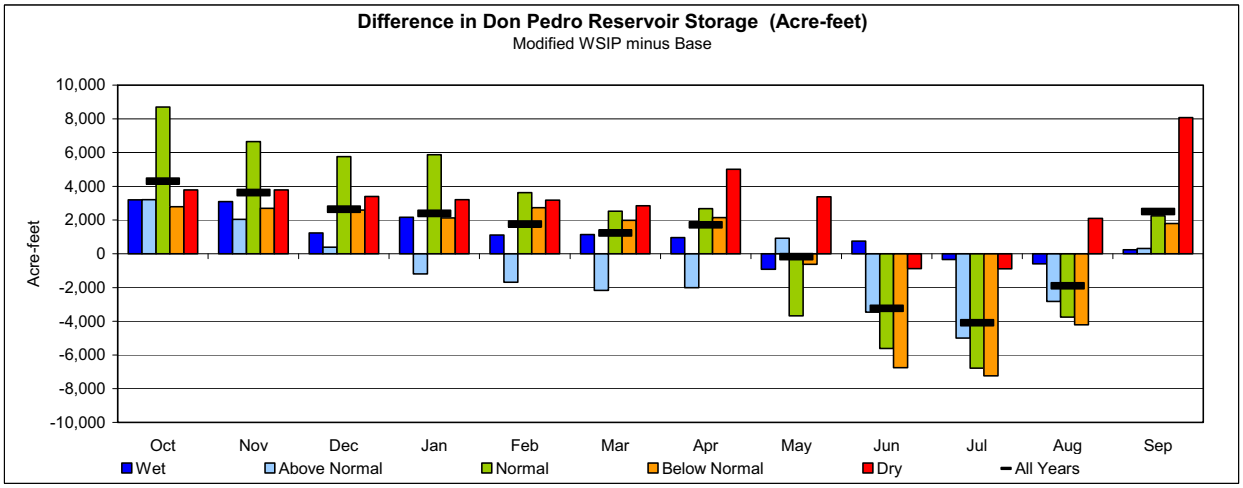
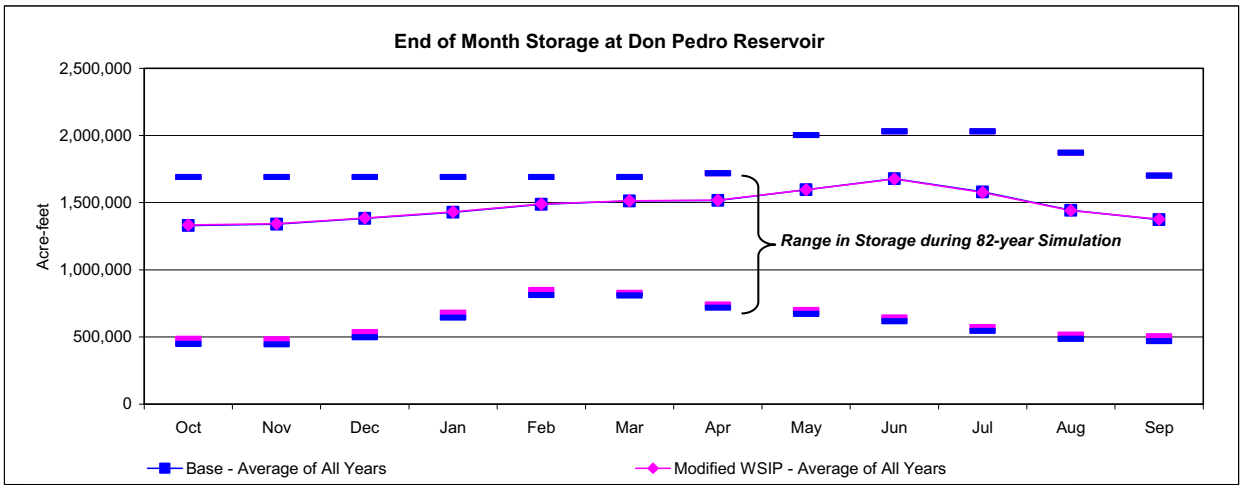


Figure 2.5-4 illustrates the average monthly storage in Don Pedro Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and base settings.

The simulation shows that the occasional large storage depletions in Don Pedro Reservoir associated with the WSIP would be largely ameliorated by the use of conserved water for the transfer. In the alternative setting, the SJPL diverts an average of 17,000 acre-feet more than in the base setting, and the transfer is an annual average of 19,600 acre-feet for design drought yield purposes. It is assumed that the conservation of water for the transfer is also 19,600 acre-feet every year to satisfy the SFPUC's need for yield during the design drought sequence. Because the conserved water transfer (occurring each year) would be greater than the SJPL/inflow effect, Don Pedro Reservoir storage, and the La Grange release to the Tuolumne River as described below, could be slightly larger at times than in the base setting. In a few other instances, Don Pedro Reservoir storage and La Grange releases could be lower. The development

and transfer of conserved water is not a perfect match (total elimination of effect) each year due to several factors, particularly the fact that the year-to-year and average numbers do not always coincide.

Figure 2.5-4



Sometimes a portion of the conserved water would be developed prior to an ensuing reservoir spill and could not be used to reduce an accumulating inflow deficit that occurred subsequent to the spill. Also, the additional SJPL diversion and its effect on Don Pedro Reservoir inflow would not occur at a constant year-to-year rate; sometimes more than the average effect, and sometimes less than the average effect, would occur. This circumstance could lead to a larger storage deficit in a year than the amount of water conserved in a year, and vise versa. Depending on the coincidence of the hydrologic sequence of Don Pedro Reservoir replenishment and the running accumulation of the inflow effect, the storage deficit might not be totally ameliorated during all hydrologic sequences.

The difference in storage in Don Pedro Reservoir attributed to the upstream effects of the alternative and the countering reduction in the TID/MID canal diversions would manifest in differences in releases from La Grange Dam to the stream. A different amount of available reservoir space in the winter and spring due to the alternative would lead to a different ability to regulate inflow, thus potentially changing the amount of water released to the stream that is in excess of minimum release requirements. During periods when inflow or canal diversions differ and Don Pedro Reservoir is at maximum capacity within the flood control storage limitation, a change in inflow or canal diversions directly manifests as a change in releases from La Grange Dam (a change of either more or less flow). Figure 2.5-1 illustrates the stream releases from La Grange Dam for the WSIP, alternative, and base settings.

Table 2.5-5 illustrates the difference in stream releases between the alternative and WSIP settings. Compared to the WSIP setting, the alternative exhibits an incrementally larger stream release, predominately during some months of the early winter through June period, which is reflective of the months when releases to the stream are made in excess of minimum release requirements due to flood control or in anticipation of filling the reservoir. Table 2.5-6 shows the same information for the alternative and WSIP settings, arranged by ranking the years in descending order of the San Joaquin River Index (an index indicating the wetness of the Tuolumne River Basin and the San Joaquin River Basin). The table illustrates the finding that differences in releases to the Tuolumne River from La Grange Dam occur only when there are releases in excess of minimum FERC flow requirements. This circumstance typically occurs only in above-normal and wet years, and predominately during early winter through June. During late summer of above-normal and wet years (August and September) there may also be releases in excess of minimum FERC flow requirements. These releases are associated with the drawdown of Don Pedro Reservoir during antecedent wetter years in anticipation of fall-time flood control objectives. During other year types and typically during the summer and fall, releases would be maintained at minimum FERC flow requirements regardless of the setting. Compared to the WSIP setting, the large potential reduction in flow following an extended drought period is reduced with the alternative, since the amount of water delivered by the SFPUC during these periods is somewhat less than that delivered in the WSIP setting, and the water for additional deliveries is derived from conserved water in Don Pedro Reservoir.

As described above concerning Don Pedro Reservoir inflow, releases, and storage, compared to the base setting the alternative setting would lead to a mixed effect on La Grange releases. Table 2.5-7 illustrates the difference in stream releases between the alternative and base settings. Table 2.5-8 shows the same information ranked in descending order of the San Joaquin River Index. Overall, releases below La Grange Dam are very similar between the alternative and base settings. This circumstance is the intended result of the mitigation measure under this alternative to use conserved water to offset the Don Pedro Reservoir inflow effect of the SFPUC's additional diversion of water from the Tuolumne River. As seen in some months, such as August and September, there are occasional increases in La Grange releases. These are instances when developing conserved water every year sometimes only adds to the water that would be released in excess of FERC requirements during a drawdown of storage prior to the fall flood control level at Don Pedro. Also, some positive values occur when early-season conserved water only adds to Don Pedro spills prior to filling.

In year-to-year operations, the conserved water could be adjusted if it would merely turn into an unneeded spill. However, outside of flood events, additional flow during the summer as a result of the conserved could be welcomed. For purposes of this analysis, the conserved water is assumed to be developed each year. However, it should be noted that the additional flow that occurs due to the conserved water was not explicitly patterned for any purpose except to draw Don Pedro Reservoir down to flood control objectives.

Table 2.5-5 and Table 2.5-7 illustrate the difference in stream releases among the alternative, WSIP, and base settings, expressed in terms of a monthly volume (acre-feet) of flow. Table 2.5-9 presents the same information and the average monthly stream releases for the alternative and WSIP settings, expressed in total monthly flow (acre-feet), and Table 2.5-10 shows the same information for the alternative and base settings. For the comparison of the alternative to the WSIP setting, the difference in monthly flow below La Grange Dam could range from an increase of approximately 212,000 acre-feet to a decrease of approximately 6,000 acre-feet. Considering the manner in which releases are determined and made to the stream, it is not always meaningful to quantify the effect of these changes in terms of average monthly flow (cfs). Similar to the operation of releases below O'Shaughnessy Dam, a change in the volume of release from La Grange Dam to the stream would likely delay or accelerate the initiation of the release by a matter of days. Using the assumption that a change in release volume equates to a delay or acceleration of releasing 6,000 acre-feet per day means that the difference in stream release from La Grange Dam between the alternative and WSIP would be an additional day of delay in releases or up to almost an added month of releases. Normally, a change in release would not affect the peak stream release rate during a year. Compared to the base setting, the alternative's effect on stream flow ranges from a reduction in releases (a potential delay in release of five days) to an increase in releases (a potential additional five days of release). In either direction, the maximum difference in La Grange releases between the alternative and base settings was reduced to about 30,000 acre-feet as the result of the conserved water measure.

APPENDIX O2

Table 2.5-5

Difference in Total La Grange Release to River (Acre-feet) Modified WSIP minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	10,550	1,295	3,379	0	0	0	0	0	15,224
1922	0	0	0	0	11,163	7,312	8,524	0	16,332	0	2,994	5,997	52,322
1923	0	0	1,607	0	0	0	6,038	0	0	0	0	0	7,645
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	34,956	0	9,765	19,149	63,870
1928	0	21,878	34,469	3,128	14,851	-1	0	0	0	0	0	0	74,325
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	212,095	4,633	6,756	0	0	0	0	0	223,484
1937	0	0	0	0	25,974	2,039	8,664	0	0	0	0	0	36,677
1938	0	0	21,216	0	0	39	8,009	10,282	1,197	0	2,993	5,997	49,733
1939	0	0	0	631	977	0	0	0	0	0	0	0	1,608
1940	0	0	0	0	0	34,432	7,881	0	0	0	0	0	42,313
1941	0	0	0	15,508	-2	0	3,000	0	7,853	0	2,994	5,997	35,350
1942	0	0	1,607	3,047	-1	0	8,524	6,000	0	0	2,994	5,997	28,168
1943	0	0	1,606	0	0	4,889	6,867	0	8,413	0	2,994	5,997	30,766
1944	0	0	0	0	0	1,608	0	0	0	0	0	0	1,608
1945	0	0	0	0	25,070	-1	4,026	0	0	0	0	0	29,095
1946	0	23,867	0	0	0	1,237	4,040	0	0	0	0	0	29,144
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	140,857	-3	0	0	0	0	0	0	0	0	140,854
1952	0	0	0	0	30,875	-1	3,000	16,030	1,197	0	2,994	5,997	60,092
1953	0	0	0	1,607	0	0	0	0	0	0	0	0	1,607
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	37,840	38,536	-5	0	5,578	0	8,413	0	2,994	5,997	99,353
1957	0	0	0	0	0	1,607	0	0	0	0	0	0	1,607
1958	0	0	0	0	0	25,042	3,001	15,426	1,013	0	2,993	5,997	53,472
1959	0	0	0	0	1,607	0	0	0	0	0	0	0	1,607
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	170,933	5,134	0	11,075	0	0	0	7,341	6,007	200,490
1966	0	1,607	523	0	16,091	-6,452	0	0	0	0	0	0	11,769
1967	0	0	0	0	0	16,553	3,000	19,378	921	0	2,994	5,997	48,843
1968	0	0	0	0	0	1,608	0	0	0	0	0	0	1,608
1969	0	0	0	20,586	624	10,837	7,879	6,000	0	0	2,993	5,997	54,916
1970	0	0	1,608	2,855	-1	0	0	0	0	0	0	0	4,462
1971	0	0	0	0	0	22,086	0	0	0	0	0	0	22,086
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	14,881	3,620	0	60,484	0	0	0	78,985
1974	0	10,551	0	0	0	6,659	7,603	0	8,413	0	2,993	5,997	42,216
1975	0	0	0	0	1,608	0	8,524	0	11,264	0	2,993	5,996	30,385
1976	1,610	0	0	0	0	0	0	0	0	0	0	0	1,610
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	76,662	0	0	1,901	78,563
1979	0	0	0	8,659	-1	4,729	3,000	6,000	0	0	0	0	22,387
1980	0	0	0	17,403	-3	4,947	5,577	6,000	0	0	2,994	5,997	42,915
1981	0	0	0	0	0	1,607	0	0	0	0	0	0	1,607
1982	0	0	0	24,409	11,947	0	3,000	7,903	1,841	0	2,994	6,006	58,100
1983	1,600	0	952	1	0	0	3,001	12,688	1,841	0	3,000	6,000	29,083
1984	0	2,518	1	0	0	0	0	0	0	0	0	0	2,519
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	9	0	40,478	11,649	13,634	7,236	1,197	0	0	8,974	83,177
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	95,016	61,107	24,874	10,886	191,883
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	33,024	13,398	6,857	829	0	3,000	5,991	63,099
1996	0	0	0	0	2,529	0	5,118	6,000	0	0	0	8,974	22,621
1997	0	1,612	0	4,729	-1	0	0	0	0	0	0	0	6,340
1998	0	0	0	19,380	-3	7,782	9,445	7,046	1,012	0	2,993	5,997	53,652
1999	0	0	1,607	0	0	1,902	10,708	0	0	0	0	0	14,217
2000	0	0	0	0	18,913	0	3,000	0	11,583	0	0	0	33,496
2001	0	0	0	0	0	10,551	2,311	0	0	0	0	0	12,862
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	39	757	2,974	4,042	5,250	2,762	2,453	1,620	4,274	745	1,133	1,925	27,973

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Table 2.5-6

Difference in Total La Grange Release to River (Acre-feet)

Matrix Data for Water Year 1921-2002 Rank Ordered by Descending Unimpaired Runoff at LaGrange

Modified WSIP minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1983	1,600	0	952	1	0	0	3,001	12,688	1,841	0	3,000	6,000	29,083
1995	0	0	0	0	0	33,024	13,398	6,857	829	0	3,000	5,991	63,099
1969	0	0	0	20,586	624	10,837	7,879	6,000	0	0	2,993	5,997	54,916
1982	0	0	0	24,409	11,947	0	3,000	7,903	1,841	0	2,994	6,006	58,100
1938	0	0	21,216	0	0	39	8,009	10,282	1,197	0	2,993	5,997	49,733
1998	0	0	0	19,380	-3	7,782	9,445	7,046	1,012	0	2,993	5,997	53,652
1997	0	1,612	0	4,729	-1	0	0	0	0	0	0	0	6,340
1956	0	0	37,840	38,536	-5	0	5,578	0	8,413	0	2,994	5,997	99,353
1967	0	0	0	0	0	16,553	3,000	19,378	921	0	2,994	5,997	48,843
1980	0	0	0	17,403	-3	4,947	5,577	6,000	0	0	2,994	5,997	42,915
1986	0	0	9	0	40,478	11,649	13,634	7,236	1,197	0	0	8,974	83,177
1952	0	0	0	0	30,875	-1	3,000	16,030	1,197	0	2,994	5,997	60,092
1978	0	0	0	0	0	0	0	0	76,662	0	0	1,901	78,563
1965	0	0	0	170,933	5,134	0	11,075	0	0	0	7,341	6,007	200,490
1958	0	0	0	0	0	25,042	3,001	15,426	1,013	0	2,993	5,997	53,472
1993	0	0	0	0	0	0	0	0	95,016	61,107	24,874	10,886	191,883
1941	0	0	0	15,508	-2	0	3,000	0	7,853	0	2,994	5,997	35,350
1951	0	0	140,857	-3	0	0	0	0	0	0	0	0	140,854
1922	0	0	0	0	11,163	7,312	8,524	0	16,332	0	2,994	5,997	52,322
1984	0	2,518	1	0	0	0	0	0	0	0	0	0	2,519
1943	0	0	1,606	0	0	4,889	6,867	0	8,413	0	2,994	5,997	30,766
1942	0	0	1,607	3,047	-1	0	8,524	6,000	0	0	2,994	5,997	28,168
1996	0	0	0	0	2,529	0	5,118	6,000	0	0	0	8,974	22,621
1974	0	10,551	0	0	0	6,659	7,603	0	8,413	0	2,993	5,997	42,216
1940	0	0	0	0	0	34,432	7,881	0	0	0	0	0	42,313
1936	0	0	0	0	212,095	4,633	6,756	0	0	0	0	0	223,484
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	1,607	0	0	1,902	10,708	0	0	0	0	0	14,217
1945	0	0	0	0	25,070	-1	4,026	0	0	0	0	0	29,095
1927	0	0	0	0	0	0	0	0	34,956	0	9,765	19,149	63,870
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	1,608	0	8,524	0	11,264	0	2,993	5,996	30,385
1973	0	0	0	0	0	14,881	3,620	0	60,484	0	0	0	78,985
1921	0	0	0	0	10,550	1,295	3,379	0	0	0	0	0	15,224
1937	0	0	0	0	25,974	2,039	8,664	0	0	0	0	0	36,677
1970	0	0	1,608	2,855	-1	0	0	0	0	0	0	0	4,462
2000	0	0	0	0	18,913	0	3,000	0	11,583	0	0	0	33,496
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	8,659	-1	4,729	3,000	6,000	0	0	0	0	22,387
1946	0	23,867	0	0	0	1,237	4,040	0	0	0	0	0	29,144
1923	0	0	1,607	0	0	0	6,038	0	0	0	0	0	7,645
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	22,086	0	0	0	0	0	0	22,086
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	1,607	0	0	0	0	0	0	0	0	1,607
1928	0	21,878	34,469	3,128	14,851	-1	0	0	0	0	0	0	74,325
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	1,607	0	0	0	0	0	0	1,607
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	1,607	523	0	16,091	-6,452	0	0	0	0	0	0	11,769
1944	0	0	0	0	0	1,608	0	0	0	0	0	0	1,608
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	10,551	2,311	0	0	0	0	0	12,862
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	1,607	0	0	0	0	0	0	1,607
1968	0	0	0	0	0	1,608	0	0	0	0	0	0	1,608
1959	0	0	0	0	1,607	0	0	0	0	0	0	0	1,607
1939	0	0	0	631	977	0	0	0	0	0	0	0	1,608
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	1,610	0	0	0	0	0	0	0	0	0	0	0	1,610
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0

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Table 2.5-7

Difference in Total La Grange Release to River (Acre-feet) Modified WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	10,550	-12,107	125	0	0	0	0	0	-1,432
1922	0	0	0	0	6,029	0	1,159	0	296	-2,183	2,989	5,997	14,287
1923	0	0	1,607	0	0	0	3,920	0	0	0	0	0	5,527
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	8,049	0	820	5,993	14,862
1928	0	1,608	0	0	0	0	-8,905	0	0	0	0	0	-7,297
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	-34,944	-12,257	3,121	0	0	0	0	0	-44,080
1937	0	0	0	0	9,774	-1,156	151	0	0	0	0	0	8,769
1938	0	0	1,626	0	0	0	866	-6,732	-3,683	0	820	5,992	-1,111
1939	0	0	0	631	977	0	0	0	0	0	0	0	1,608
1940	0	0	0	0	0	-3,763	2,203	0	0	0	0	0	-1,560
1941	0	0	0	18,819	-448	-422	2,481	0	4,317	-2,184	2,989	5,997	31,549
1942	0	0	1,607	-2,495	0	-2,664	3,000	3,146	-2,762	-2,188	2,994	5,997	6,635
1943	0	0	1,606	0	0	2,888	146	0	4,114	0	820	5,992	15,566
1944	0	0	0	0	0	1,608	0	0	0	0	0	0	1,608
1945	0	0	0	0	-12,386	-15,316	3,824	0	0	0	0	0	-23,878
1946	0	31,175	106	0	0	-10,971	428	0	0	0	0	0	20,738
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	24,303	0	0	0	0	0	0	0	0	0	24,303
1952	0	0	0	0	9,518	-1	3,000	151	-920	0	820	5,993	18,561
1953	0	0	0	1,607	0	0	0	0	0	0	0	0	1,607
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	772	0	0	-3,555	2,510	0	-921	-2,188	2,994	5,997	5,609
1957	0	0	0	0	0	1,607	0	0	0	0	0	0	1,607
1958	0	0	0	0	0	-13,416	3,001	3,936	0	-2,188	2,993	5,997	323
1959	0	0	0	0	1,607	0	0	0	0	0	0	0	1,607
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	-11,774	0	0	0	0	0	0	0	-11,774
1965	0	0	0	-14,803	2	-10,710	1,306	0	0	0	18,344	6,031	170
1966	0	1,608	-629	0	-1,078	-6,452	0	0	0	0	0	0	-6,551
1967	0	0	0	0	0	-1,945	3,000	6,951	921	-2,188	810	5,992	13,541
1968	0	0	0	0	0	1,608	0	0	0	0	0	0	1,608
1969	0	0	0	-4,658	-1,824	0	238	3,812	-2,117	0	819	5,993	2,263
1970	0	0	1,608	29,451	-5,958	-21,074	0	0	0	0	0	0	4,027
1971	0	0	0	0	0	6,554	0	0	0	0	0	0	6,554
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	7,677	3,000	0	94	0	0	0	10,771
1974	0	10,551	0	-8,392	1	-3,806	3,000	0	-1,494	0	819	5,992	6,671
1975	0	0	0	0	1,608	0	238	0	17,785	-2,183	2,989	5,996	26,433
1976	1,610	0	0	0	0	0	0	0	0	0	0	0	1,610
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	-12,821	0	0	1,901	-10,920
1979	0	0	0	5,094	-1	-11,490	882	3,812	0	0	0	0	-1,703
1980	0	0	0	25,044	-4	-2,664	698	3,812	-2,118	-2,188	2,994	5,997	31,571
1981	0	0	0	0	0	1,607	0	0	0	0	0	0	1,607
1982	0	0	0	-2,806	396	0	3,000	6,000	0	0	-1,364	3,879	9,105
1983	554	2,762	0	0	0	0	3,001	3,146	-2,762	-2,188	3,000	3,820	11,333
1984	0	4,057	1	0	0	3,936	0	0	0	0	0	0	7,994
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	9	0	23,365	-8,478	2,334	2,194	-3,683	0	0	6,807	22,548
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	-35,371	-2,184	2,988	5,997	-28,570
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	23,761	4,192	4,954	-1,013	-2,188	3,000	3,814	36,520
1996	0	0	0	0	835	0	238	958	-4,880	0	0	6,807	3,958
1997	0	1,609	0	-1,479	0	0	0	0	0	0	0	0	130
1998	0	0	0	658	0	4,663	-1,603	3,146	-2,762	-2,188	2,993	5,997	10,904
1999	0	0	1,607	0	0	-6,660	-274	0	0	0	0	0	-5,327
2000	0	0	0	0	-181	0	3,000	0	-893	0	0	0	1,926
2001	0	0	0	0	0	10,551	2,311	0	0	0	0	0	12,862
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	26	651	417	569	-48	-1,005	605	479	-520	-320	678	1,573	3,106

APPENDIX O2

Table 2.5-8

Difference in Total La Grange Release to River (Acre-feet)

Matrix Data for Water Year 1921-2002 Rank Ordered by Descending Unimpaired Runoff at LaGrange

Modified WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1983	554	2,762	0	0	0	0	3,001	3,146	-2,762	-2,188	3,000	3,820	11,333
1995	0	0	0	0	0	23,761	4,192	4,954	-1,013	-2,188	3,000	3,814	36,520
1969	0	0	0	-4,658	-1,824	0	238	3,812	-2,117	0	819	5,993	2,263
1982	0	0	0	-2,806	396	0	3,000	6,000	0	0	-1,364	3,879	9,105
1938	0	0	1,626	0	0	0	866	-6,732	-3,683	0	820	5,992	-1,111
1998	0	0	0	658	0	4,663	-1,603	3,146	-2,762	-2,188	2,993	5,997	10,904
1997	0	1,609	0	-1,479	0	0	0	0	0	0	0	0	130
1956	0	0	772	0	0	-3,555	2,510	0	-921	-2,188	2,994	5,997	5,609
1967	0	0	0	0	0	-1,945	3,000	6,951	921	-2,188	810	5,992	13,541
1980	0	0	0	25,044	-4	-2,664	698	3,812	-2,118	-2,188	2,994	5,997	31,571
1986	0	0	9	0	23,365	-8,478	2,334	2,194	-3,683	0	0	6,807	22,548
1952	0	0	0	0	9,518	-1	3,000	151	-920	0	820	5,993	18,561
1978	0	0	0	0	0	0	0	0	-12,821	0	0	1,901	-10,920
1965	0	0	0	-14,803	2	-10,710	1,306	0	0	0	18,344	6,031	170
1958	0	0	0	0	0	-13,416	3,001	3,936	0	-2,188	2,993	5,997	323
1993	0	0	0	0	0	0	0	0	-35,371	-2,184	2,988	5,997	-28,570
1941	0	0	0	18,819	-448	-422	2,481	0	4,317	-2,184	2,989	5,997	31,549
1951	0	0	24,303	0	0	0	0	0	0	0	0	0	24,303
1922	0	0	0	0	6,029	0	1,159	0	296	-2,183	2,989	5,997	14,287
1984	0	4,057	1	0	0	3,936	0	0	0	0	0	0	7,994
1943	0	0	1,606	0	0	2,888	146	0	4,114	0	820	5,992	15,566
1942	0	0	1,607	-2,495	0	-2,664	3,000	3,146	-2,762	-2,188	2,994	5,997	6,635
1996	0	0	0	0	835	0	238	958	-4,880	0	0	6,807	3,958
1974	0	10,551	0	-8,392	1	-3,806	3,000	0	-1,494	0	819	5,992	6,671
1940	0	0	0	0	0	-3,763	2,203	0	0	0	0	0	-1,560
1936	0	0	0	0	-34,944	-12,257	3,121	0	0	0	0	0	-44,080
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	1,607	0	0	-6,660	-274	0	0	0	0	0	-5,327
1945	0	0	0	0	-12,386	-15,316	3,824	0	0	0	0	0	-23,878
1927	0	0	0	0	0	0	0	0	8,049	0	820	5,993	14,862
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	1,608	0	238	0	17,785	-2,183	2,989	5,996	26,433
1973	0	0	0	0	0	7,677	3,000	0	94	0	0	0	10,771
1921	0	0	0	0	10,550	-12,107	125	0	0	0	0	0	-1,432
1937	0	0	0	0	9,774	-1,156	151	0	0	0	0	0	8,769
1970	0	0	1,608	29,451	-5,958	-21,074	0	0	0	0	0	0	4,027
2000	0	0	0	0	-181	0	3,000	0	-893	0	0	0	1,926
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	5,094	-1	-11,490	882	3,812	0	0	0	0	-1,703
1946	0	31,175	106	0	0	-10,971	428	0	0	0	0	0	20,738
1923	0	0	1,607	0	0	0	3,920	0	0	0	0	0	5,527
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	6,554	0	0	0	0	0	0	6,554
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	1,607	0	0	0	0	0	0	0	0	1,607
1928	0	1,608	0	0	0	0	-8,905	0	0	0	0	0	-7,297
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	1,607	0	0	0	0	0	0	1,607
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	1,608	-629	0	-1,078	-6,452	0	0	0	0	0	0	-6,551
1944	0	0	0	0	0	1,608	0	0	0	0	0	0	1,608
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	-11,774	0	0	0	0	0	0	0	-11,774
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	10,551	2,311	0	0	0	0	0	12,862
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	1,607	0	0	0	0	0	0	1,607
1968	0	0	0	0	0	1,608	0	0	0	0	0	0	1,608
1959	0	0	0	0	1,607	0	0	0	0	0	0	0	1,607
1939	0	0	0	631	977	0	0	0	0	0	0	0	1,608
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	1,610	0	0	0	0	0	0	0	0	0	0	0	1,610
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0

APPENDIX O2

Table 2.5-9

Total La Grange Release to River (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)

Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	23,001	21,563	56,842	151,415	186,738	273,821	217,239	244,709	227,921	142,651	69,115	50,878	1,665,894
Above Normal	18,683	31,026	67,978	74,978	128,547	166,616	131,514	79,097	84,366	27,869	21,031	21,212	852,917
Normal	18,264	17,579	35,872	51,349	74,834	104,445	85,081	78,304	20,306	9,992	9,992	9,670	515,686
Below Normal	17,105	13,863	19,925	15,874	17,549	21,794	34,964	33,554	4,025	4,160	4,160	4,025	190,997
Dry	17,340	13,842	14,866	13,990	15,673	20,873	21,732	21,240	3,347	3,459	3,459	3,347	153,168
All Years	18,855	19,645	39,215	61,129	84,385	116,941	97,743	90,526	67,413	37,099	21,333	17,699	671,982

Total La Grange Release to River (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)

WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	22,901	21,463	53,092	132,916	181,173	266,954	211,640	237,532	215,975	138,831	65,042	45,019	1,592,538
Above Normal	18,683	30,258	59,409	73,887	113,696	163,096	126,954	78,391	79,235	27,869	19,400	17,441	808,318
Normal	18,264	14,720	33,517	50,334	70,441	101,554	83,097	77,929	15,802	9,992	9,992	9,670	495,309
Below Normal	17,105	13,768	19,894	15,874	16,603	21,364	34,828	33,554	4,025	4,160	4,160	4,025	189,359
Dry	17,240	13,842	14,866	13,950	15,511	20,672	21,732	21,240	3,347	3,459	3,459	3,347	152,665
All Years	18,815	18,888	36,241	57,087	79,135	114,179	95,290	88,906	63,139	36,354	20,200	15,774	644,009

Difference in Total La Grange Release to River (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)

Modified WSIP minus WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	100	101	3,751	18,499	5,565	6,867	5,600	7,178	11,946	3,819	4,072	5,859	73,357
Above Normal	0	769	8,569	1,091	14,851	3,519	4,561	706	5,131	0	1,631	3,771	44,599
Normal	0	2,859	2,355	1,016	4,393	2,892	1,984	375	4,504	0	0	0	20,377
Below Normal	0	95	31	0	947	430	136	0	0	0	0	0	1,638
Dry	101	0	0	39	162	201	0	0	0	0	0	0	503
All Years	39	757	2,974	4,042	5,250	2,762	2,453	1,620	4,274	745	1,133	1,925	27,973

Table 2.5-10

Total La Grange Release to River (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)

Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	23,001	21,563	56,842	151,415	186,738	273,821	217,239	244,709	227,921	142,651	69,115	50,878	1,665,894
Above Normal	18,683	31,026	67,978	74,978	128,547	166,616	131,514	79,097	84,366	27,869	21,031	21,212	852,917
Normal	18,264	17,579	35,872	51,349	74,834	104,445	85,081	78,304	20,306	9,992	9,992	9,670	515,686
Below Normal	17,105	13,863	19,925	15,874	17,549	21,794	34,964	33,554	4,025	4,160	4,160	4,025	190,997
Dry	17,340	13,842	14,866	13,990	15,673	20,873	21,732	21,240	3,347	3,459	3,459	3,347	153,168
All Years	18,855	19,645	39,215	61,129	84,385	116,941	97,743	90,526	67,413	37,099	21,333	17,699	671,982

Total La Grange Release to River (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)

Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	22,967	21,290	56,692	151,293	184,772	274,592	215,643	242,749	232,124	143,744	66,539	45,865	1,658,271
Above Normal	18,683	30,167	66,265	74,511	130,859	168,855	130,389	78,856	82,871	28,383	20,182	18,343	848,363
Normal	18,264	15,530	35,664	49,090	73,947	107,106	84,918	78,066	20,356	9,992	9,992	9,670	512,593
Below Normal	17,105	13,768	19,962	15,874	18,305	21,364	34,828	33,554	4,025	4,160	4,160	4,025	191,130
Dry	17,240	13,842	14,866	13,950	15,511	20,672	21,732	21,240	3,347	3,459	3,459	3,347	152,665
All Years	18,828	18,994	38,798	60,559	84,433	117,947	97,139	90,047	67,933	37,419	20,654	16,126	668,876

Difference in Total La Grange Release to River (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)

Modified WSIP minus Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	35	273	150	122	1,966	-772	1,596	1,961	-4,203	-1,094	2,576	5,013	7,624
Above Normal	0	859	1,713	467	-2,312	-2,239	1,126	241	1,496	-514	848	2,869	4,554
Normal	0	2,049	208	2,260	887	-2,660	163	238	-50	0	0	0	3,093
Below Normal	0	95	-37	0	-756	430	136	0	0	0	0	0	-132
Dry	101	0	0	39	162	201	0	0	0	0	0	0	503
All Years	26	651	417	569	-48	-1,005	605	479	-520	-320	678	1,573	3,106

2.6 Calaveras and San Antonio Reservoirs, Alameda Creek, and Downstream

Compared to the WSIP setting, the operation of Calaveras Reservoir in the alternative setting is almost identical. Figure 2.6-1 illustrates a chronological trace of the simulation of Calaveras Reservoir storage and stream releases from Calaveras Dam. Shown in Figure 2.6-1 are the results for the WSIP, alternative, and base settings. In recognition of the different levels of systemwide deliveries served in each setting, the near identical operation of Calaveras Reservoir resulting from the two settings is an indication that Calaveras Reservoir operations are mostly influenced by the principles that manage local watershed production. The slight differences in reservoir operation are the result of modeling assumptions that balance reservoir storage among SFPUC reservoirs and the selection of the monthly SJPL conveyance rate. It is anticipated that the difference in Calaveras Reservoir operation during actual operations would be minimal, if any difference occurred at all. The difference in storage between the alternative and WSIP settings and the base setting is due to the restoration of the operational capacity of Calaveras Reservoir. Under both the alternative and WSIP settings, the full capacity of Calaveras Reservoir would be available, and a greater range in storage operation would occur. Figure 2.6-2 illustrates the average monthly storage in Calaveras Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and base settings.

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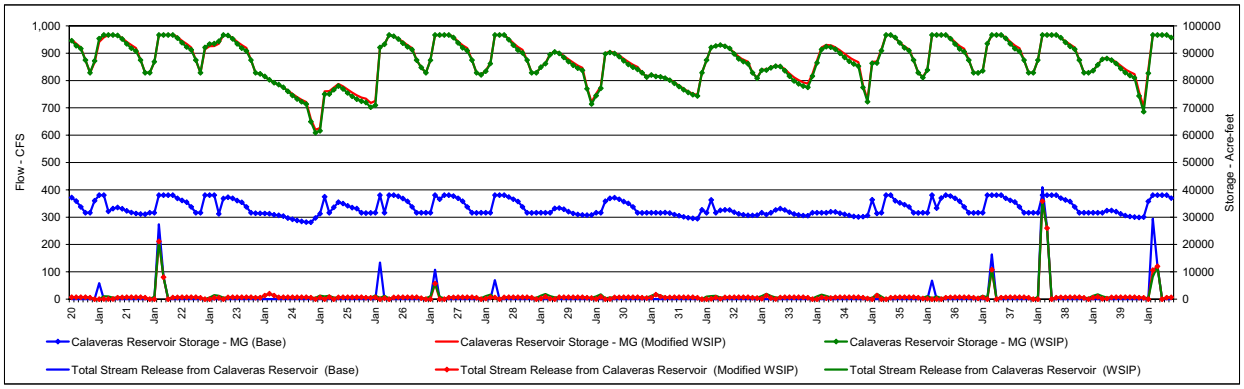
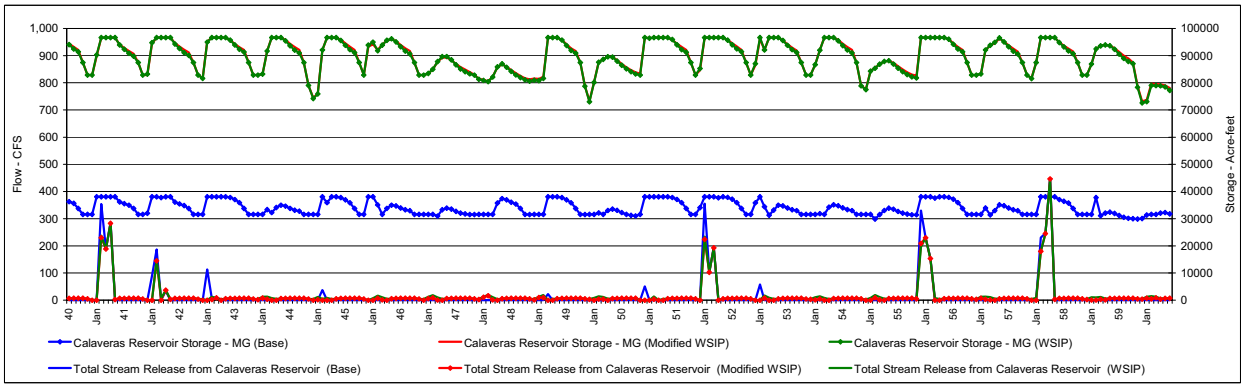
Figure 2.6-1
Calaveras Reservoir Storage and Stream Release

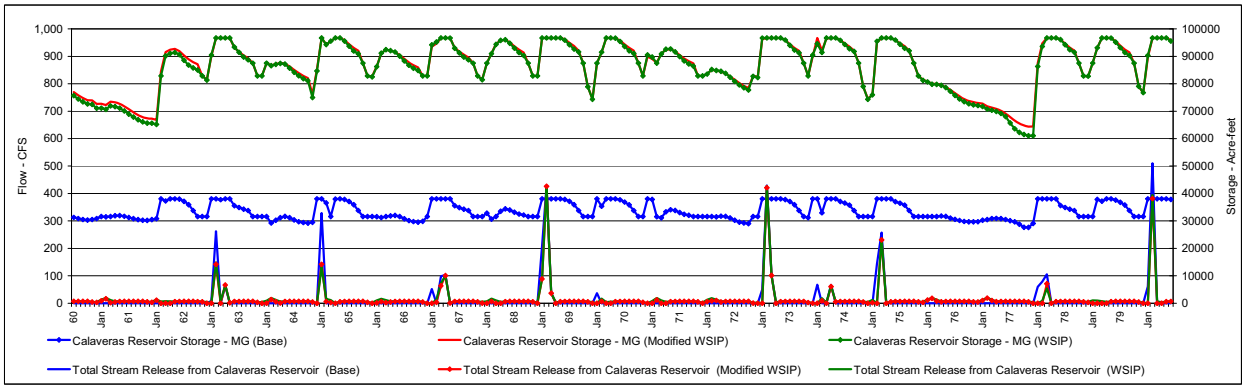
1920 - 1939



1940 - 1959



1960 - 1979



1980 - 2002

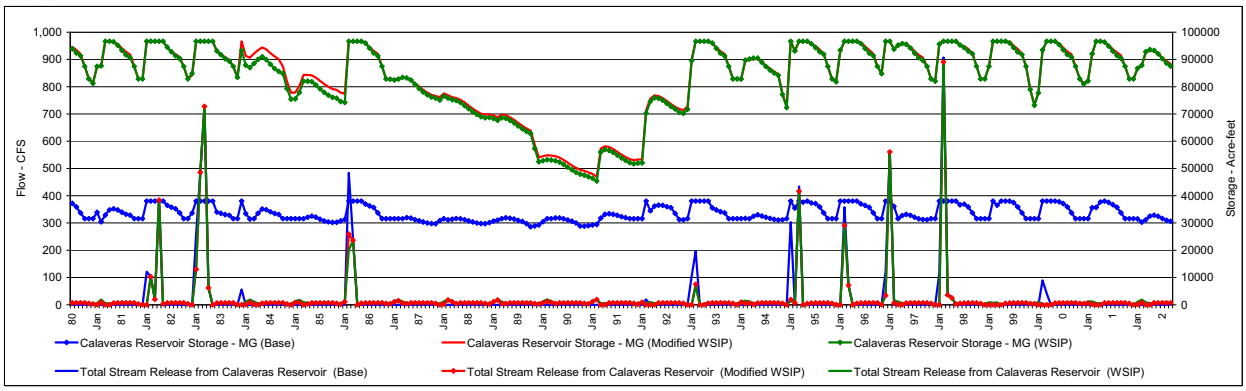


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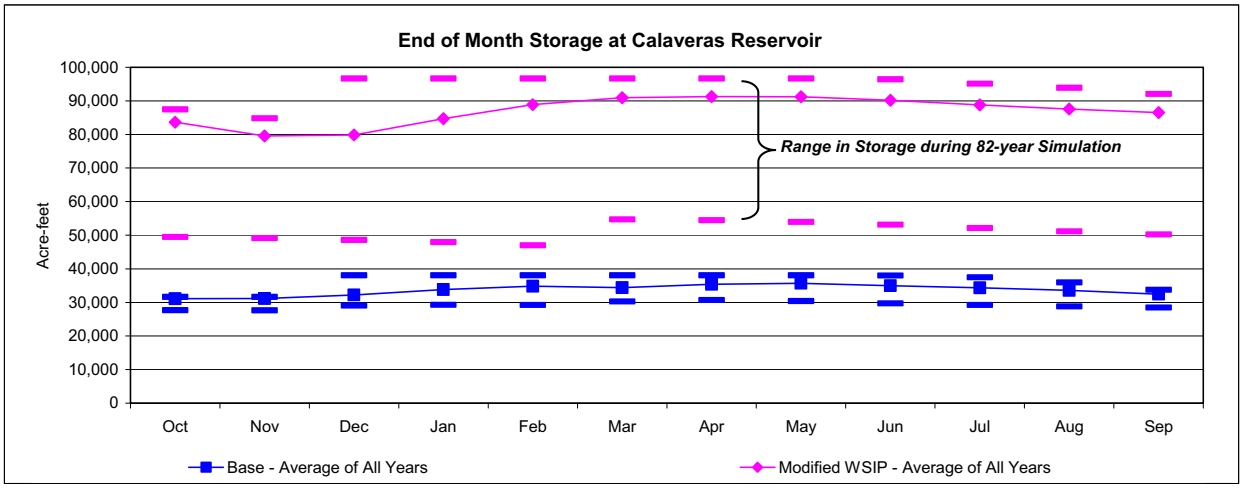
Figure 2.6-2



There would be almost identical spills from Calaveras Reservoir for the alternative and WSIP settings. Both the alternative and WSIP settings have fishery releases (1997 CDFG MOU) that are not included in the base setting. Table 2.6-1 illustrates the difference in releases to Calaveras Creek between the alternative and WSIP settings. The difference in flow (for the reach below Calaveras Reservoir to the confluence with Alameda Creek) during December through April is due to the flow bypass measure at ACDD that is associated with the Modified WSIP setting. The reductions in flow in this reach of stream are an indication that bypass flow is being provided at the diversion dam and is subsequently used to contribute to the 1997 MOU flow requirement at the confluence. The bypass flow does not exist in the WSIP setting, and additional releases would be required from Calaveras Reservoir to meet the 1997 MOU flow requirement. Supplementing the Figure 2.6-1 representation of Calaveras Dam stream releases and Table 2.6-1 is Table 2.6-2, which illustrates releases for the alternative and WSIP settings, and the difference in releases between the two. Table 2.6-3 provides the same form of information for the alternative and base settings. The notable difference in releases between the alternative and base settings is the addition of the required flows to satisfy the 1997 MOU and the reduction of stream releases during wetter-year, wetter-season flows due to the restoration of Calaveras Reservoir operational capacity.

The bypass flow measure at the ACDD is modeled as a release at the diversion dam of 10 cfs or inflow to the diversion dam, whichever is less, for the months December through April. Table 2.6-4 illustrates the flow past the ACDD for the alternative setting, which includes the bypass measure. Table 2.6-5 illustrates the flow for the WSIP setting, and Table 2.6-6 illustrates the difference in flow below the ACDD between the alternative and WSIP settings. As seen in Table 2.6-4, flow past the diversion dam occurs regularly during the December through April period, its magnitude either as an explicit bypass of up to 10 cfs (approximately 600 acre-feet per month), or more during rain-runoff events when either Calaveras Reservoir is not receiving water from Alameda Creek or the runoff at the diversion dam exceeds the diversion tunnel capacity. Table 2.6-6 illustrates the difference in flow below the diversion dam between the two settings. The positive values (up to 10 cfs) indicate the measure's passage of flow that would otherwise not occur in the WSIP setting. The few exceptions of reduced flow indicate periods when the alternative setting would divert more water to Calaveras Reservoir from the diversion dam; however, review of the remaining flow below the diversion dam (Table 2.6-4) shows that it would still be in excess of the minimum bypass flow.

Table 2.6-7 illustrates the difference in flow below the ACDD between the alternative and base settings. The seasonal increase in flow past the diversion dam in the alternative setting is again apparent. The reductions in flow below the diversion dam are due to the additional diversions to Calaveras Reservoir resulting from the restoration of reservoir operating capacity. Table 2.6-8 and Table 2.6-9 illustrate the flow past the ACDD, comparing the alternative, WSIP, and base settings by year type and the average of all years.

APPENDIX O2

Table 2.6-1

Difference in Total Stream Release from Calaveras Reservoir (Acre-feet) Modified WSIP minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	-555	-614	-301	0	0	0	0	0	-1,470
1922	0	0	-9	-568	-71	0	-196	0	0	0	0	0	-845
1923	0	0	0	-381	-555	-466	-307	0	0	0	0	0	-1,709
1924	0	0	0	0	0	-3	-9	0	0	0	0	0	-12
1925	0	0	-270	-396	-528	-255	-301	0	0	0	0	0	-1,749
1926	0	0	-9	-411	-236	-552	-157	0	0	0	0	0	-1,366
1927	0	0	-224	-614	11	-543	-138	0	0	0	0	0	-1,508
1928	0	0	-212	-540	-555	191	-58	0	0	0	0	0	-1,175
1929	0	0	-267	-614	-555	-614	-402	0	0	0	0	0	-2,452
1930	0	0	-34	-614	-555	-175	-325	0	0	0	0	0	-1,703
1931	0	0	-61	-430	-184	-221	-74	0	0	0	0	0	-970
1932	0	0	0	-562	-555	-390	-276	0	0	0	0	0	-1,783
1933	0	0	-49	-614	-325	-470	-319	0	0	0	0	0	-1,777
1934	0	0	-166	-611	-555	-491	-147	0	0	0	0	0	-1,970
1935	0	0	-126	-252	-335	-580	0	0	0	0	0	0	-1,292
1936	0	0	-129	-614	-206	-614	-230	0	0	0	0	0	-1,792
1937	0	0	-92	-402	-377	-178	-92	0	0	0	0	0	-1,141
1938	0	0	-12	-491	0	0	-31	0	0	0	0	0	-534
1939	0	0	-239	-424	-555	-614	-255	0	0	0	0	0	-2,087
1940	0	0	-34	-249	1,330	0	0	0	0	0	0	0	1,047
1941	0	0	-34	-166	-429	0	0	0	0	0	0	0	-629
1942	0	0	0	0	-355	-405	0	0	0	0	0	0	-760
1943	0	0	-261	0	-555	0	-221	0	0	0	0	0	-1,037
1944	0	0	-163	-307	-555	-482	-319	0	0	0	0	0	-1,826
1945	0	0	-264	-614	-279	-528	-288	0	0	0	0	0	-1,973
1946	0	0	0	-430	-555	-614	-301	0	0	0	0	0	-1,900
1947	0	0	-264	-399	-555	-614	-301	0	0	0	0	0	-2,133
1948	0	0	-138	-132	-184	-614	-218	0	0	0	0	0	-1,286
1949	0	0	-178	-193	-500	0	-298	0	0	0	0	0	-1,169
1950	0	0	-104	-531	-555	-513	-338	0	0	0	0	0	-2,041
1951	0	0	0	0	-555	0	-307	0	0	0	0	0	-862
1952	0	0	0	-613	0	0	-123	0	0	0	0	0	-736
1953	0	0	0	-64	-555	-574	-316	0	0	0	0	0	-1,510
1954	0	0	-107	-614	-555	-516	-279	0	0	0	0	0	-2,072
1955	0	0	-147	-543	-555	-611	-335	0	0	0	0	0	-2,191
1956	0	0	830	0	0	-460	-273	0	0	0	0	0	97
1957	0	0	-104	-331	-555	-614	-331	0	0	0	0	0	-1,936
1958	0	0	-264	-537	0	0	0	0	0	0	0	0	-801
1959	0	0	-120	-614	-555	-531	-285	0	0	0	0	0	-2,105
1960	0	0	-46	-347	-555	-221	-172	0	0	0	0	0	-1,341
1961	0	0	-107	-252	-193	-586	-132	0	0	0	0	0	-1,271
1962	0	0	-89	-107	-344	-473	-338	0	0	0	0	0	-1,350
1963	0	0	-270	-12	-410	-454	0	0	0	0	0	0	-1,147
1964	0	0	-279	-552	-350	-396	-307	0	0	0	0	0	-1,884
1965	0	0	0	605	-555	-559	0	0	0	0	0	0	-509
1966	0	0	-132	-614	-555	-592	-114	0	0	0	0	0	-2,007
1967	0	0	-71	0	-555	-613	0	0	0	0	0	0	-1,239
1968	0	0	-258	-436	-555	-614	-316	0	0	0	0	0	-2,179
1969	0	0	-212	0	0	0	-203	0	0	0	0	0	-414
1970	0	0	-270	0	-555	-239	-335	0	0	0	0	0	-1,399
1971	0	0	0	-506	-390	-614	-304	0	0	0	0	0	-1,814
1972	0	0	-166	-390	-555	-160	-114	0	0	0	0	0	-1,384
1973	0	0	-212	0	-369	0	-239	0	0	0	0	0	-820
1974	0	0	0	0	-555	-132	-220	0	0	0	0	0	-907
1975	0	0	-273	-614	-28	-360	-25	0	0	0	0	0	-1,299
1976	0	0	-107	-98	-110	-270	-110	0	0	0	0	0	-697
1977	0	0	-37	-169	-71	-150	-77	0	0	0	0	0	-503
1978	0	0	-261	0	-470	1,050	-64	0	0	0	0	0	255
1979	0	0	-80	-614	-528	-470	-292	0	0	0	0	0	-1,983
1980	0	0	-190	0	-718	-381	-236	0	0	0	0	0	-1,525
1981	0	0	-110	-335	-555	-347	-316	0	0	0	0	0	-1,663
1982	0	0	-95	0	0	0	0	0	0	0	0	0	-95
1983	0	0	0	-613	0	0	0	0	0	0	0	0	-613
1984	0	0	0	-614	-555	-614	-316	0	0	0	0	0	-2,099
1985	0	0	-252	-285	-513	-602	-209	0	0	0	0	0	-1,860
1986	0	0	9	-147	3,242	0	-178	0	0	0	0	0	2,926
1987	0	0	-86	-147	-252	-408	-138	0	0	0	0	0	-1,031
1988	0	0	-273	-583	-132	-95	-120	0	0	0	0	0	-1,203
1989	0	0	-132	-144	-129	-485	-129	0	0	0	0	0	-1,019
1990	0	0	-107	-347	-408	-233	-117	0	0	0	0	0	-1,212
1991	0	0	-71	-64	-61	-325	-341	0	0	0	0	0	-862
1992	0	0	-160	-233	-322	-586	-322	0	0	0	0	0	-1,623
1993	0	0	-242	0	435	0	-267	0	0	0	0	0	-75
1994	0	0	-273	-212	-555	-368	-267	0	0	0	0	0	-1,676
1995	0	0	-288	481	-555	0	-123	0	0	0	0	0	-486
1996	0	0	-230	-40	-382	0	-273	0	0	0	0	0	-926
1997	0	0	0	0	-555	-614	-331	0	0	0	0	0	-1,501
1998	0	0	-203	0	191	0	0	0	0	0	0	0	-12
1999	0	0	-264	-555	-402	-528	0	0	0	0	0	0	-1,749
2000	0	0	-46	-614	-157	0	-313	0	0	0	0	0	-1,129
2001	0	0	-37	-390	-555	-408	-307	0	0	0	0	0	-1,697
2002	0	0	-46	-614	-555	-559	-344	0	0	0	0	0	-2,118
Avg (21-02)	0	0	-112	-298	-298	-318	-197	0	0	0	0	0	-1,223

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Table 2.6-2

Total Stream Release from Calaveras Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	429	246	941	4,855	14,418	9,708	4,977	255	386	417	425	415	37,472
Above Normal	425	258	42	543	2,970	2,524	446	327	396	424	428	417	9,199
Normal	429	275	93	168	286	69	6	370	408	428	430	417	3,377
Below Normal	428	275	95	194	366	108	51	389	411	430	430	417	3,594
Dry	429	292	151	485	746	402	215	407	416	430	430	417	4,819
All Years	428	269	260	1,228	3,706	2,532	1,117	350	403	426	428	417	11,563

Total Stream Release from Calaveras Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	429	246	998	4,985	14,425	9,862	5,085	255	386	417	425	415	37,928
Above Normal	425	258	172	746	3,196	2,688	606	327	396	424	428	417	10,082
Normal	429	275	194	548	725	506	265	370	408	428	430	417	4,995
Below Normal	428	275	246	672	876	596	345	389	411	430	430	417	5,515
Dry	429	292	281	778	1,044	747	375	407	416	430	430	417	6,044
All Years	428	269	374	1,526	4,004	2,850	1,314	350	403	426	428	417	12,788

Difference in Total Stream Release from Calaveras Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

Modified WSIP minus WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	-46	-130	-7	-155	-109	0	0	0	0	0	-446
Above Normal	0	0	-130	-203	-227	-164	-160	0	0	0	0	0	-883
Normal	0	0	-102	-381	-439	-438	-259	0	0	0	0	0	-1,618
Below Normal	0	0	-150	-478	-510	-488	-294	0	0	0	0	0	-1,921
Dry	0	0	-130	-293	-298	-344	-159	0	0	0	0	0	-1,225
All Years	0	0	-112	-298	-298	-318	-197	0	0	0	0	0	-1,223

Table 2.6-3

Total Stream Release from Calaveras Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	429	246	941	4,855	14,418	9,708	4,977	255	386	417	425	415	37,472
Above Normal	425	258	42	543	2,970	2,524	446	327	396	424	428	417	9,199
Normal	429	275	93	168	286	69	6	370	408	428	430	417	3,377
Below Normal	428	275	95	194	366	108	51	389	411	430	430	417	3,594
Dry	429	292	151	485	746	402	215	407	416	430	430	417	4,819
All Years	428	269	260	1,228	3,706	2,532	1,117	350	403	426	428	417	11,563

Total Stream Release from Calaveras Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	1,741	9,267	16,622	9,968	5,024	0	0	0	0	0	42,623
Above Normal	0	0	184	2,685	5,918	3,096	459	0	0	0	0	0	12,342
Normal	0	0	216	364	898	353	0	0	0	0	0	0	1,831
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	420	2,436	4,645	2,656	1,076	0	0	0	0	0	11,233

Difference in Total Stream Release from Calaveras Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

Modified WSIP minus Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	429	246	-808	-4,412	-2,203	-260	-48	255	386	417	425	415	-5,159
Above Normal	425	258	-142	-2,141	-2,948	-572	-13	327	396	424	428	417	-3,142
Normal	429	275	-123	-196	-613	-284	6	370	408	428	430	417	1,545
Below Normal	428	275	95	194	366	108	51	389	411	430	430	417	3,594
Dry	429	292	151	485	746	402	215	407	416	430	430	417	4,819
All Years	428	269	-162	-1,208	-939	-124	42	350	403	426	428	417	329

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Table 2.6-4

Flow Passing Alameda Creek Diversion Dam (Acre-feet) Modified WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	1,043	2,826	555	614	301	0	0	0	0	0	5,340
1922	0	0	1,083	614	9,857	4,591	595	0	0	0	0	0	16,741
1923	0	0	2,581	841	666	466	595	0	0	0	0	0	5,150
1924	0	0	0	0	0	3	9	0	0	0	0	0	12
1925	0	0	420	396	1,117	255	552	0	0	0	0	0	2,741
1926	0	0	9	411	4,671	552	1,086	0	0	0	0	0	6,730
1927	0	396	494	614	6,184	614	648	0	0	0	0	0	8,949
1928	0	0	1,062	540	746	6,500	1,248	0	0	0	0	0	10,095
1929	0	0	614	614	555	614	448	0	0	0	0	0	2,845
1930	0	0	34	614	555	3,545	325	0	0	0	0	0	5,073
1931	0	0	61	430	184	221	74	0	0	0	0	0	970
1932	0	0	1,786	614	595	390	276	0	0	0	0	0	3,661
1933	0	0	49	614	325	470	319	0	0	0	0	0	1,777
1934	0	0	614	878	555	491	147	0	0	0	0	0	2,685
1935	0	0	126	614	335	614	721	0	0	0	0	0	2,409
1936	0	0	129	614	3,579	614	595	0	0	0	0	0	5,531
1937	0	0	92	402	1,013	6,291	595	0	0	0	0	0	8,393
1938	0	0	872	614	12,362	8,289	595	0	0	0	0	0	22,731
1939	0	0	605	424	555	614	255	0	0	0	0	0	2,452
1940	0	0	34	663	8,820	5,414	1,840	0	0	0	0	0	16,770
1941	0	0	614	792	9,188	6,816	8,525	0	0	0	0	0	25,935
1942	0	0	829	6,779	6,104	1,878	3,646	0	0	0	0	0	19,236
1943	0	0	396	7,519	1,426	3,201	595	0	0	0	0	0	13,137
1944	0	0	163	307	555	691	528	0	0	0	0	0	2,243
1945	0	0	264	614	1,602	614	595	0	0	0	0	0	3,689
1946	0	0	614	614	555	614	595	0	0	0	0	0	2,992
1947	0	0	390	399	555	614	595	0	0	0	0	0	2,553
1948	0	0	138	132	184	614	595	0	0	0	0	0	1,663
1949	0	0	178	193	500	638	595	0	0	0	0	0	2,105
1950	0	0	104	614	786	513	411	0	0	0	0	0	2,427
1951	0	0	3,110	3,155	1,303	3,149	595	0	0	0	0	0	11,313
1952	0	0	804	11,527	4,542	6,905	595	0	0	0	0	0	24,373
1953	0	0	829	853	555	614	534	0	0	0	0	0	3,385
1954	0	0	107	614	761	614	595	0	0	0	0	0	2,691
1955	0	0	614	614	555	611	439	0	0	0	0	0	2,833
1956	0	0	11,877	7,608	5,484	614	595	0	0	0	0	0	26,178
1957	0	0	104	331	555	614	454	0	0	0	0	0	2,059
1958	0	0	359	911	9,047	7,979	11,775	0	0	0	0	0	30,072
1959	0	0	120	614	555	531	285	0	0	0	0	0	2,105
1960	0	0	46	347	1,117	221	172	0	0	0	0	0	1,903
1961	0	0	107	252	193	586	132	0	0	0	0	0	1,271
1962	0	0	89	107	2,010	614	408	0	0	0	0	0	3,228
1963	123	0	313	3,578	7,442	614	4,198	0	0	0	0	0	16,268
1964	0	0	282	905	350	396	307	0	0	0	0	0	2,240
1965	0	0	3,683	9,673	555	559	3,250	0	0	0	0	0	17,720
1966	0	0	614	614	555	592	114	0	0	0	0	0	2,489
1967	0	0	614	5,064	555	4,959	4,916	0	0	0	0	0	16,109
1968	0	0	258	826	555	614	537	0	0	0	0	0	2,790
1969	0	0	614	9,333	10,551	3,695	595	0	0	0	0	0	24,787
1970	0	0	335	2,197	555	1,433	427	0	0	0	0	0	4,947
1971	0	0	1,172	614	390	614	595	0	0	0	0	0	3,385
1972	0	0	617	390	562	160	114	0	0	0	0	0	1,841
1973	0	43	614	2,053	11,109	5,275	595	0	0	0	0	0	19,690
1974	0	0	2,185	1,766	555	4,324	4,373	0	0	0	0	0	13,203
1975	0	0	307	614	2,851	8,286	595	0	0	0	0	0	12,653
1976	0	0	107	98	110	270	110	0	0	0	0	0	697
1977	0	0	37	169	71	150	77	0	0	0	0	0	503
1978	0	0	387	3,578	1,234	5,082	595	0	0	0	0	0	10,876
1979	0	0	80	740	1,473	614	595	0	0	0	0	0	3,502
1980	0	0	614	3,566	12,125	1,452	595	0	0	0	0	0	18,352
1981	0	0	110	2,185	555	614	528	0	0	0	0	0	3,993
1982	0	0	902	7,660	4,628	3,419	10,720	0	0	0	0	0	27,329
1983	0	52	2,170	9,811	11,751	18,057	4,168	2,774	0	0	0	0	48,783
1984	0	101	3,533	614	555	614	595	0	0	0	0	0	6,013
1985	0	0	580	285	1,200	614	209	0	0	0	0	0	2,888
1986	0	0	153	147	13,847	7,820	595	0	0	0	0	0	22,563
1987	0	0	86	147	463	408	138	0	0	0	0	0	1,243
1988	0	0	304	583	132	95	120	0	0	0	0	0	1,234
1989	0	0	132	144	129	485	129	0	0	0	0	0	1,019
1990	0	0	107	347	408	233	117	0	0	0	0	0	1,212
1991	0	0	71	64	61	1,267	399	0	0	0	0	0	1,863
1992	0	0	160	233	2,345	614	500	0	0	0	0	0	3,851
1993	0	0	568	2,820	6,251	1,943	595	0	0	0	0	0	12,177
1994	0	0	273	212	694	368	267	0	0	0	0	0	1,814
1995	0	0	417	14,528	555	12,954	598	0	0	0	0	0	29,053
1996	0	0	614	4,944	14,372	7,807	595	0	0	0	0	0	28,332
1997	0	353	7,681	14,593	552	614	331	0	0	0	0	0	24,125
1998	0	0	614	9,151	16,968	3,127	3,284	0	0	0	0	0	33,144
1999	0	0	288	1,436	2,668	614	1,877	0	0	0	0	0	6,883
2000	0	0	46	1,792	3,502	4,192	562	6	0	0	0	0	10,100
2001	0	0	37	390	611	850	473	0	0	0	0	0	2,360
2002	0	0	911	614	552	614	353	0	0	0	0	0	3,044
Avg (21-02)	1	12	807	2,155	2,875	2,278	1,149	34	0	0	0	0	9,311

APPENDIX O2

Table 2.6-5

Flow Passing Alameda Creek Diversion Dam (Acre-feet) WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	430	2,213	393	0	0	0	0	0	0	0	3,035
1922	0	0	470	0	9,857	4,591	0	0	0	0	0	0	14,918
1923	0	0	1,967	227	110	0	0	0	0	0	0	0	2,305
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	562	0	0	0	0	0	0	0	562
1926	0	0	0	0	4,115	0	491	0	0	0	0	0	4,606
1927	0	396	0	0	6,184	0	287	0	0	0	0	0	6,867
1928	0	0	476	0	190	6,500	1,189	0	0	0	0	0	8,355
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	2,931	0	0	0	0	0	0	2,931
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	1,172	0	40	0	0	0	0	0	0	0	1,212
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	264	0	0	0	0	0	0	0	0	264
1935	0	0	0	0	0	0	126	0	0	0	0	0	126
1936	0	0	0	0	3,182	0	0	0	0	0	0	0	3,182
1937	0	0	0	0	457	6,291	0	0	0	0	0	0	6,749
1938	0	0	258	0	12,362	8,289	321	0	0	0	0	0	21,229
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	49	8,820	5,414	1,840	0	0	0	0	0	16,122
1941	0	0	0	178	9,188	6,816	8,525	0	0	0	0	0	24,708
1942	0	0	215	6,779	6,104	1,264	3,646	0	0	0	0	0	18,008
1943	0	0	0	7,519	680	3,201	0	0	0	0	0	0	11,400
1944	0	0	0	0	0	77	0	0	0	0	0	0	77
1945	0	0	0	0	1,046	0	0	0	0	0	0	0	1,046
1946	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	25	0	0	0	0	0	0	25
1950	0	0	0	0	230	0	0	0	0	0	0	0	230
1951	0	0	2,537	3,155	748	3,149	0	0	0	0	0	0	9,589
1952	0	0	190	11,527	4,542	6,905	0	0	0	0	0	0	23,164
1953	0	0	215	884	0	0	0	0	0	0	0	0	1,098
1954	0	0	0	0	206	0	0	0	0	0	0	0	206
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	11,877	7,608	5,484	0	0	0	0	0	0	0	24,969
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	298	9,047	7,979	11,775	0	0	0	0	0	29,099
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	562	0	0	0	0	0	0	0	562
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	1,455	0	0	0	0	0	0	0	1,455
1963	123	0	0	2,965	7,442	0	4,198	0	0	0	0	0	14,728
1964	0	0	0	292	0	0	0	0	0	0	0	0	292
1965	0	0	3,069	9,673	0	0	3,250	0	0	0	0	0	15,992
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	4,450	0	4,959	4,916	0	0	0	0	0	14,326
1968	0	0	0	212	0	0	0	0	0	0	0	0	212
1969	0	0	0	9,333	10,551	3,695	0	0	0	0	0	0	23,578
1970	0	0	0	1,584	0	819	0	0	0	0	0	0	2,403
1971	0	0	559	0	0	0	0	0	0	0	0	0	559
1972	0	0	3	0	6	0	0	0	0	0	0	0	9
1973	0	43	0	1,439	11,109	5,275	0	0	0	0	0	0	17,867
1974	0	0	1,571	4,474	0	2,482	4,373	0	0	0	0	0	12,901
1975	0	0	0	0	2,296	8,286	486	0	0	0	0	0	11,068
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	2,965	678	5,082	0	0	0	0	0	0	8,725
1979	0	0	0	126	918	0	0	0	0	0	0	0	1,043
1980	0	0	0	2,952	12,125	1,071	0	0	0	0	0	0	16,149
1981	0	0	0	1,571	0	0	0	0	0	0	0	0	1,571
1982	0	0	288	7,660	4,628	3,419	10,720	0	0	0	0	0	26,715
1983	0	52	1,556	9,811	11,751	18,057	4,168	2,774	0	0	0	0	48,169
1984	0	101	6,939	0	0	0	0	0	0	0	0	0	7,040
1985	0	0	0	0	687	0	0	0	0	0	0	0	687
1986	0	0	0	0	13,847	7,820	0	0	0	0	0	0	21,666
1987	0	0	0	0	212	0	0	0	0	0	0	0	212
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	654	0	0	0	0	0	0	654
1992	0	0	0	0	1,789	0	0	0	0	0	0	0	1,789
1993	0	0	0	2,207	6,251	2,694	0	0	0	0	0	0	11,152
1994	0	0	0	0	138	0	0	0	0	0	0	0	138
1995	0	0	0	14,528	0	12,954	3	0	0	0	0	0	27,485
1996	0	0	0	4,330	14,372	7,807	0	0	0	0	0	0	26,509
1997	0	353	7,681	14,593	0	0	0	0	0	0	0	0	22,627
1998	0	0	0	9,151	16,968	3,127	3,284	0	0	0	0	0	32,530
1999	0	0	0	822	2,266	0	1,877	0	0	0	0	0	4,965
2000	0	0	0	1,178	2,946	4,192	0	6	0	0	0	0	8,323
2001	0	0	0	0	55	236	0	0	0	0	0	0	292
2002	0	0	298	0	0	0	0	0	0	0	0	0	298
Avg (21-02)	1	12	509	1,793	2,520	1,903	798	34	0	0	0	0	7,570

APPENDIX O2

Table 2.6-6

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet) Modified WSIP minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	614	614	163	614	301	0	0	0	0	0	2,305
1922	0	0	614	614	0	0	595	0	0	0	0	0	1,823
1923	0	0	614	614	555	466	595	0	0	0	0	0	2,845
1924	0	0	0	0	0	3	9	0	0	0	0	0	12
1925	0	0	420	396	555	255	552	0	0	0	0	0	2,179
1926	0	0	9	411	555	552	595	0	0	0	0	0	2,124
1927	0	0	494	614	0	614	361	0	0	0	0	0	2,082
1928	0	0	586	540	555	0	58	0	0	0	0	0	1,740
1929	0	0	614	614	555	614	448	0	0	0	0	0	2,845
1930	0	0	34	614	555	614	325	0	0	0	0	0	2,142
1931	0	0	61	430	184	221	74	0	0	0	0	0	970
1932	0	0	614	614	555	390	276	0	0	0	0	0	2,449
1933	0	0	49	614	325	470	319	0	0	0	0	0	1,777
1934	0	0	614	614	555	491	147	0	0	0	0	0	2,421
1935	0	0	126	614	335	614	595	0	0	0	0	0	2,283
1936	0	0	129	614	397	614	595	0	0	0	0	0	2,348
1937	0	0	92	402	555	0	595	0	0	0	0	0	1,645
1938	0	0	614	614	0	0	275	0	0	0	0	0	1,502
1939	0	0	605	424	555	614	255	0	0	0	0	0	2,452
1940	0	0	34	614	0	0	0	0	0	0	0	0	648
1941	0	0	614	614	0	0	0	0	0	0	0	0	1,228
1942	0	0	614	0	0	614	0	0	0	0	0	0	1,228
1943	0	0	396	0	746	0	595	0	0	0	0	0	1,738
1944	0	0	163	307	555	614	528	0	0	0	0	0	2,167
1945	0	0	264	614	555	614	595	0	0	0	0	0	2,642
1946	0	0	614	614	555	614	595	0	0	0	0	0	2,992
1947	0	0	390	399	555	614	595	0	0	0	0	0	2,553
1948	0	0	138	132	184	614	595	0	0	0	0	0	1,663
1949	0	0	178	193	500	614	595	0	0	0	0	0	2,081
1950	0	0	104	614	555	513	411	0	0	0	0	0	2,197
1951	0	0	573	0	555	0	595	0	0	0	0	0	1,724
1952	0	0	614	0	0	0	595	0	0	0	0	0	1,209
1953	0	0	614	-30	555	614	534	0	0	0	0	0	2,287
1954	0	0	107	614	555	614	595	0	0	0	0	0	2,486
1955	0	0	614	614	555	611	439	0	0	0	0	0	2,833
1956	0	0	0	0	0	614	595	0	0	0	0	0	1,209
1957	0	0	104	331	555	614	454	0	0	0	0	0	2,059
1958	0	0	359	614	0	0	0	0	0	0	0	0	973
1959	0	0	120	614	555	531	285	0	0	0	0	0	2,105
1960	0	0	46	347	555	221	172	0	0	0	0	0	1,341
1961	0	0	107	252	193	586	132	0	0	0	0	0	1,271
1962	0	0	89	107	555	614	408	0	0	0	0	0	1,774
1963	0	0	313	614	0	614	0	0	0	0	0	0	1,541
1964	0	0	282	614	350	396	307	0	0	0	0	0	1,949
1965	0	0	614	0	555	559	0	0	0	0	0	0	1,728
1966	0	0	614	614	555	592	114	0	0	0	0	0	2,489
1967	0	0	614	614	555	0	0	0	0	0	0	0	1,783
1968	0	0	258	614	555	614	537	0	0	0	0	0	2,578
1969	0	0	614	0	0	0	595	0	0	0	0	0	1,209
1970	0	0	335	614	555	614	427	0	0	0	0	0	2,544
1971	0	0	614	614	390	614	595	0	0	0	0	0	2,826
1972	0	0	614	390	555	160	114	0	0	0	0	0	1,832
1973	0	0	614	614	0	0	595	0	0	0	0	0	1,823
1974	0	0	614	-2,709	555	1,842	0	0	0	0	0	0	302
1975	0	0	307	614	555	0	109	0	0	0	0	0	1,585
1976	0	0	107	98	110	270	110	0	0	0	0	0	697
1977	0	0	37	169	71	150	77	0	0	0	0	0	503
1978	0	0	387	614	555	0	595	0	0	0	0	0	2,151
1979	0	0	80	614	555	614	595	0	0	0	0	0	2,458
1980	0	0	614	614	0	381	595	0	0	0	0	0	2,203
1981	0	0	110	614	555	614	528	0	0	0	0	0	2,421
1982	0	0	614	0	0	0	0	0	0	0	0	0	614
1983	0	0	614	0	0	0	0	0	0	0	0	0	614
1984	0	0	-3,406	614	555	614	595	0	0	0	0	0	-1,027
1985	0	0	580	285	513	614	209	0	0	0	0	0	2,200
1986	0	0	9	147	0	0	595	0	0	0	0	0	752
1987	0	0	86	147	252	408	138	0	0	0	0	0	1,031
1988	0	0	304	583	132	95	120	0	0	0	0	0	1,234
1989	0	0	132	144	129	485	129	0	0	0	0	0	1,019
1990	0	0	107	347	408	233	117	0	0	0	0	0	1,212
1991	0	0	71	64	61	614	399	0	0	0	0	0	1,209
1992	0	0	160	233	555	614	500	0	0	0	0	0	2,062
1993	0	0	568	614	0	-752	595	0	0	0	0	0	1,025
1994	0	0	273	212	555	368	267	0	0	0	0	0	1,676
1995	0	0	417	0	555	0	595	0	0	0	0	0	1,568
1996	0	0	614	614	0	0	595	0	0	0	0	0	1,823
1997	0	0	0	0	552	614	331	0	0	0	0	0	1,498
1998	0	0	614	0	0	0	0	0	0	0	0	0	614
1999	0	0	288	614	402	614	0	0	0	0	0	0	1,918
2000	0	0	46	614	555	0	562	0	0	0	0	0	1,777
2001	0	0	37	390	555	614	473	0	0	0	0	0	2,068
2002	0	0	614	614	552	614	353	0	0	0	0	0	2,747
Avg (21-02)	0	0	296	362	356	375	351	0	0	0	0	0	1,739

APPENDIX O2

Table 2.6-7

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet) Modified WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	614	-1,946	-1,783	614	301	0	0	0	0	0	-2,200
1922	0	0	614	614	0	0	595	0	0	0	0	0	1,823
1923	0	0	-2,242	-1,074	-448	466	595	0	0	0	0	0	-2,702
1924	0	0	0	0	0	3	9	0	0	0	0	0	12
1925	0	0	420	396	555	255	552	0	0	0	0	0	2,179
1926	0	0	9	411	-2,655	552	595	0	0	0	0	0	-1,086
1927	0	0	494	614	0	614	595	0	0	0	0	0	2,317
1928	0	0	586	540	555	0	-156	0	0	0	0	0	1,526
1929	0	0	614	614	555	614	448	0	0	0	0	0	2,845
1930	0	0	34	614	555	614	325	0	0	0	0	0	2,142
1931	0	0	61	430	184	221	74	0	0	0	0	0	970
1932	0	0	614	614	555	390	276	0	0	0	0	0	2,449
1933	0	0	49	614	325	470	319	0	0	0	0	0	1,777
1934	0	0	614	614	555	491	147	0	0	0	0	0	2,421
1935	0	0	126	614	335	614	595	0	0	0	0	0	2,283
1936	0	0	129	614	-2,473	614	595	0	0	0	0	0	-521
1937	0	0	92	402	-3,409	0	595	0	0	0	0	0	-2,319
1938	0	0	614	614	0	0	88	0	0	0	0	0	1,316
1939	0	0	605	424	555	614	255	0	0	0	0	0	2,452
1940	0	0	34	614	0	0	-156	0	0	0	0	0	492
1941	0	0	614	-584	0	0	0	0	0	0	0	0	30
1942	0	0	614	0	0	614	0	0	0	0	0	0	1,228
1943	0	0	396	0	-1,366	0	595	0	0	0	0	0	-375
1944	0	0	163	307	555	614	528	0	0	0	0	0	2,167
1945	0	0	264	614	-3,916	614	595	0	0	0	0	0	-1,829
1946	0	0	-4,037	-908	555	614	595	0	0	0	0	0	-3,181
1947	0	0	390	399	555	614	595	0	0	0	0	0	2,553
1948	0	0	138	132	184	614	595	0	0	0	0	0	1,663
1949	0	0	178	193	500	-4,910	595	0	0	0	0	0	-3,443
1950	0	0	104	614	555	513	411	0	0	0	0	0	2,197
1951	0	0	-3,709	209	-520	301	595	0	0	0	0	0	-3,124
1952	0	0	614	0	0	0	595	0	0	0	0	0	1,209
1953	0	0	614	-3,986	555	614	534	0	0	0	0	0	-1,669
1954	0	0	107	614	555	614	595	0	0	0	0	0	2,486
1955	0	0	614	614	555	611	439	0	0	0	0	0	2,833
1956	0	0	0	0	0	614	595	0	0	0	0	0	1,209
1957	0	0	104	331	555	614	454	0	0	0	0	0	2,059
1958	0	0	359	614	0	0	0	0	0	0	0	0	973
1959	0	0	120	614	555	531	285	0	0	0	0	0	2,105
1960	0	0	46	347	555	221	172	0	0	0	0	0	1,341
1961	0	0	107	252	193	586	132	0	0	0	0	0	1,271
1962	0	0	89	107	-2,719	614	408	0	0	0	0	0	-1,501
1963	0	0	313	-1,605	0	614	0	0	0	0	0	0	-678
1964	0	0	282	614	350	396	307	0	0	0	0	0	1,949
1965	0	0	-550	0	555	559	3,250	0	0	0	0	0	3,814
1966	0	0	614	614	555	592	114	0	0	0	0	0	2,489
1967	0	0	614	-1,062	-1,317	0	0	0	0	0	0	0	-1,765
1968	0	0	258	614	555	614	537	0	0	0	0	0	2,578
1969	0	0	614	0	0	0	595	0	0	0	0	0	1,209
1970	0	0	335	-3,634	555	-1,009	427	0	0	0	0	0	-3,326
1971	0	0	-646	614	390	614	595	0	0	0	0	0	1,567
1972	0	0	614	390	555	160	114	0	0	0	0	0	1,832
1973	0	0	614	-4,312	0	0	595	0	0	0	0	0	-3,103
1974	0	0	-178	-2,709	555	1,444	0	0	0	0	0	0	-887
1975	0	0	307	614	-4,640	0	-72	0	0	0	0	0	-3,791
1976	0	0	107	98	110	270	110	0	0	0	0	0	697
1977	0	0	37	169	71	150	77	0	0	0	0	0	503
1978	0	0	387	-3,538	-2,848	0	595	0	0	0	0	0	-5,404
1979	0	0	80	614	555	614	595	0	0	0	0	0	2,458
1980	0	0	614	-2,747	0	-101	595	0	0	0	0	0	-1,639
1981	0	0	110	614	555	614	528	0	0	0	0	0	2,421
1982	0	0	614	0	0	0	0	0	0	0	0	0	614
1983	0	0	614	0	0	0	0	687	0	0	0	0	1,301
1984	0	0	-3,406	614	555	614	595	0	0	0	0	0	-1,027
1985	0	0	580	285	513	614	209	0	0	0	0	0	2,200
1986	0	0	9	147	0	0	595	0	0	0	0	0	752
1987	0	0	86	147	252	408	138	0	0	0	0	0	1,031
1988	0	0	304	583	132	95	120	0	0	0	0	0	1,234
1989	0	0	132	144	129	485	129	0	0	0	0	0	1,019
1990	0	0	107	347	408	233	117	0	0	0	0	0	1,212
1991	0	0	71	64	61	614	399	0	0	0	0	0	1,209
1992	0	0	160	233	-2,799	614	500	0	0	0	0	0	-1,292
1993	0	0	568	-4,385	0	-101	595	0	0	0	0	0	-3,324
1994	0	0	273	212	555	368	267	0	0	0	0	0	1,676
1995	0	0	417	0	555	0	595	0	0	0	0	0	1,568
1996	0	0	614	-4,625	0	0	595	0	0	0	0	0	-3,416
1997	0	0	0	0	552	614	331	0	0	0	0	0	1,498
1998	0	0	614	0	0	0	0	0	0	0	0	0	614
1999	0	0	288	614	-2,821	614	1,392	0	0	0	0	0	87
2000	0	0	46	614	-4,011	0	562	0	0	0	0	0	-2,790
2001	0	0	37	390	555	614	473	0	0	0	0	0	2,068
2002	0	0	614	614	552	614	353	0	0	0	0	0	2,747
Avg (21-02)	0	0	113	-144	-200	289	401	8	0	0	0	0	467

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Table 2.6-8

Flow Passing Alameda Creek Diversion Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	28	1,859	6,509	8,086	5,866	3,258	173	0	0	0	0	25,779
Above Normal	7	23	1,013	2,755	4,074	3,398	1,318	0	0	0	0	0	12,589
Normal	0	6	655	735	1,314	1,017	618	0	0	0	0	0	4,345
Below Normal	0	0	332	547	614	790	387	0	0	0	0	0	2,669
Dry	0	0	191	293	355	344	201	0	0	0	0	0	1,385
All Years	1	12	807	2,155	2,875	2,278	1,149	34	0	0	0	0	9,311

Flow Passing Alameda Creek Diversion Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	28	1,379	6,269	7,982	5,727	2,960	173	0	0	0	0	24,518
Above Normal	7	23	591	2,457	3,735	3,129	959	0	0	0	0	0	10,903
Normal	0	6	585	260	796	459	113	0	0	0	0	0	2,219
Below Normal	0	0	18	45	102	229	0	0	0	0	0	0	394
Dry	0	0	0	0	57	0	0	0	0	0	0	0	58
All Years	1	12	509	1,793	2,520	1,903	798	34	0	0	0	0	7,570

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Modified WSIP minus WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	471	239	104	139	298	0	0	0	0	0	1,252
Above Normal	0	0	422	298	339	269	359	0	0	0	0	0	1,686
Normal	0	0	70	475	518	558	506	0	0	0	0	0	2,125
Below Normal	0	0	315	501	512	560	387	0	0	0	0	0	2,275
Dry	0	0	191	293	298	344	201	0	0	0	0	0	1,328
All Years	0	0	296	362	356	375	351	0	0	0	0	0	1,739

Table 2.6-9

Flow Passing Alameda Creek Diversion Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	28	1,859	6,509	8,086	5,866	3,258	173	0	0	0	0	25,779
Above Normal	7	23	1,013	2,755	4,074	3,398	1,318	0	0	0	0	0	12,589
Normal	0	6	655	735	1,314	1,017	618	0	0	0	0	0	4,345
Below Normal	0	0	332	547	614	790	387	0	0	0	0	0	2,669
Dry	0	0	191	293	355	344	201	0	0	0	0	0	1,385
All Years	1	12	807	2,155	2,875	2,278	1,149	34	0	0	0	0	9,311

Flow Passing Alameda Creek Diversion Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	28	1,379	6,967	8,099	5,757	2,972	130	0	0	0	0	25,331
Above Normal	7	23	1,126	3,672	5,294	3,096	692	0	0	0	0	0	13,911
Normal	0	6	954	868	1,870	906	126	0	0	0	0	0	4,731
Below Normal	0	0	18	45	102	229	0	0	0	0	0	0	394
Dry	0	0	0	0	57	0	0	0	0	0	0	0	58
All Years	1	12	692	2,299	3,075	1,989	748	26	0	0	0	0	8,843

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Modified WSIP minus Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	471	-458	-13	109	287	43	0	0	0	0	438
Above Normal	0	0	-112	-917	-1,220	301	626	0	0	0	0	0	-1,322
Normal	0	0	-300	-133	-556	111	492	0	0	0	0	0	-386
Below Normal	0	0	315	501	512	560	387	0	0	0	0	0	2,275
Dry	0	0	191	293	298	344	201	0	0	0	0	0	1,328
All Years	0	0	113	-144	-200	289	401	8	0	0	0	0	467

Comparing the alternative and WSIP settings, differences in releases from Calaveras Dam to the stream and differences in spills and bypass flows at the ACDD result in differences in flow below the Alameda Creek and Calaveras Creek confluence between the settings. Table 2.6-10 illustrates the flow below the confluence for the alternative and WSIP settings. The flow would be generally the same, with slightly additional flow occurring during December and April due to the bypass flows. Fishery releases for the 1997 MOU are assumed in both of the settings. Table 2.6-11 provides the same form of information for the alternative and base settings. The notable differences between the alternative and base settings (comparable to the differences between the WSIP and base settings) are the addition of required stream flows for the 1997 MOU and the reduction of wetter-year, wet-season flows due to the restoration of Calaveras Reservoir storage.

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Table 2.6-10

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	430	326	3,145	12,372	23,692	16,559	8,836	605	417	429	429	417	67,658
Above Normal	437	326	1,299	3,896	7,820	6,484	2,075	430	418	430	429	417	24,461
Normal	429	304	974	1,171	1,985	1,413	782	430	417	429	430	417	9,182
Below Normal	429	297	488	882	1,215	1,118	510	430	417	430	430	417	7,063
Dry	429	298	368	813	1,168	816	460	430	417	430	430	417	6,475
All Years	431	310	1,246	3,792	7,111	5,242	2,502	464	417	430	429	417	22,792

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	430	326	2,721	12,263	23,595	16,575	8,647	605	417	429	429	417	66,854
Above Normal	437	326	1,007	3,801	7,708	6,379	1,876	430	418	430	429	417	23,658
Normal	429	304	1,006	1,077	1,907	1,293	536	430	417	429	430	417	8,675
Below Normal	429	297	324	859	1,214	1,046	417	430	417	430	430	417	6,709
Dry	429	298	307	813	1,168	816	418	430	417	430	430	417	6,373
All Years	431	310	1,063	3,728	7,053	5,185	2,349	464	417	430	429	417	22,276

Difference in Flow below Alameda/Calaveras Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

Modified WSIP minus WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	424	109	97	-16	190	0	0	0	0	0	805
Above Normal	0	0	293	95	112	105	198	0	0	0	0	0	803
Normal	0	0	-32	94	79	120	246	0	0	0	0	0	507
Below Normal	0	0	164	23	1	72	93	0	0	0	0	0	354
Dry	0	0	61	0	0	0	42	0	0	0	0	0	103
All Years	0	0	183	64	58	57	154	0	0	0	0	0	516

Table 2.6-11

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	430	326	3,145	12,372	23,692	16,559	8,836	605	417	429	429	417	67,658
Above Normal	437	326	1,299	3,896	7,820	6,484	2,075	430	418	430	429	417	24,461
Normal	429	304	974	1,171	1,985	1,413	782	430	417	429	430	417	9,182
Below Normal	429	297	488	882	1,215	1,118	510	430	417	430	430	417	7,063
Dry	429	298	368	813	1,168	816	460	430	417	430	430	417	6,475
All Years	431	310	1,246	3,792	7,111	5,242	2,502	464	417	430	429	417	22,792

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	1	80	3,465	17,243	25,909	16,711	8,598	307	30	12	4	2	72,361
Above Normal	12	68	1,554	6,954	11,987	6,754	1,462	103	22	6	2	1	28,926
Normal	1	29	1,397	1,501	3,154	1,586	284	60	9	2	0	0	8,022
Below Normal	1	22	78	186	338	450	72	41	7	0	0	0	1,195
Dry	1	6	26	35	124	69	43	23	1	0	0	0	328
All Years	3	41	1,292	5,145	8,250	5,077	2,060	106	14	4	1	1	21,993

Difference in Flow below Alameda/Calaveras Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

Modified WSIP minus Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	429	246	-337	-4,871	-2,216	-152	239	298	386	417	425	415	-4,721
Above Normal	425	258	-254	-3,058	-4,168	-270	612	327	396	424	428	417	-4,465
Normal	429	275	-423	-330	-1,168	-173	498	370	408	428	430	417	1,160
Below Normal	428	275	410	695	877	668	438	389	411	430	430	417	5,869
Dry	429	292	342	778	1,044	747	417	407	416	430	430	417	6,147
All Years	428	269	-49	-1,353	-1,139	165	443	358	403	426	428	417	796

A flow recapture facility in Alameda Creek below Calaveras Reservoir is incorporated in the alternative and WSIP settings. This facility is assumed to recapture flows explicitly released for the 1997 MOU. The effect of the recapture would be a reduction in the flow below the confluence of Alameda and Calaveras Creeks, but only to the extent that releases were explicitly made for the 1997 MOU. Flows below this diversion have been estimated and noted as the flow above the Alameda Creek and San Antonio Creek confluence. Table 2.6-12 illustrates the flow at this location for the alternative and WSIP settings. The flows identified at this location are indicative of flow occurring below the confluence of Alameda and Calaveras Creeks (described above) with the addition of estimated stream accretions between the Alameda and Calaveras Creek confluence and the Alameda and San Antonio Creek confluence, less the water assumed to be recaptured (diverted) by the SFPUC from the creek. The flow changes at this location for the comparison of the WSIP and alternative settings are considered insubstantial and may not occur. The differences during the December through April period of wetter years indicate that too much of the spills/releases past the diversion dam were counted as 1997 MOU releases and were subsequently recaptured. The modeled accounting tends to overstate the amount of water allowed to be recaptured. A more precise accounting method would tend to minimize the differences between the alternative and WSIP settings. Table 2.6-13 provides the same form of information for the alternative and base settings.

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Table 2.6-12

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	6	154	3,088	13,218	24,845	17,207	9,016	556	76	33	15	9	68,224
Above Normal	19	150	1,201	4,082	8,259	6,568	1,897	217	54	20	9	6	22,482
Normal	7	64	880	869	1,730	1,192	432	128	28	9	4	3	5,344
Below Normal	7	56	183	404	678	717	154	91	20	5	3	2	2,321
Dry	6	19	70	98	231	145	91	48	9	3	2	2	724
All Years	9	89	1,075	3,698	7,083	5,129	2,286	207	38	14	7	4	19,638

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	6	154	3,113	13,610	25,199	17,720	9,297	556	76	33	15	9	69,788
Above Normal	19	150	1,203	4,350	8,422	6,871	2,127	217	54	20	9	6	23,450
Normal	7	64	1,131	909	1,740	1,219	466	128	28	9	4	3	5,706
Below Normal	7	56	183	404	678	717	154	91	20	5	3	2	2,321
Dry	6	19	70	98	231	145	91	48	9	3	2	2	724
All Years	9	89	1,129	3,838	7,188	5,297	2,396	207	38	14	7	4	20,215

Difference in Alameda Creek Flow abv San Antonio Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

Modified WSIP minus WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	-24	-392	-354	-513	-281	0	0	0	0	0	-1,564
Above Normal	0	0	-2	-268	-163	-303	-230	0	0	0	0	0	-967
Normal	0	0	-251	-40	-10	-26	-34	0	0	0	0	0	-361
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-54	-140	-105	-168	-109	0	0	0	0	0	-576

Table 2.6-13

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	6	154	3,088	13,218	24,845	17,207	9,016	556	76	33	15	9	68,224
Above Normal	19	150	1,201	4,082	8,259	6,568	1,897	217	54	20	9	6	22,482
Normal	7	64	880	869	1,730	1,192	432	128	28	9	4	3	5,344
Below Normal	7	56	183	404	678	717	154	91	20	5	3	2	2,321
Dry	6	19	70	98	231	145	91	48	9	3	2	2	724
All Years	9	89	1,075	3,698	7,083	5,129	2,286	207	38	14	7	4	19,638

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	6	154	3,973	18,714	27,673	17,977	9,358	513	76	33	15	9	78,502
Above Normal	19	150	1,922	7,772	13,068	7,467	1,861	217	54	20	9	6	32,566
Normal	7	64	1,716	1,881	3,712	2,007	479	128	28	9	4	3	10,037
Below Normal	7	56	183	404	678	717	154	91	20	5	3	2	2,321
Dry	6	19	70	98	231	145	91	48	9	3	2	2	724
All Years	9	89	1,560	5,733	9,019	5,624	2,355	198	38	14	7	4	24,650

Difference in Alameda Creek Flow abv San Antonio Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

Modified WSIP minus Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	-885	-5,496	-2,828	-771	-341	43	0	0	0	0	-10,278
Above Normal	0	0	-722	-3,690	-4,809	-899	35	0	0	0	0	0	-10,084
Normal	0	0	-837	-1,012	-1,982	-815	-47	0	0	0	0	0	-4,693
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-485	-2,035	-1,936	-496	-68	8	0	0	0	0	-5,012

Compared to the WSIP setting, the alternative's San Antonio Reservoir operation would draw less from storage on an annual basis, particularly during cyclic maintenance. Figure 2.6-3 illustrates a chronological trace of the simulation of San Antonio Reservoir storage and stream releases from San Antonio Dam. Shown in Figure 2.6-3 are the results for the WSIP, alternative, and base settings. The difference in San Antonio Reservoir storage between the alternative and WSIP settings is mostly caused by the lesser demand of the alternative. Considering that Calaveras Reservoir storage is essentially the same between the settings, the difference in San Antonio Reservoir storage is indicative of the operational strategy to affect storage in San Antonio Reservoir more than storage in the other SFPUC Bay Area reservoirs. San Antonio Reservoir would retain more storage in the alternative setting compared to the WSIP setting.

The difference in storage between the alternative and WSIP settings and the base setting is due to the restoration of the operational capacity of Calaveras Reservoir. In the base setting, the limited operating storage capacity at Calaveras Reservoir leads to a different operation at San Antonio Reservoir, one that retains relatively more stored water for system demands when the draw from Calaveras Reservoir is constrained due to limited storage. There is also a notable difference in storage operation between the alternative and WSIP settings and the base setting due to assumed maintenance. Assumed systematic maintenance of Hetch Hetchy conveyance facilities constrains diversions to the Bay Area from Hetch Hetchy every year, and particularly during every fifth year, in the WSIP and alternative settings.

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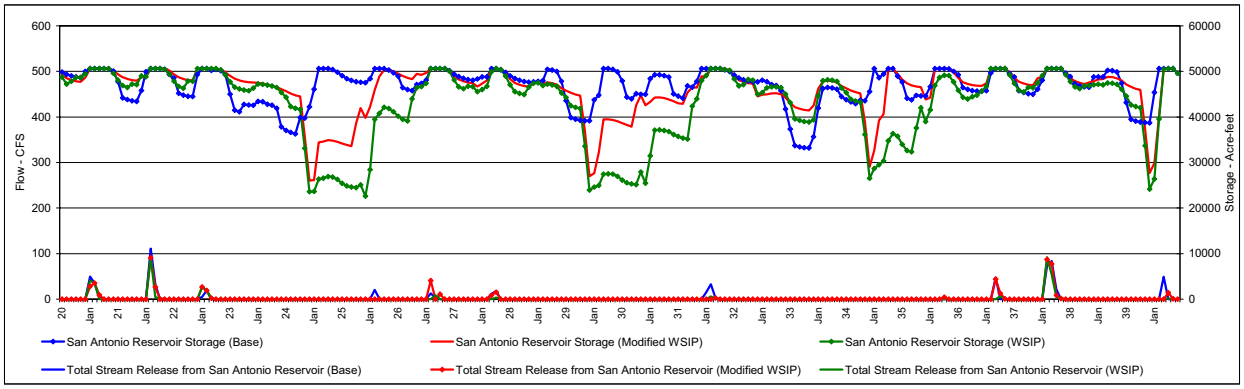
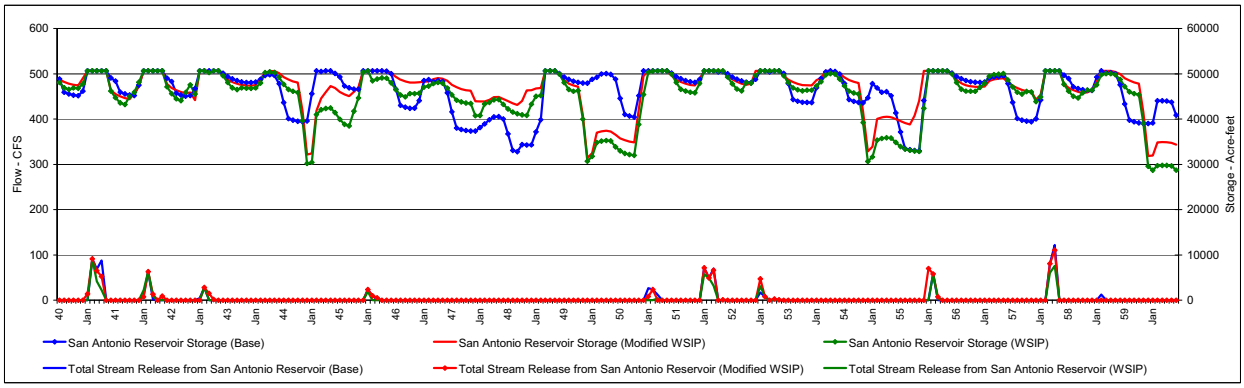
Figure 2.6-3
San Antonio Reservoir Storage and Stream Release

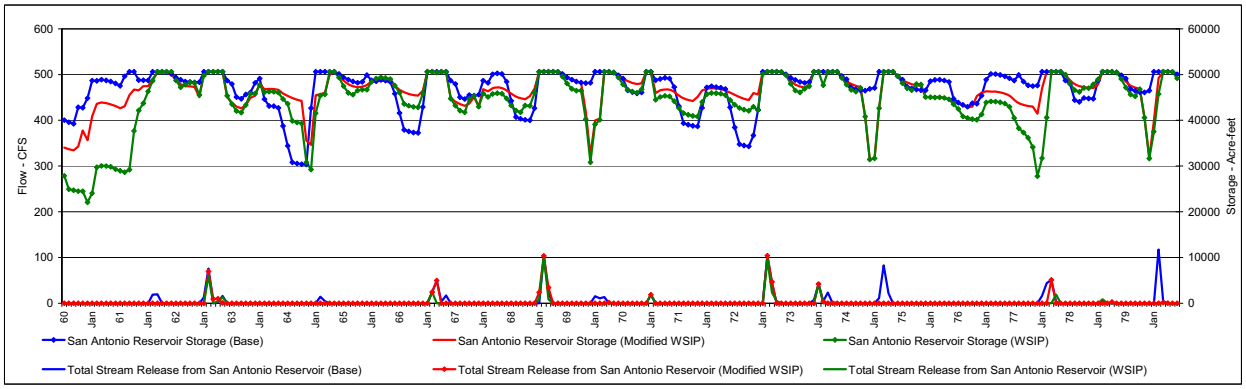
1920 - 1939



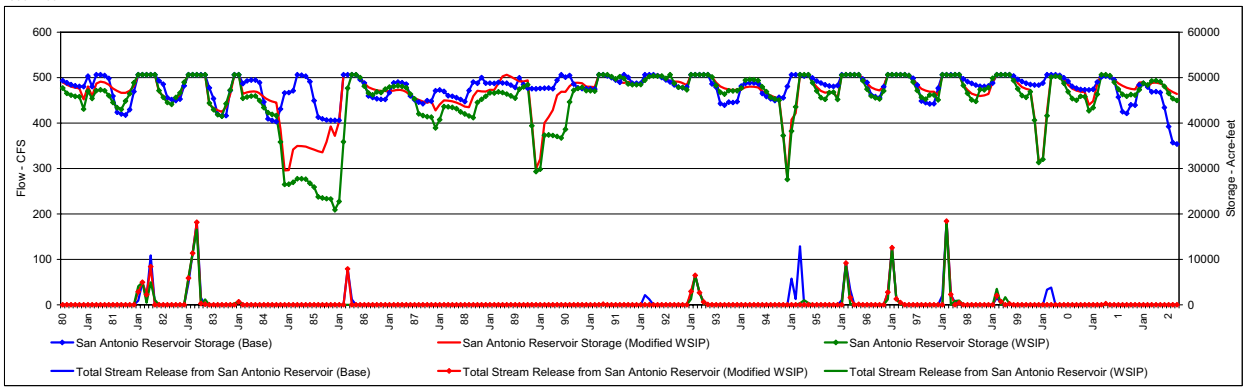
1940 - 1959



1960 - 1979

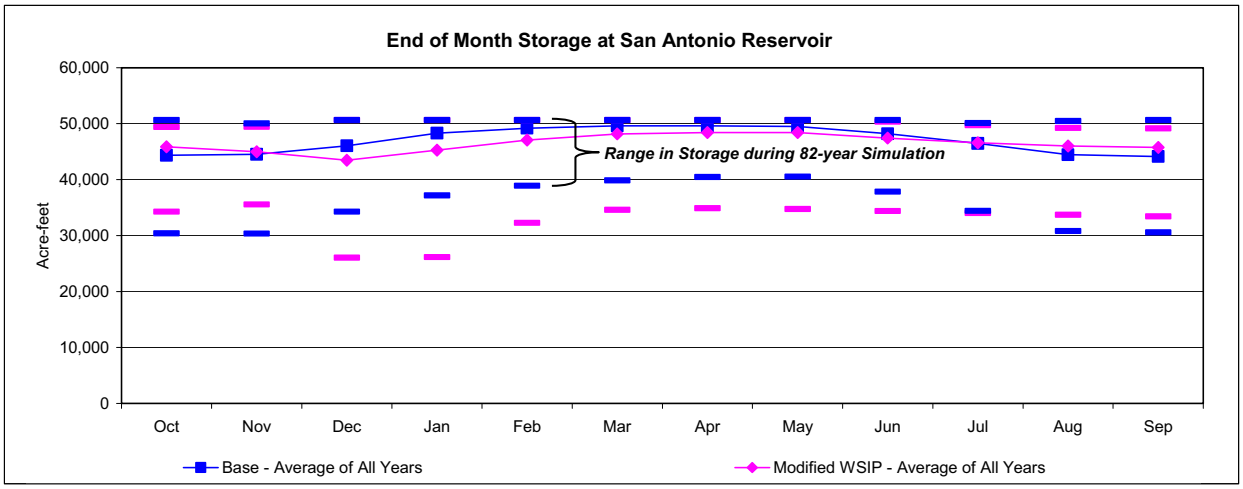


1980 - 2002



The reduction in diversions from Hetch Hetchy during these periods is accommodated in the system by drawing additional water from the Bay Area reservoirs. The proportionate share of this operation is evident in the tracing of San Antonio Reservoir storage for the alternative and WSIP settings. Figure 2.6-4 illustrates the average monthly storage in San Antonio Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and base settings. Compared to the base setting, the alternative would draw less storage from San Antonio Reservoir during many years, typically retaining a fuller reservoir, but would draw more storage during the every-fifth-year maintenance cycle.

Figure 2.6-4



There is very little anticipated change in stream releases below San Antonio Reservoir between the alternative and WSIP settings. Table 2.6-14 illustrates the modeled releases to San Antonio Creek from San Antonio Reservoir for the two settings and the differences for the average release during a year type. With a fuller reservoir operation at times, as seen in Figure 2.6-3, it is expected that there would be a decrease in the ability to regulate reservoir inflow and avoid stream releases. Given the sometimes rigid constraints within the modeling assumptions, the model will overestimate the frequency and magnitude of stream releases from San Antonio Reservoir under any of the investigated settings. The flexibility that occurs in actual operations would likely avoid most of the releases represented by the model. The modeled stream releases from San Antonio Reservoir and the difference between releases for the alternative and base settings are shown in Table 2.6-15. The differences between the two settings reflect a general decrease in modeled releases in the alternative setting. This modeled circumstance reflects the different resulting storage operation between the two settings, as seen in Figure 2.6-3. In most instances, the alternative setting storage at San Antonio Reservoir during a period would be equal to or lower than that projected for the base setting during the same period. This circumstance could lead to an occasionally greater modeled release for the base setting, which is reflected in the results. As described above, the model will overestimate the frequency and magnitude of releases from San Antonio Reservoir, and the actual releases from the reservoir in any setting and the difference between settings are expected to be minor.

Flow below the confluence of Alameda and San Antonio Creeks is influenced by releases from San Antonio Creek and flow arriving at the location from Alameda Creek, which includes upstream impairment by SFPUC operations and facilities. Table 2.6-16 illustrates the flow below the confluence for the alternative and WSIP settings, and the differences in flow between the two. The differences in flow between the alternative and WSIP settings at this location are the net sum of the differences identified for flow reaching the location from Alameda Creek and from San Antonio Creek. The difference in flow from upstream in Alameda Creek was previously identified as insubstantial. Along with the conclusion that flow differences in San Antonio Creek would not be substantial, modeled differences below the confluence are also considered insubstantial.

APPENDIX O2

Table 2.6-14

Total Stream Release from San Antonio Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	106	1,534	3,265	2,891	960	66	0	0	0	0	8,823
Above Normal	0	0	0	487	1,593	748	193	22	0	0	0	0	3,043
Normal	0	0	0	368	62	61	99	3	0	0	0	0	594
Below Normal	0	0	0	0	0	0	12	0	0	0	0	0	12
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	21	472	980	731	249	18	0	0	0	0	2,471

Total Stream Release from San Antonio Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	44	1,208	3,251	1,558	658	151	0	0	0	0	6,870
Above Normal	0	0	0	442	1,381	158	192	62	0	0	0	0	2,235
Normal	0	0	11	287	78	6	13	0	0	0	0	0	395
Below Normal	0	0	0	0	0	0	4	0	0	0	0	0	4
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	11	383	936	338	172	42	0	0	0	0	1,882

Difference in Total Stream Release from San Antonio Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Modified WSIP minus WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	62	326	14	1,333	302	-85	0	0	0	0	1,953
Above Normal	0	0	0	45	212	590	1	-40	0	0	0	0	808
Normal	0	0	-11	81	-16	56	86	3	0	0	0	0	199
Below Normal	0	0	0	0	0	0	8	0	0	0	0	0	8
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	10	89	44	393	78	-24	0	0	0	0	589

Table 2.6-15

Total Stream Release from San Antonio Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	106	1,534	3,265	2,891	960	66	0	0	0	0	8,823
Above Normal	0	0	0	487	1,593	748	193	22	0	0	0	0	3,043
Normal	0	0	0	368	62	61	99	3	0	0	0	0	594
Below Normal	0	0	0	0	0	0	12	0	0	0	0	0	12
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	21	472	980	731	249	18	0	0	0	0	2,471

Total Stream Release from San Antonio Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	101	1,322	3,669	3,288	1,398	94	0	0	0	0	9,872
Above Normal	0	0	26	687	1,909	1,487	116	58	0	0	0	0	4,283
Normal	0	0	7	370	441	237	65	0	0	0	0	0	1,120
Below Normal	0	0	0	0	41	0	0	0	0	0	0	0	41
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	26	472	1,206	996	309	30	0	0	0	0	3,041

Difference in Total Stream Release from San Antonio Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Modified WSIP minus Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	5	213	-404	-398	-438	-28	0	0	0	0	-1,049
Above Normal	0	0	-26	-200	-316	-739	78	-36	0	0	0	0	-1,240
Normal	0	0	-7	-1	-379	-176	34	3	0	0	0	0	-525
Below Normal	0	0	0	0	-41	0	12	0	0	0	0	0	-29
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-6	0	-227	-265	-60	-12	0	0	0	0	-570

Table 2.6-16

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	6	154	3,194	14,753	28,110	20,097	9,977	622	76	33	15	9	77,046
Above Normal	19	150	1,201	4,569	9,852	7,316	2,090	239	54	20	9	6	25,526
Normal	7	64	880	1,237	1,792	1,253	531	131	28	9	4	3	5,939
Below Normal	7	56	183	404	678	717	167	91	20	5	3	2	2,334
Dry	6	19	70	98	231	145	91	48	9	3	2	2	724
All Years	9	89	1,095	4,170	8,063	5,860	2,536	225	38	14	7	4	22,109

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	6	154	3,157	14,818	28,449	19,278	9,955	707	76	33	15	9	76,658
Above Normal	19	150	1,203	4,792	9,803	7,029	2,320	279	54	20	9	6	25,685
Normal	7	64	1,142	1,197	1,818	1,224	478	128	28	9	4	3	6,101
Below Normal	7	56	183	404	678	717	159	91	20	5	3	2	2,326
Dry	6	19	70	98	231	145	91	48	9	3	2	2	724
All Years	9	89	1,140	4,221	8,124	5,635	2,567	249	38	14	7	4	22,097

Difference in Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Modified WSIP minus WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	37	-65	-339	819	22	-85	0	0	0	0	389
Above Normal	0	0	-2	-223	49	287	-230	-40	0	0	0	0	-159
Normal	0	0	-263	41	-26	29	53	3	0	0	0	0	-162
Below Normal	0	0	0	0	0	0	8	0	0	0	0	0	8
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-44	-51	-61	225	-31	-24	0	0	0	0	13

Table 2.6-17 illustrates the same information for the alternative and base settings. Table 2.6-17 illustrates the larger differences in flow that would occur between the alternative and base settings. Those differences are particularly due to the effects of the restoration of Calaveras Reservoir operating capacity.

Table 2.6-17

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	6	154	3,194	14,753	28,110	20,097	9,977	622	76	33	15	9	77,046
Above Normal	19	150	1,201	4,569	9,852	7,316	2,090	239	54	20	9	6	25,526
Normal	7	64	880	1,237	1,792	1,253	531	131	28	9	4	3	5,939
Below Normal	7	56	183	404	678	717	167	91	20	5	3	2	2,334
Dry	6	19	70	98	231	145	91	48	9	3	2	2	724
All Years	9	89	1,095	4,170	8,063	5,860	2,536	225	38	14	7	4	22,109

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	6	154	4,075	20,036	31,342	21,266	10,756	607	76	33	15	9	88,374
Above Normal	19	150	1,948	8,459	14,977	8,954	1,977	276	54	20	9	6	36,849
Normal	7	64	1,723	2,251	4,153	2,244	544	128	28	9	4	3	11,157
Below Normal	7	56	183	404	720	717	154	91	20	5	3	2	2,363
Dry	6	19	70	98	231	145	91	48	9	3	2	2	724
All Years	9	89	1,587	6,205	10,225	6,620	2,664	229	38	14	7	4	27,691

Difference in Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Modified WSIP minus Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	-880	-5,283	-3,232	-1,169	-779	15	0	0	0	0	-11,327
Above Normal	0	0	-747	-3,890	-5,125	-1,638	113	-36	0	0	0	0	-11,323
Normal	0	0	-843	-1,014	-2,361	-991	-13	3	0	0	0	0	-5,218
Below Normal	0	0	0	0	-41	0	12	0	0	0	0	0	-29
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-491	-2,035	-2,162	-761	-128	-4	0	0	0	0	-5,582

2.7 Crystal Springs and San Andreas Reservoirs

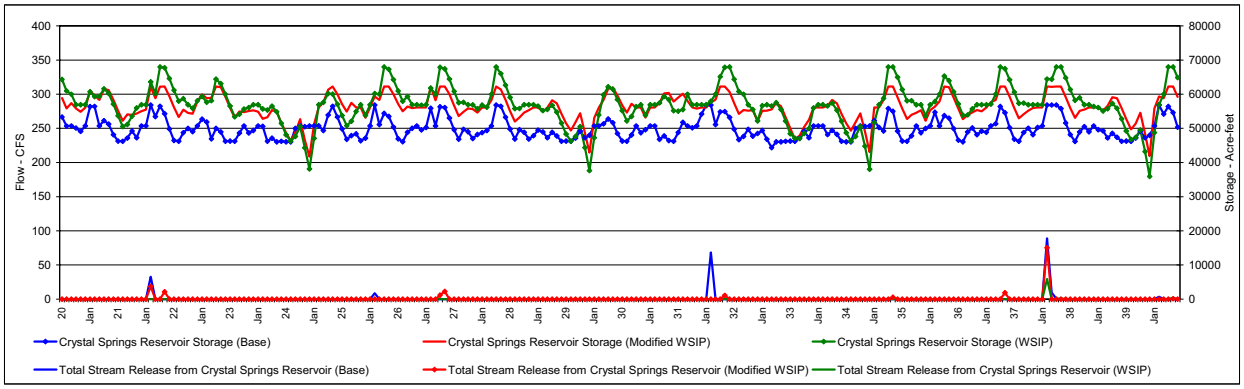
There are differences in Crystal Springs Reservoir operations between the WSIP setting and the alternative and base settings. Figure 2.7-1 illustrates a chronological trace of the simulation of Crystal Springs Reservoir storage and stream releases from Crystal Springs Dam. Shown in Figure 2.7-1 are the results for the WSIP, alternative, and base settings. Fundamental to the difference in storage operations between the WSIP and alternative settings and the base setting is the restoration of reservoir operation capacity, which does not occur in the base setting. The result is the operation of Crystal Springs Reservoir at a lower maximum storage in the base setting. The alternative setting differs from the WSIP setting in that the restored capacity of the Crystal Springs Reservoir is not fully used in the alternative setting. The Crystal Springs Reservoir restricted storage measure affects the maximum storage attained in the reservoir. Rather than having the full reservoir capacity of 22.15 billion gallons to regulate and store water, the reservoir is operationally constrained to a maximum of 20.28 billion gallons.

The operation of Crystal Springs Reservoir storage is generally consistent for the alternative and WSIP settings, except in the alternative setting the reservoir is not filled to the same level of storage. The annual drawdown of the reservoir occurs to about the same level. The alternative setting would provide less carryover storage at Crystal Springs Reservoir into periods of drought and would thereby cause additional draw from other resources to serve the same delivery. The magnitude of the draw of storage from Crystal Springs Reservoir is partially dependent on the discretionary assumptions of the model that proportions the use of storage among the Bay Area system reservoirs. In actual operations, some of these differences may not occur, as system operations and prevailing hydraulic and hydrologic conditions may result in a different apportionment of effect among the reservoirs. However, the operational strategy prefers the retention of storage in the Peninsula reservoirs, similar to the strategy used by the model. Figure 2.7-2 illustrates the average monthly storage in Crystal Springs Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and WSIP settings.

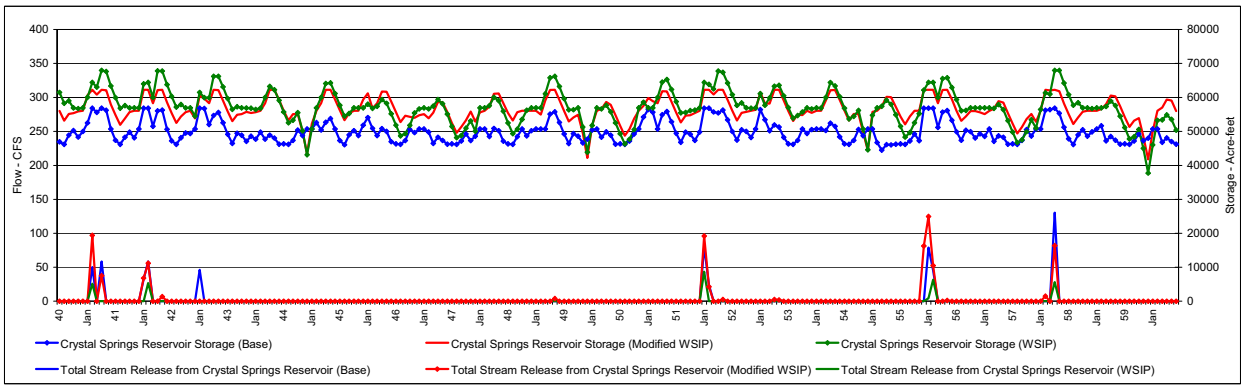
APPENDIX O2

Figure 2.7-1
Crystal Springs Reservoir Storage and Release

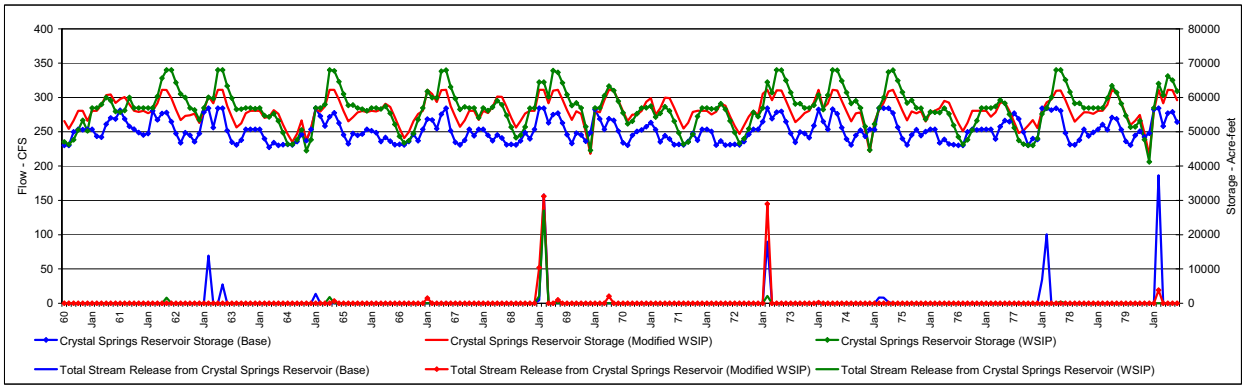
1920 - 1939



1940 - 1959



1960 - 1979



1980 - 2002

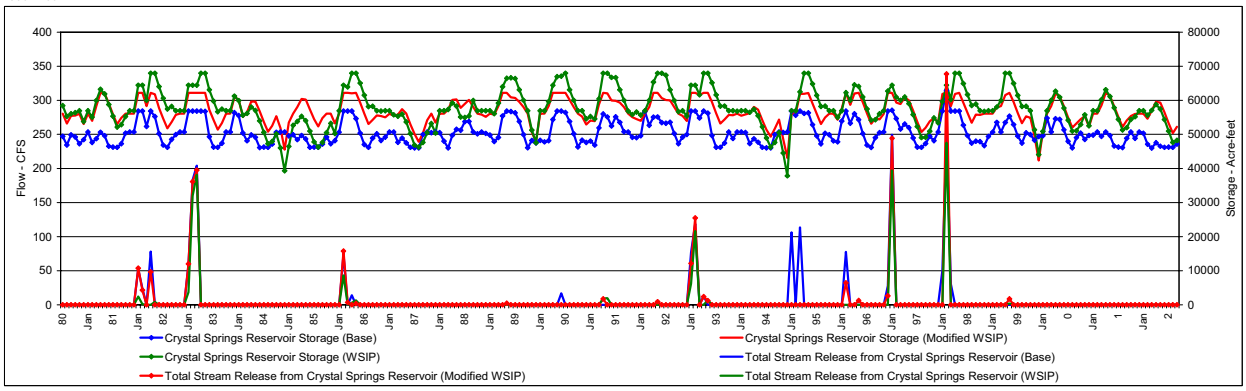


Figure 2.7-2

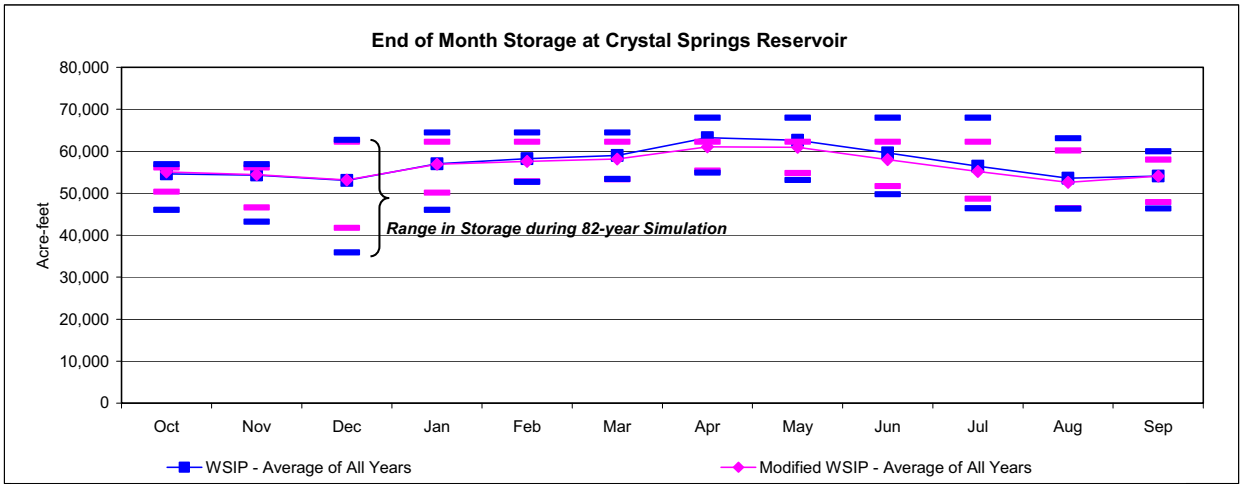


Figure 2.7-3 illustrates the average monthly storage in Crystal Springs Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and base settings. The alternative setting would result in reservoir storage operating at a slightly higher average level during all months, and the range of operating storage would typically be smaller in the alternative setting, except during the system maintenance cycle.

Figure 2.7-3

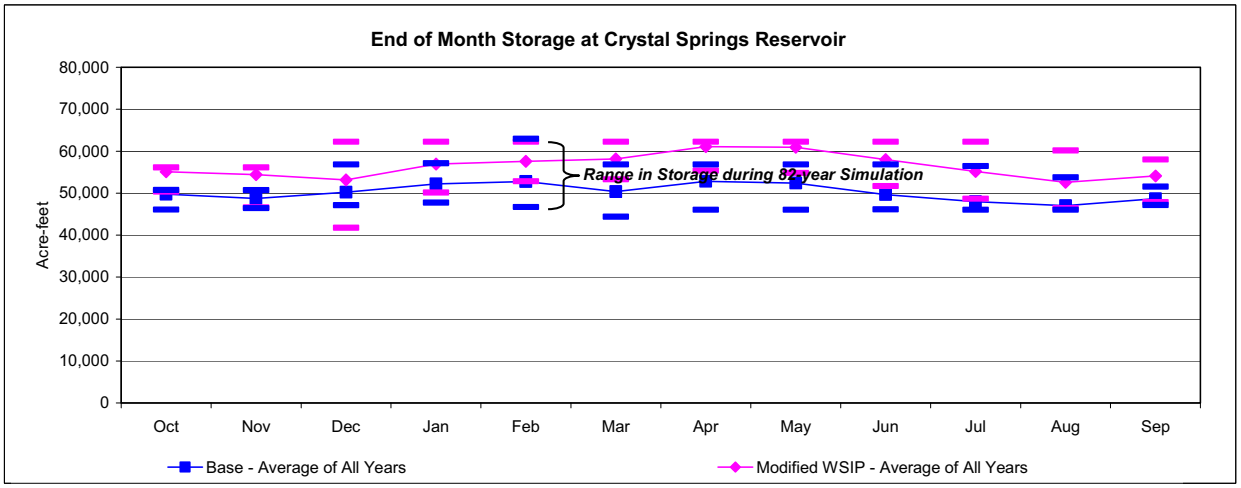


Table 2.7-1 illustrates the modeled alternative and WSIP stream releases from Crystal Springs Reservoir and the differences between the two settings. Modeling results indicate that an increase in the occasional release could occur. The potential difference is attributed to a narrower operating range of reservoir storage in the alternative setting. This narrower range in storage would lead to a greater potential for stream releases. In actual operations, it is anticipated that system operators would manage the reservoir system whereby stream releases would be minimal under any setting, and the effect would be essentially no difference between the alternative and WSIP settings. Similarly, Table 2.7-2 illustrates the stream releases for the alternative and base settings, and the difference in modeled flows between the two settings. A lesser drawdown in Crystal Springs Reservoir storage associated with the alternative setting would lead to a decreased potential to regulate reservoir inflow, which would lead to additional risk in needing to make stream releases. However, as described above, actual system operations attempt to minimize releases under any setting, and thus the difference in releases between the alternative and base setting is minimal, if any.

APPENDIX O2

Table 2.7-1

Total Stream Release from Crystal Springs Reservoir (Acre-feet)
(Average within Year Type - Grouped by SJR Index Year Type)
Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	242	1,880	2,967	515	445	135	0	0	0	0	6,185
Above Normal	0	0	0	0	473	0	56	104	0	0	0	0	634
Below Normal	0	0	0	0	0	0	12	29	0	0	0	0	41
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	32	26	0	0	0	0	59
All Years	0	0	71	550	967	151	150	71	0	0	0	0	1,959

Total Stream Release from Crystal Springs Reservoir (Acre-feet)
(Average within Year Type - Grouped by SJR Index Year Type)
WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	0	811	1,849	488	99	55	0	0	0	0	3,303
Above Normal	0	0	0	0	35	0	0	14	0	0	0	0	49
Below Normal	0	0	0	0	0	0	0	42	0	0	0	0	42
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	33	38	0	0	0	0	71
All Years	0	0	0	237	548	143	36	33	0	0	0	0	997

Difference in Total Stream Release from Crystal Springs Reservoir (Acre-feet)
(Average within Year Type - Grouped by SJR Index Year Type)
Modified WSIP minus WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	242	1,069	1,118	27	346	80	0	0	0	0	2,882
Above Normal	0	0	0	0	438	0	56	90	0	0	0	0	585
Below Normal	0	0	0	0	0	0	12	-13	0	0	0	0	-1
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	-1	-11	0	0	0	0	-12
All Years	0	0	71	313	418	8	114	38	0	0	0	0	962

Table 2.7-2

Total Stream Release from Crystal Springs Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	363	2,583	4,335	772	624	65	0	0	0	0	8,743
Above Normal	0	0	0	223	582	0	62	204	0	0	0	0	1,071
Normal	0	0	0	0	0	0	47	71	0	0	0	0	118
Below Normal	0	0	0	0	0	0	30	0	0	0	0	0	30
Dry	0	0	0	0	0	0	0	9	0	0	0	0	9
All Years	0	0	71	550	967	151	150	71	0	0	0	0	1,959

Total Stream Release from Crystal Springs Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	107	2,744	4,279	1,376	1,047	2	0	0	0	0	9,556
Above Normal	0	0	0	618	1,343	29	52	100	0	0	0	0	2,142
Normal	0	0	0	0	268	0	0	0	0	0	0	0	268
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	62	0	0	0	62
All Years	0	0	21	664	1,166	274	215	21	12	0	0	0	2,373

Difference in Total Stream Release from Crystal Springs Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Modified WSIP minus Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	256	-161	56	-603	-423	63	0	0	0	0	-812
Above Normal	0	0	0	-396	-761	-29	10	104	0	0	0	0	-1,071
Normal	0	0	0	0	-268	0	47	71	0	0	0	0	-150
Below Normal	0	0	0	0	0	0	30	0	0	0	0	0	30
Dry	0	0	0	0	0	0	0	9	-62	0	0	0	-54
All Years	0	0	50	-113	-199	-124	-65	50	-12	0	0	0	-414

Reservoir storage at San Andreas Reservoir would follow a systematic filling and lowering each year; however, there would be slight differences in drawdown between the alternative and WSIP settings, primarily due to the coincidence of the effects of different systemwide maintenance and water demands within each setting. Figure 2.7-4 illustrates a chronological trace of the simulation of San Andreas Reservoir storage and stream releases from San Andreas Dam. Shown in Figure 2.7-4 are the results for the WSIP, alternative, and base settings. There are no projected stream releases from San Andreas Reservoir in any setting. Compared to the base setting, as Figure 2.7-4 illustrates, there would be a difference in storage operation every fifth year for the WSIP and alternative settings. These differences would be the result of Hetch Hetchy conveyance maintenance, which is assumed to occur systematically in the alternative and WSIP settings. The maintenance constrains the amount of Hetch Hetchy water supplied to serve water demands in the Bay Area. As previously discussed, during these winter periods the Bay Area reservoir system would accommodate the reduction in imported supply by serving the Bay Area water deliveries with the local watersheds' runoff and storage. At San Andreas Reservoir, serving this water demand would affect the reservoir when additional required water production at Harry Tracy WTP associated with WSIP or the alternative exceeded the ability to maintain San Andreas Reservoir storage with pumping from Crystal Springs Reservoir. In the modeling, the conveyance capacity from Crystal Springs Reservoir is assumed to be the same among all of the settings. The additional water demand of the WSIP and alternative require additional production from Harry Tracy WTP to be drawn from San Andreas Reservoir.

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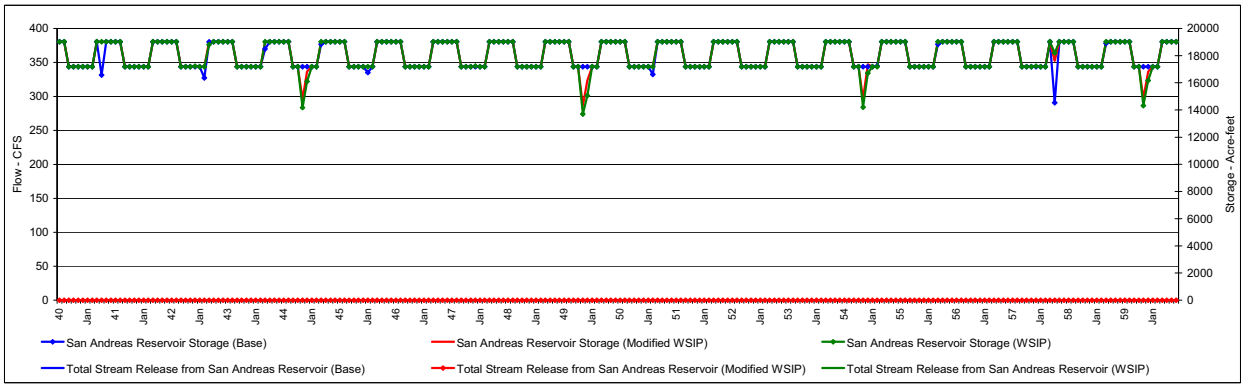
Figure 2.7-4
San Andreas Reservoir Storage and Stream Release

1920 - 1939

1940 - 1959



1960 - 1979

1980 - 2002

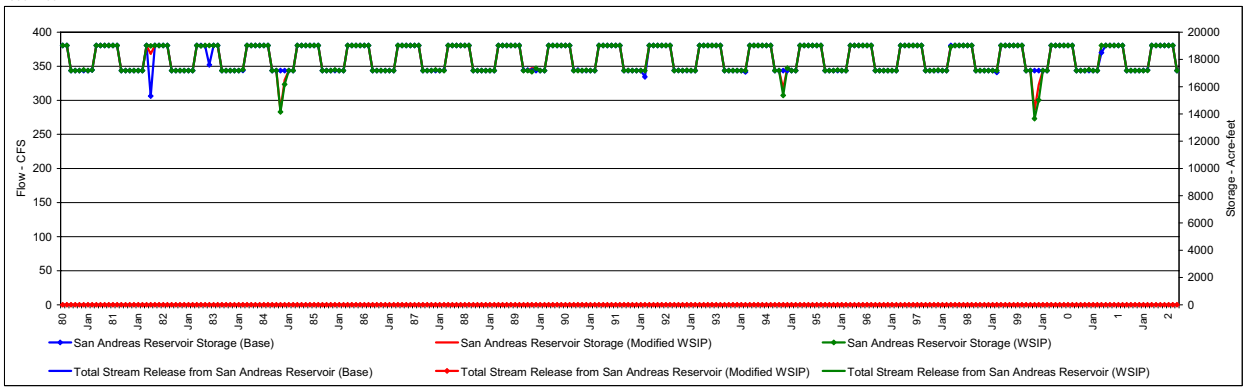
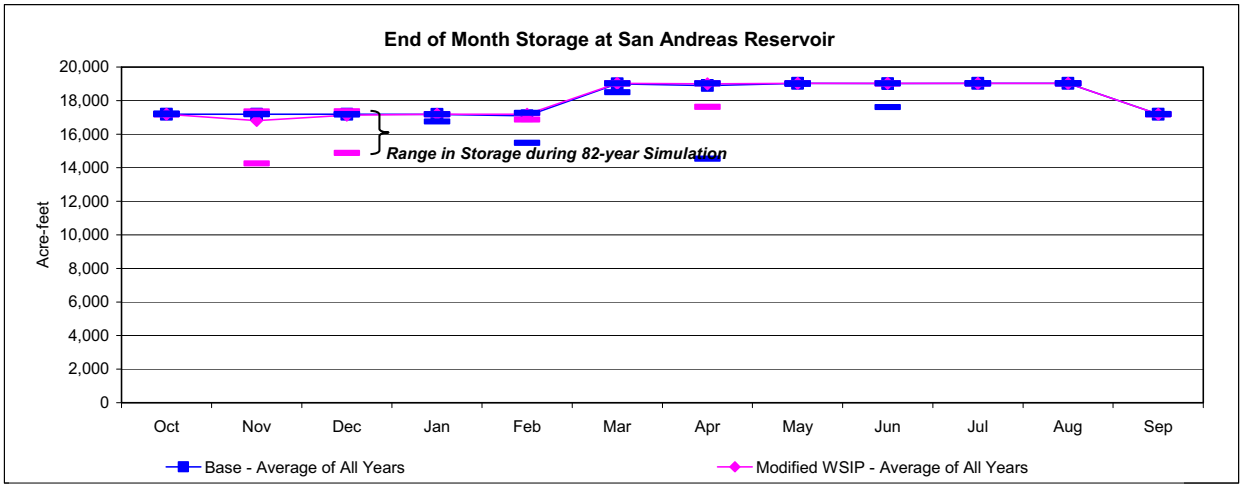


Figure 2.7-5 illustrates the average monthly storage in San Andreas Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and base settings.

Figure 2.7-5



2.8 Pilarcitos Reservoir

Coastside County Water District's (Coastside CWD) water demand and its SFPUC purchase request are projected to increase within the WSIP planning horizon of year 2030. Within the context of the 2030 purchase request of 300 mgd, Coastside CWD's portion is estimated to amount to about 3 mgd. This projected purchase request is approximately 1 mgd greater that its current purchase request. Considering the current physical constraints on deliveries from the SFPUC to Coastside CWD and the ongoing planning activities in the watershed, the precise means of serving Coastside CWD's additional purchase request, and the resultant potential changes in the operation of SFPUC facilities and their affected environs, are uncertain.[2]

Assuming a range of potential means to serve the additional purchase request from Coastside CWD, the following are potential hydrologic effects on SFPUC facilities and their affected environs:

- Due to limited yield from Pilarcitos Reservoir, additional diversions would be required from Crystal Springs Reservoir.
- If deliveries to Coastside CWD from Pilarcitos Reservoir increase during the fall/winter/spring seasons, these deliveries could potentially reduce storage in Pilarcitos Reservoir, thereby potentially reducing diversions to the San Mateo Creek watershed. Although the increased delivery would increase releases to Pilarcitos Creek from Pilarcitos Dam for a period of time, the increase would subsequently lead to a reduction in spills past Stone Dam.
- Additional fall/spring/winter deliveries could also potentially impair the ability to provide carryover storage into the summer season from Pilarcitos Reservoir, and subsequently lead to an acceleration of the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.
- An increase in summertime deliveries from Pilarcitos Creek could also accelerate the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.

In the WSIP setting, Coastside CWD is assumed to increase its SFPUC demand from 1.8 mgd (average annual purchase request) to 3 mgd. It is also assumed that the month-to-month shape of Coastside CWD's future purchase request to the SFPUC system would follow the existing monthly shape. Currently,

[2] See *Analysis of SFPUC PIlarcitos/Coastside County Water District Operations*, Memorandum by Daniel B. Steiner, March 8, 2007.

APPENDIX O2

Coastside CWD can only receive a maximum of 2 mgd from the Pilarcitos Creek system due to the capacity of the connection to the Stone Tunnel, and it reaches its maximum delivery rate during the summer in the base setting. It is assumed that Coastside CWD would increase its delivery from Stone Dam following the shape of its increase in demand during the months when it currently does not reach the 2 mgd capacity (e.g., fall/winter/spring). By taking delivery of additional Pilarcitos Creek water in the fall/winter/spring, there are times when Pilarcitos Reservoir would not fill during the ensuing winter and thus the additional delivery would affect the carryover of reservoir storage into the summer. The effect is that the reservoir could empty to the spillway invert earlier in the summer than in the base setting. The effect would then cause the creek below Pilarcitos Reservoir to experience only reservoir inflow as compared to a controlled release (larger) out of the reservoir. A way to avoid or reduce this effect would be to provide extraction (pumping) of reservoir storage during the summer to maintain controlled releases to the creek in excess of reservoir inflow. The measure is modeled by allowing the Coastside CWD delivery to be met from Pilarcitos Reservoir storage even if the spillway crest has been reached, inferring pumping out water below the spillway invert.

The summer flow reduction in the WSIP setting (compared to the base setting) occurs in about 25 percent of the years, during one or more of the months of July through September. There are a few exceptions of years when the effect occurs in months prior to July. The effect typically manifests as one additional month of flow reduction in a year, amounting to about 150 to 190 acre-feet. The worst event was a reduction in two months of a year (1947), amounting to about 300 acre-feet.

The July through September flow reduction effect could be ameliorated by allowing water to be extracted from the reservoir below the spillway invert to meet the Coastside CWD delivery request during the summer. The model allows Pilarcitos Reservoir to operate at a lower minimum storage for the months of July through September. Figure 2.8-1 illustrates a chronological trace of the simulation of Pilarcitos Reservoir storage and stream releases from Pilarcitos Dam. Shown in Figure 2.8-1 are the results for the WSIP, alternative, and base settings. The alternative setting includes an allowance to draw up to 300 acre-feet from Pilarcitos Reservoir below the spillway invert to maintain July through September flows in Pilarcitos Creek.

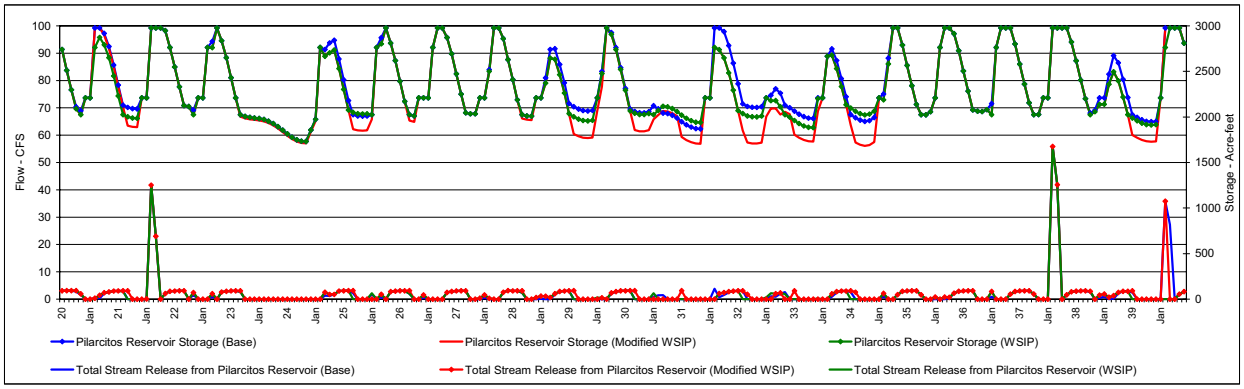
The effect of the assumed Coastside CWD operation in combination with the effects of the overall SFPUC regional system operations would be occasional differences in the storage operation of Pilarcitos Reservoir. Overall, there would be a slightly lower average storage at Pilarcitos Reservoir. Figure 2.8-2 illustrates the average monthly storage in Pilarcitos Reservoir for the 82-year simulation, and the range in storage for each month for the WSIP and base settings.

Figure 2.8-1 illustrates the result of allowing the reservoir to go below the spillway invert during July through September in the alternative setting. The 300-acre-foot value is representative of the largest effect of the WSIP in a year (1947) for the July through September period. The hydrograph illustrates that the measure is not needed every year, and the full 300 acre-feet of the measure is rarely used. In effect, the measure assures controlled flow during the July through September period, even if the base did not have controlled flow. Several factors contribute to other changes in Pilarcitos Reservoir storage. At times, additional water is drawn from Pilarcitos Reservoir to the San Mateo Creek watershed in reaction to additional demands being served from the SFPUC system. Pilarcitos Reservoir is at times also drawn to meet the increase in demand from Coastside CWD during months (e.g., spring months) when available conveyance capacity from Stone Dam exists. Both of these additional draws from the reservoir would deplete storage below that experienced in the base setting. Pilarcitos storage would typically replenish at the expense of future reservoir spills, or within a year storage would end the same and the reservoir would still reach the minimum level at the spillway invert.

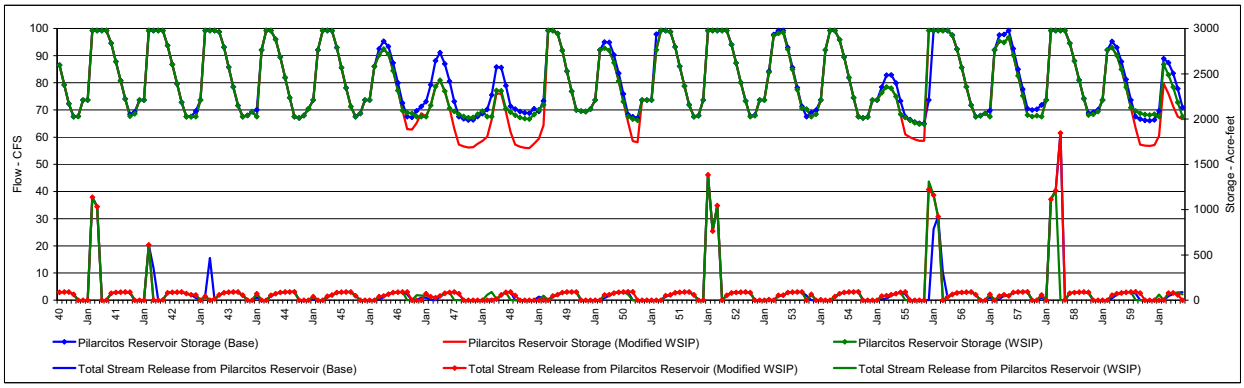
APPENDIX O2

Figure 2.8-1
Pilarcitos Reservoir Storage and Stream Release

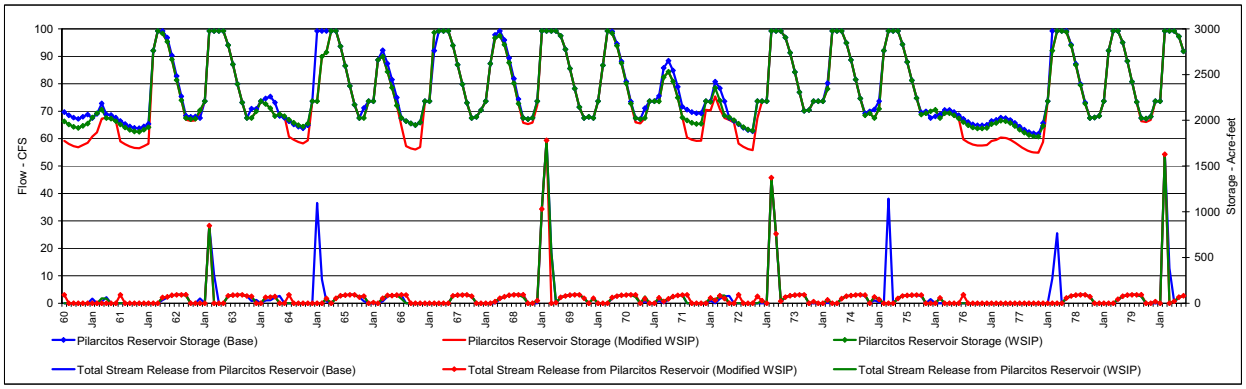
1920 - 1939



1940 - 1959



1960 - 1979



1980 - 2002

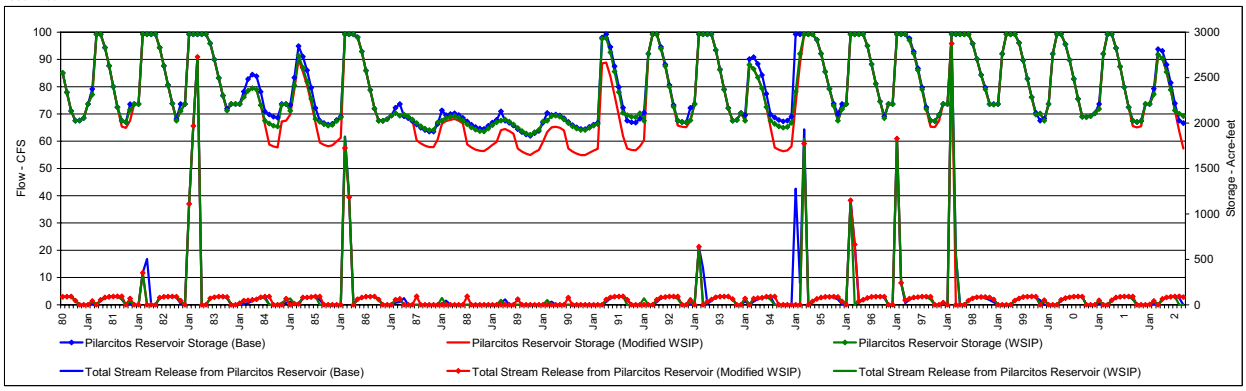
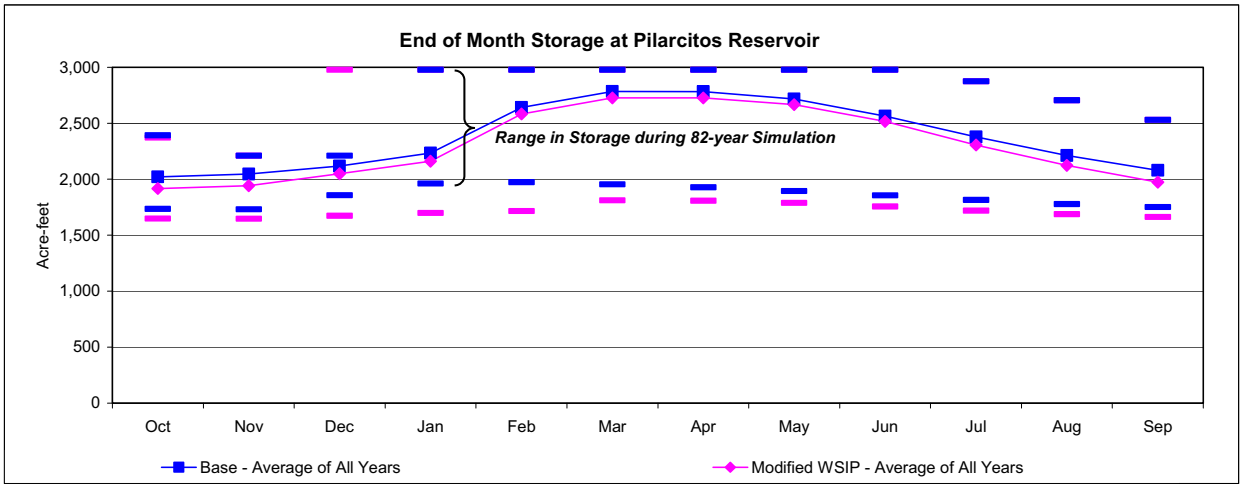


Figure 2.8-2



Stream releases from Pilarcitos Dam are also shown in Figure 2.8-1. Releases can occur for diversions at Stone Dam for Coastside CWD deliveries, conveyance to the San Mateo Creek watershed (e.g., Crystal Springs Reservoir), and reservoir spills. Pilarcitos Creek typically gains flow from unregulated tributary streams and runoff below Pilarcitos Dam. The differences in flow between the alternative and WSIP settings are shown chronologically in Table 2.8-1. The differences in flow between the alternative and base settings are shown chronologically in Table 2.8-2. The results shown in these two tables illustrate that the alternative's flow measure would ameliorate all summer (July through September) flow reductions associated with the WSIP, and at times would provide flow in excess of the flow occurring in the base setting.

Table 2.8-3 summarizes monthly average flow within year types for the comparison of the alternative and WSIP settings. Table 2.8-4 provides the same information for the alternative and base settings. When compared to the base setting, the alternative setting would result in positive changes in flows during the winter and spring, which are indicative of the additional draw of water from the reservoir to serve the increased demand of Coastside CWD during the period when conveyance capacity to Coastside CWD exists from Stone Dam. In this same comparison, the few reductions in flow during the early summer are indicative of years when additional releases earlier in a year would lead to the reservoir being depleted to minimum storage earlier in the year, thus reducing the amount of water released in a later month. During the summer, the increased releases are indicative of the alternative's flow measure. Reductions in flow during the winter and spring are indicative of the reservoir replenishing additionally depleted storage associated with the alternative setting.

The effect of the WSIP on Pilarcitos Creek flows below Stone Dam differs from the effect on flows below Pilarcitos Dam. Figure 2.8-3 illustrates the chronological trace of inflow to Stone Dam, which includes releases from Pilarcitos Dam to Pilarcitos Creek and unregulated flow to the stream below Pilarcitos Dam, and releases (spills) from Stone Dam to Pilarcitos Creek. Shown in the figure are the results for the alternative, WSIP, and base settings. The flow past Stone Dam in all the settings is typically minor (zero in modeling results, but may be measurable in terms of leakage and seepage past the dam), as inflow to the dam is diverted to Coastside CWD or to the San Mateo watershed. Releases past Stone Dam typically occur when unregulated flow below Pilarcitos Dam exceeds the delivery needs of Coastside CWD at a time when the storage level at Crystal Springs Reservoir rejects the water from the Pilarcitos watershed. During times when inflow to Stone Dam is reduced due to reduced spills from Pilarcitos Reservoir, there are still substantial spills from Stone Dam to Pilarcitos Creek from the unregulated flow below Pilarcitos Dam.

In comparison to the base setting, the changes in flow below Stone Dam in the alternative setting would typically occur during the rainy season between the months of January and March, in at least one month during about half of the years. Tables 2.8-5 and 2.8-6 summarize the results of the alternative, WSIP, and base settings in terms of average monthly flows by year type, and the average differences in flow among the settings.

APPENDIX O2

Table 2.8-1

Difference in Total Stream Release from Pilarcitos Reservoir (Acre-feet) Modified WSIP minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	21	0	0	0	0	0	15	181	217
1922	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	21	21
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	184	184
1926	0	0	0	-131	0	0	0	0	0	0	0	66	-66
1927	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	0	0	0	0	0	0	0	0	0	42	42
1929	0	0	0	0	0	0	0	0	0	0	190	0	190
1930	0	0	0	-34	0	0	0	0	0	0	0	184	150
1931	0	0	0	-131	0	0	0	0	0	190	0	0	59
1932	0	0	0	0	0	0	0	0	0	0	187	108	295
1933	0	0	0	-40	-120	0	0	-116	0	187	0	0	-89
1934	0	0	-15	0	0	0	0	0	0	187	158	0	330
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	0	0	0	0	0	0	0	0	0
1937	0	0	0	0	0	0	0	0	0	0	0	0	0
1938	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	187	0	0	187
1940	0	0	0	0	1,991	0	0	0	0	0	0	0	1,991
1941	0	0	0	0	0	0	0	0	0	0	0	0	0
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	1	1
1945	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	181	181
1947	0	-110	-107	37	0	0	0	0	0	187	148	0	155
1948	0	0	0	0	-107	-187	0	0	0	187	108	0	1
1949	0	0	0	0	-92	0	0	0	0	0	0	0	-92
1950	0	0	0	0	0	0	0	0	0	0	58	184	242
1951	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	1	1
1955	0	0	0	0	0	0	0	0	0	187	0	0	187
1956	0	0	-184	0	0	0	0	0	0	0	0	0	-184
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	3,661	0	0	0	0	0	3,661
1959	0	0	0	0	0	0	0	0	0	0	190	155	346
1960	0	0	0	-129	0	0	0	-51	-129	187	0	0	-121
1961	0	0	0	0	0	-110	-100	0	0	187	0	0	-23
1962	0	0	0	0	0	0	0	0	0	0	0	18	18
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	187	0	0	187
1965	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	88	185	0	273
1967	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	53	53
1969	0	0	0	-42	0	-1,136	0	0	0	0	0	0	-1,179
1970	0	0	0	0	0	0	0	0	0	0	0	48	48
1971	0	-47	0	0	0	0	0	0	0	0	187	0	140
1972	0	0	-15	0	0	0	-66	0	0	190	0	0	109
1973	0	149	0	0	0	0	0	0	0	0	0	0	149
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	190	0	0	190
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	36	36
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	63	63
1982	0	58	0	0	0	0	0	0	0	0	0	0	58
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	44	187	0	232
1985	0	-46	31	-141	0	0	0	0	0	0	187	0	31
1986	0	0	9	0	-224	0	0	0	0	0	0	0	-215
1987	0	0	0	0	0	0	0	0	0	190	0	0	190
1988	0	0	0	-153	0	0	0	0	0	190	0	0	37
1989	0	0	0	0	0	-111	0	0	0	126	0	0	15
1990	0	0	0	0	-98	0	0	0	0	162	0	0	64
1991	0	0	0	0	0	0	0	0	0	0	0	111	111
1992	0	0	0	-148	0	0	0	0	0	0	0	54	-94
1993	0	0	-50	0	0	0	0	0	0	0	0	0	-50
1994	0	0	0	0	0	0	0	0	0	75	187	0	262
1995	0	0	0	0	0	-107	0	0	0	0	0	0	-107
1996	0	0	0	0	0	1,360	0	0	0	0	0	0	1,360
1997	0	0	0	0	0	0	0	0	0	0	0	67	67
1998	0	0	0	0	0	-1,133	0	0	0	0	0	0	-1,133
1999	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	60	60
2002	0	0	0	0	0	0	0	0	0	0	190	169	359
Avg (21-02)	0	0	-4	-11	17	-17	43	-2	-2	38	27	24	112

APPENDIX O2

Table 2.8-2

Difference in Total Stream Release from Pilarcitos Reservoir (Acre-feet) Modified WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	21	21	0	0	0	68	21	0	0	0	0	181	312
1922	0	0	0	3	0	0	0	0	0	0	0	0	3
1923	0	51	0	0	0	68	0	0	0	0	0	21	140
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	75	36	0	0	0	0	56	166
1926	0	0	0	-107	0	68	0	0	0	0	0	66	26
1927	0	0	64	0	0	0	0	0	0	0	0	0	64
1928	0	0	21	64	18	0	0	0	0	0	0	42	146
1929	0	0	37	64	58	37	21	0	0	0	190	0	407
1930	0	0	0	0	25	0	21	0	0	0	0	184	230
1931	0	0	0	-52	-80	-92	0	0	0	190	0	0	-34
1932	0	0	0	0	-211	79	52	17	0	0	0	108	45
1933	0	0	0	0	-59	68	21	-160	0	187	0	0	57
1934	0	0	0	0	0	68	21	0	0	30	158	0	277
1935	0	0	0	0	64	0	0	0	0	0	0	0	64
1936	0	0	0	46	0	46	21	0	0	0	0	0	113
1937	0	0	0	122	0	0	0	0	0	0	0	0	122
1938	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	16	0	64	64	40	68	21	0	-6	37	0	0	304
1940	0	0	0	0	0	-1,677	0	0	0	0	0	0	-1,677
1941	0	0	0	0	0	0	0	0	0	0	0	0	0
1942	21	0	0	0	0	-734	0	0	0	0	0	0	-713
1943	0	0	64	0	0	-958	21	0	0	0	0	0	-874
1944	0	0	0	77	0	0	21	0	0	0	0	1	99
1945	0	0	0	64	0	0	21	0	0	0	0	0	85
1946	0	0	0	0	0	68	21	0	0	0	0	53	141
1947	0	0	-59	91	61	58	21	0	0	0	12	0	185
1948	0	0	0	0	0	-27	21	0	0	0	108	0	102
1949	0	0	0	-83	-31	0	21	0	0	0	0	0	-94
1950	0	0	0	0	0	68	21	0	0	0	0	184	273
1951	0	0	0	0	0	0	21	0	0	0	0	0	21
1952	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	7	0	0	0	12	0	21	0	0	0	0	0	40
1954	-104	128	0	9	0	0	21	0	0	0	0	1	55
1955	0	0	0	0	61	68	21	0	0	50	0	0	200
1956	0	0	2,505	766	0	-624	21	0	0	0	0	0	2,668
1957	0	0	0	68	0	68	21	0	0	0	0	0	157
1958	0	0	59	0	0	0	0	0	0	0	0	0	59
1959	21	0	0	0	0	68	21	0	0	0	42	155	307
1960	0	0	0	0	0	68	21	-51	-178	187	0	0	47
1961	0	0	0	-104	0	-36	-130	0	0	187	0	0	-83
1962	0	0	0	0	0	0	52	17	0	0	0	0	70
1963	0	0	-107	0	0	-639	0	0	0	0	0	0	-747
1964	1	101	-74	0	61	68	21	-166	0	187	0	0	199
1965	0	0	0	-2,248	-485	68	0	0	0	0	0	0	-2,666
1966	0	110	0	15	0	68	21	0	0	3	185	0	401
1967	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	34	21	0	0	0	0	4	59
1969	0	0	55	-42	0	-1,136	12	0	0	0	0	0	-1,111
1970	0	0	0	0	0	0	21	0	0	0	0	28	49
1971	0	59	0	0	61	40	21	0	0	0	187	0	367
1972	0	0	0	64	61	68	-45	-162	0	190	0	0	176
1973	0	149	55	0	0	0	21	0	0	0	0	0	226
1974	0	37	0	0	61	0	0	0	0	0	0	0	98
1975	21	0	72	64	0	-2,341	0	0	0	0	0	0	-2,184
1976	21	0	-93	0	108	0	0	0	0	190	0	0	226
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	-503	-1,569	0	17	0	0	0	0	-2,054
1979	-10	0	0	0	0	0	21	0	0	0	0	36	47
1980	0	0	37	0	0	-783	21	0	0	0	0	0	-726
1981	0	0	0	0	61	0	21	0	0	0	0	63	145
1982	0	120	0	0	0	-1,032	0	0	0	0	0	0	-912
1983	19	62	0	0	0	0	0	0	0	0	0	0	80
1984	21	0	0	34	61	68	21	0	0	0	187	0	392
1985	0	0	95	-77	21	18	21	0	0	0	81	0	160
1986	0	0	9	0	-236	0	0	0	0	0	0	0	-227
1987	0	0	0	0	61	68	-145	0	0	190	0	0	174
1988	0	0	0	-24	-83	0	0	0	0	190	0	0	83
1989	0	0	0	0	0	-36	-116	0	0	126	0	0	-25
1990	0	0	0	0	0	-73	0	0	0	162	0	0	89
1991	0	0	0	0	0	0	52	17	0	0	0	-6	64
1992	0	0	0	0	0	0	52	17	0	0	0	37	106
1993	0	0	88	0	0	-820	52	17	0	0	0	0	-662
1994	-1	0	0	62	0	68	21	0	0	0	187	0	336
1995	0	0	0	-2,620	-442	-320	0	0	0	0	0	0	-3,383
1996	21	53	64	0	0	0	21	0	0	0	0	0	159
1997	21	0	0	0	0	68	21	0	0	0	0	47	157
1998	0	0	49	0	0	-1,133	0	0	0	0	0	0	-1,084
1999	21	62	64	0	0	0	0	0	0	0	0	0	147
2000	21	-101	104	0	0	0	21	0	0	0	0	0	45
2001	0	0	0	64	0	0	21	0	0	0	0	60	145
2002	0	0	0	6	61	0	21	0	0	0	35	169	292
Avg (21-02)	2	10	39	-44	-14	-150	9	-5	-2	26	17	18	-96

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Table 2.8-3

Total Stream Release from Pilarcitos Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	57	24	176	834	2,102	1,414	248	70	152	175	183	180	5,616
Above Normal	63	44	44	15	550	182	31	117	161	181	186	181	1,754
Normal	56	6	8	16	26	32	83	143	171	185	187	155	1,069
Below Normal	52	25	10	28	23	61	126	146	164	187	165	112	1,099
Dry	38	0	6	33	24	54	51	46	43	159	28	0	481
All Years	53	20	48	181	539	343	107	105	139	178	150	126	1,990

Total Stream Release from Pilarcitos Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	57	11	188	837	2,116	1,563	19	70	152	175	183	176	5,547
Above Normal	63	44	47	15	432	102	31	117	161	181	185	169	1,546
Normal	56	9	8	34	32	32	83	143	171	183	152	116	1,018
Below Normal	52	28	9	39	23	61	126	146	164	149	96	47	940
Dry	38	7	13	59	44	79	61	56	51	7	0	0	416
All Years	53	20	53	193	522	360	64	107	141	140	124	102	1,878

Difference in Total Stream Release from Pilarcitos Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

Modified WSIP minus WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	13	-11	-3	-14	-149	229	0	0	0	0	4	70
Above Normal	0	0	-3	0	118	80	0	0	0	0	1	12	208
Normal	0	-3	0	-17	-6	0	0	0	0	3	35	38	50
Below Normal	0	-3	1	-10	0	0	0	0	0	38	68	65	159
Dry	0	-7	-8	-26	-20	-26	-10	-10	-8	152	28	0	65
All Years	0	0	-4	-11	17	-17	43	-2	-2	38	27	24	112

Table 2.8-4

Total Stream Release from Pilarcitos Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	57	24	176	834	2,102	1,414	248	70	152	175	183	180	5,616
Above Normal	63	44	44	15	550	182	31	117	161	181	186	181	1,754
Normal	56	6	8	16	26	32	83	143	171	185	187	155	1,069
Below Normal	52	25	10	28	23	61	126	146	164	187	165	112	1,099
Dry	38	0	6	33	24	54	51	46	43	159	28	0	481
All Years	53	20	48	181	539	343	107	105	139	178	150	126	1,990

Total Stream Release from Pilarcitos Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	54	3	4	953	2,144	1,770	242	70	152	175	183	177	5,927
Above Normal	56	37	20	137	605	641	22	115	161	181	186	169	2,328
Normal	55	3	7	15	24	9	60	139	171	185	164	128	960
Below Normal	57	6	7	15	6	23	103	154	164	171	124	65	894
Dry	36	0	11	26	17	41	70	69	55	44	8	0	378
All Years	52	10	10	225	553	493	98	110	141	152	134	108	2,085

Difference in Total Stream Release from Pilarcitos Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

Modified WSIP minus Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	4	21	173	-119	-42	-356	6	0	0	0	0	3	-310
Above Normal	6	7	24	-121	-55	-459	9	2	0	0	0	12	-574
Normal	1	4	1	1	2	23	23	3	0	0	23	27	109
Below Normal	-5	20	3	13	17	38	24	-9	0	16	41	48	205
Dry	2	0	-5	6	7	13	-19	-23	-11	115	19	0	102
All Years	2	10	39	-44	-14	-150	9	-5	-2	26	17	18	-96

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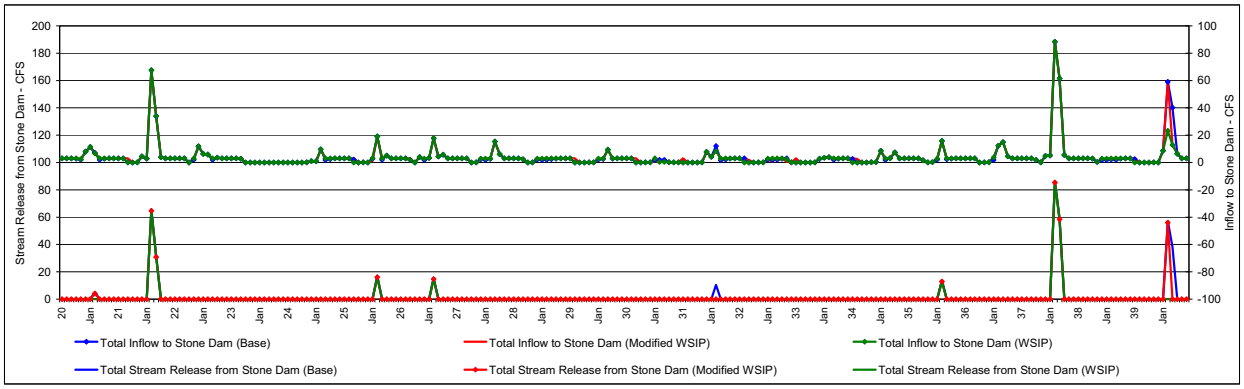
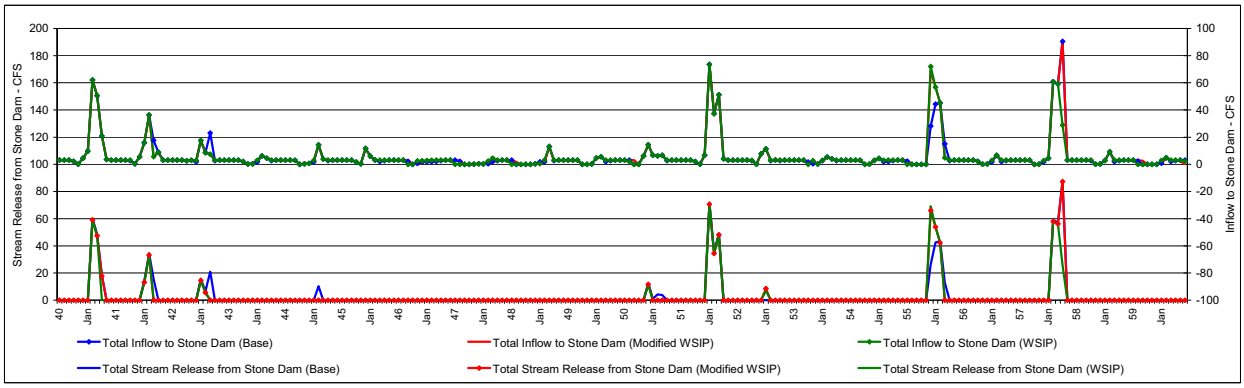
Figure 2.8-3
Stone Dam Stream Release and Inflow

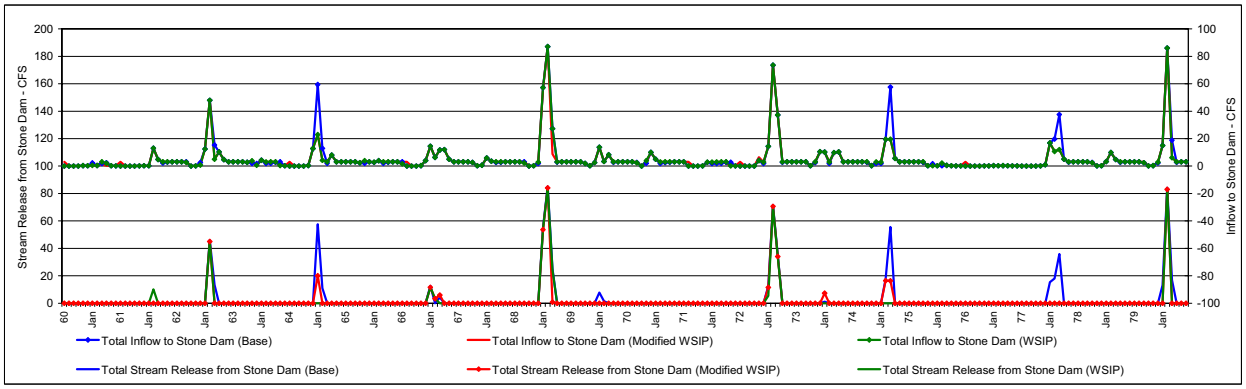
1920 - 1939



1940 - 1959



1960 - 1979



1980 - 2002

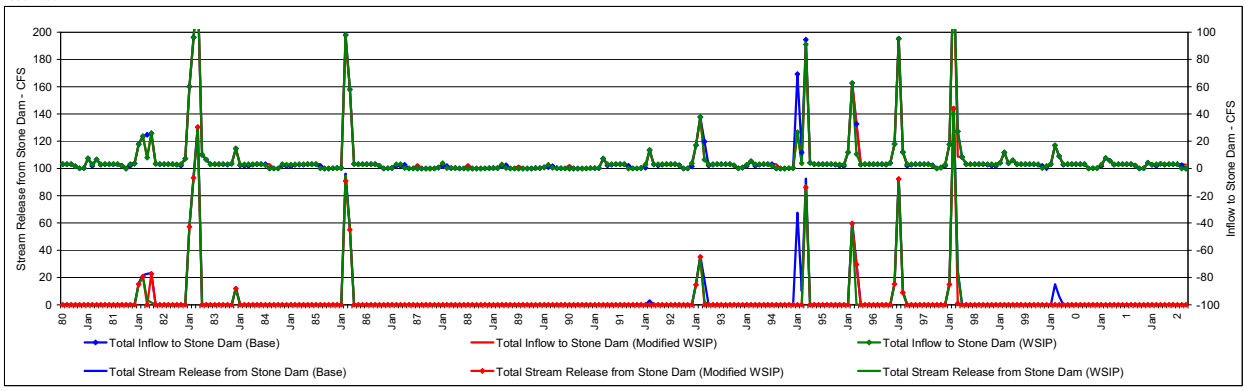


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Table 2.8-5

Total Stream Release from Stone Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	312	1,514	3,162	2,011	475	0	0	0	0	0	7,474
Above Normal	0	0	42	205	985	278	0	0	0	0	0	0	1,509
Normal	0	0	45	33	100	0	0	0	0	0	0	0	179
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	78	344	841	450	93	0	0	0	0	0	1,806

Total Stream Release from Stone Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	324	1,493	3,176	2,188	103	0	0	0	0	0	7,282
Above Normal	0	0	42	108	734	120	0	0	0	0	0	0	1,003
Normal	0	0	45	27	135	0	0	0	0	0	0	0	208
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	81	319	798	452	20	0	0	0	0	0	1,669

Difference in Total Stream Release from Stone Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Modified WSIP minus WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	-11	21	-14	-176	373	0	0	0	0	0	193
Above Normal	0	0	0	97	250	158	0	0	0	0	0	0	505
Normal	0	0	0	6	-35	0	0	0	0	0	0	0	-29
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-2	25	42	-2	73	0	0	0	0	0	137

Table 2.8-6

Total Stream Release from Stone Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Modified WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	312	1,514	3,162	2,011	475	0	0	0	0	0	7,474
Above Normal	0	0	42	205	985	278	0	0	0	0	0	0	1,509
Normal	0	0	45	33	100	0	0	0	0	0	0	0	179
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	78	344	841	450	93	0	0	0	0	0	1,806

Total Stream Release from Stone Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	164	1,819	3,252	2,509	479	0	0	0	0	0	8,223
Above Normal	0	0	46	384	1,174	921	0	0	0	0	0	0	2,525
Normal	0	0	49	30	197	0	0	0	0	0	0	0	276
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	51	440	917	680	94	0	0	0	0	0	2,182

Difference in Total Stream Release from Stone Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Modified WSIP minus Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	149	-305	-91	-498	-4	0	0	0	0	0	-748
Above Normal	0	0	-4	-180	-190	-643	0	0	0	0	0	0	-1,017
Normal	0	0	-4	3	-97	0	0	0	0	0	0	0	-98
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	28	-96	-76	-230	-1	0	0	0	0	0	-376

APPENDIX O3

Memorandum

Subject: **HH/LSM Assumptions and Results – WSIP Variants 2018 WSIP**
From: **Daniel B. Steiner**
Date: **May 6, 2008**

1. Introduction

This memorandum summarizes assumptions for and describes the interpretation of HH/LSM results for the simulation of the WSIP variant referenced as the "2018 WSIP." The PEIR analyzed three WSIP variants described as: WSIP Variant 1 - All Tuolumne; WSIP Variant 2 - Regional Desalination for Drought; and WSIP Variant 3 - 10% Rationing. The major difference between the variants and the proposed program (WSIP) was either in the proposed source(s) of water supply or in the drought-year rationing level of service (LOS). The 2018 WSIP variant supplements the previously described analyses. Tables 1-1 and 1-2 summarize the components, various modeling assumptions, and performance and hydrologic results for the 2018 WSIP variant in comparison to the modeled existing (2005) base setting (with Calaveras Reservoir constrained by DSOD restrictions) and the WSIP setting.

The hydrology that would result under this variant is primarily discussed in terms of a comparison to the WSIP and contrasted to the baseline condition of the PEIR, namely the simulated current (2005) operation of the SFPUC regional water system assuming that the Calaveras and Crystal Springs Reservoirs operation are constrained by DSOD restrictions. Only primary hydrologic parameters such as projected water deliveries, reservoir storage, and stream flows are compared, and only those parameters that have been identified as key hydrologic factors that lead to environmental impacts are illustrated.

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Table 1-1
Setting Characteristics and Modeling Assumptions (Part 1/3)

Assumptions and Characteristics of Setting and/or Program	Units	Baseline Baseline Conditions[1] - Calaveras Constrained	Proposed WSIP	WSIP Variants[3] 2018 WSIP
Time Horizon for Setting of Analysis / Date[4]		2005	2030	2018 / 2030
HH/LSM Simulation Study Name[5]		Base1LT	WSIP1LT	2018WSIPLT
System Wide Parameters				
Customer Purchase Request (Demand Level)[6]	MGD	265	300	275 / 300
Demand Level Supplied from Other Sources[7]				
Regional Recycled Water/Conservation/Groundwater in SF	MGD	0	10	10
Other Regional Recycled Water/Conservation/Groundwater	MGD	0	0	0
Demand Level Supplied from Tuolumne + Local Watersheds[8]	MGD	265	290	265
Average Annual Deliveries and Supplies[9]				
Deliveries from Tuolume + Local Watersheds (Average Annual)	MGD	258	287	
Supply or Deliveries from Other Sources - Regional Recl/Cons/GW	MGD	0	10	
Total Deliveries and Supply for Demand Level (Average Annual)	MGD	258	297	
Features and Facilities[10]				
Regional Reclaimed Water/Conservation/Groundwater - SF			●	●
Regional Reclaimed Water/Conservation/Groundwater - Other				
Calaveras Reservoir - 12.4 BG (Constrained)		●		
Calaveras Reservoir - 31.6 BG (Restored/Unconstrained)			●	●
Calaveras Reseroivr Release for Fish			●	●
Calaveras Reservoir Release for Fish & Flow Recapture			●	●
Alameda Creek Diversion Dam Bypass Flow & Recapture				
Pilarcitos Reservoir Pump for Creek Summer Release				
Crystal Springs Reservoir - 18.52 BG (Constrained)		●		
Crystal Springs Reservoir - 20.28 BG (Restricted)				
Crystal Springs Reservoir - 22.15 BG (Restored/Unconstrained)			●	●
Sunol Valley Water Treatment Plant Expansion			●	●
Sunol Valley Water Treatment Plant Feed from SJPL			●	●
Harry Tracy Water Treatment Plant Expansion			●	●
Bay Division Pipeline Increased Conveyance			●	●
San Joaquin Pipeline Increased Conveyance			●	●
Desalination Project				
Westside Groundwater Project			●	●
Tuolumne River Transfer			**29,350 (From Storage)**	**2,300 (From Storage)**
Water Supply Reliability[11]				
Action	Level	Rationing %	Rationing %	Rationing %
Implement Drought Water Supply Action (Westside GW or Desal)	1	NA	GW	GW
Rationing (Level 1)	2	10	10	10
Rationing (Level 2)	3	20	20	20
Rationing (Level 3)	4	25	25	25
	Years	Action Level	Action Level	Action Level
	1921			
	1924	2	1	1
	1925		1	
	1926		1	
	1929		1	
	1930		1	
	1931	3	2	2
	1932			
	1933			
	1934	2	1	1
	1935			
	1939			
	1944			
	1946			
	1947			
	1948		1	1
	1949			
	1950		1	
	1953			
	1954			
	1955		1	
	1957			
	1959			
	1960	2	1	1
	1961	3	2	2
	1962			
	1964		1	
	1966			
	1968			
	1971			
	1972		1	
	1976	2	1	1
	1977	3	2	2
	1979			
	1981			
	1984			
	1985		1	
	1987	2	1	1
	1988	3	2	2
	1989	3	2	2
	1990	3	3	3
	1991	3	2	2
	1992	3	3	3
	1994	2	1	1
	DD1993	4	3	3
	DD1994	4	3	3
Max Drought Rationing - Policy Cap[12]	DD	Incidental 25%	20%	20%
	Historical	Incidental 20%	20%	20%

APPENDIX O3

Table 1-1
Setting Characteristics and Modeling Assumptions (Part 2/3)

Assumptions and Characteristics of Setting and/or Program	Units	Baseline: Baseline Conditions[1] - Calaveras Constrained	Proposed WSIP	WSIP Variants[2]: 2018 WSIP
System Wide Parameters				
Incremental Supply - Average[13]				
System Customer Purchase Request Level	MGD	265	300	275 / 300
Demand Level Supplied from Other Sources	MGD	0	10	10
Demand Level Supplied from Tuolumne + Local Watersheds	MGD	265	290	265 / 290
System Deliveries	MGD	258	287	263
Regional Desalination	MGD	0	0	0
San Joaquin Pipelines (Tuolumne Diversion)	MGD	221	245	223
Inferred Local Watershed Production	MGD	37	41	40
Addt'l Tuolumne Diversion (Compared to Calaveras Constrained)	MGD	*221*	24	2
Incremental Design Drought Supply[14]				
From Other Sources - Regional Recl/Cons/GW (Every Year)	MGD	0	10	10
Restoration of Calaveras Reservoir Capacity (w/ flow recapture)	MGD	0	7	7
Restoration of Crystal Springs Capacity		0	1	1
MID/TID Transfer to SFPUC (Results in additional diversion from TR)	MGD	0	25	2
Westside Basin Conjunctive Use (8,100 acre-feet Storage)	MGD	0	6	6
Regional Desalination (26 mgd)	MGD	0	0	0
Sum of Incremental Supplies	MGD	0	48	26
Yield - Without Other Sources Added (Compared to Calaveras Constrained)	MGD	219	257	235
Yield - With Other Sources Added (Compared to Calaveras Constrained)	MGD	219	267	245
Design Drought Delivery Calculator[15]		2	3	7
	MGD			
Average Annual Delivery During	Year 1	265	290	265
Average Annual Delivery During	Year 2	239	290	265
Average Annual Delivery During	Year 3	212	261	239
Average Annual Delivery During	Year 4	212	261	239
Average Annual Delivery During	Year 5	212	232	212
Average Annual Delivery During	Year 6	212	261	239
Average Annual Delivery During	Year 7	212	232	212
Average Annual Delivery During	Year 8	199	232	212
Average Annual Delivery During	Last 6 Mo	99	116	106
	DD Ave	219	256	234
Firm Yield (Nominal) Not Including Other Sources	MGD	219	256	234
Local System Operational Parmeters				
Crystal Springs Reservoir Operation				
Storage - Minimum/Maximum	BG	5.4 - 18.52	5.4 - 22.15	Same
	TAF	16.6 - 56.8	16.6 - 68.0	as
Fall/Winter Operation Storage		16.52 BG (50.7 TAF)	18.55 BG (56.9 TAF)	WSIP
Stream Release		Up to 250 cfs to not exceed 18.52 BG	Up to 250 cfs to not exceed 21 BG	Same as WSIP
Calaveras Reservoir Operation				
Storage - Minimum/Maximum	BG	8.4 - 12.4	8.4 - 31.5	Same
	TAF	25.7 - 38.0	25.7 - 96.8	as
Fall/Winter Operation Storage		10.3 BG (31.6 TAF)	27.0 BG (82.9 TAF)	WSIP
Alameda Creek Release/Recapture[16]	AFY	0	Up to 6,300	Same as WSIP
San Andreas Reservoir Operation				
Storage - Minimum/Maximum	BG	3.0 - 6.2	3.0 - 6.2	Same
	TAF	9.2 - 19.0	9.2 - 19.0	as
Fall/Winter Operation Storage		5.6 BG (17.2 TAF)	5.6 BG (17.2 TAF)	WSIP
San Antonio Reservoir Operation				
Storage - Minimum/Maximum	BG	1.0 - 16.5	1.0 - 16.5	Same
	TAF	3.1 - 50.5	3.1 - 50.5	as
Fall/Winter Operation Storage		15.9 BG (48.8 TAF)	15.9 BG (48.8 TAF)	WSIP
Pilarcitos Reservoir Operation				
Storage - Minimum/Maximum	BG	0.66 - 0.97	0.66 - 0.97	Same
	TAF	2.0 - 3.0	2.0 - 3.0	as
Fall/Winter Operation Storage		0.72 BG (2.2 TAF)	0.72 BG (2.2 TAF)	WSIP
Water Treatment Plants				
Sunol Valley Water Treatment Plant Maximum	MGD	120	160	Same as WSIP
		90 MGD from Calaveras	90 MGD from Calaveras + Recapture	Same as WSIP
Sunol Valley Water Treatment Plant Minimum	MGD	20	20	Same as WSIP
		From Calavers & San Antonio & SJPL	From Calavers & San Antonio & SJPL	Same as WSIP
Harry Tracy Water Treatment Plant Maximum	MGD	120	140	Same as WSIP
Harry Tracy Water Treatment Plant Minimum	MGD	20	20	Same as WSIP
Conveyance				
Bay Division Pipeline Maximum		340 MGD Jun - Sep 320 MGD Apr, May & Oct 290 MGD Nov - Mar	380 MGD Apr - Oct 320 MGD Nov - Mar	Same as WSIP
Bay Division Pipeline Maintenance		Cycle one pipeline out Nov - Mar each year (average remaining capacity rotation) maximum 230 MGD	Same as Baselines, except maximum 320 MGD	Same as WSIP

APPENDIX O3

Table 1-1
Setting Characteristics and Modeling Assumptions (Part 3/3)

Assumptions and Characteristics of Setting and/or Program	Units	Baseline		WSIP Variants[3]
		Baseline Conditions[1] - Calaveras Constrained	Proposed WSIP	2018 WSIP
Tuolumne River System Operational Parameters				
Hetch Hetchy Reservoir Operation				
Storage - Minimum/Maximum Fall/Winter Operation Storage	TAF	26.1 - 360.4 30 TAF winter buffer	26.1 - 360.4 30 TAF winter buffer	Same as WSIP
1987 Stipulation Minimum Release Flows		Yes	Yes	Same as WSIP
1987 Stipulation Supplemental Release Flows		No	No	Same as WSIP
Cherry Reservoir Operation				
Storage - Minimum/Maximum Fall/Winter Operation Storage	TAF	1.0 - 273.3 25.3 TAF winter buffer	1.0 - 273.3 25.3 TAF winter buffer	Same as WSIP
Eleanor Reservoir Operation				
Storage - Minimum/Maximum Fall/Winter Operation Storage	TAF	0.0 - 27.1 Required Minimum Storage	0.0 - 27.1 Reqrd Minimum Stor	Same as WSIP
New Don Pedro Water Bank Account				
Storage - Minimum/Maximum	TAF	0.0 - 570.0 Temporary storage up to 740 TAF during Apr - Sep	0.0 - 570.0 Temp stor up to 740 TAF during Apr - Sep	Same as WSIP
Conveyance				
San Joaquin Pipelines Maximum	MGD	290	313	Same as WSIP
San Joaquin Pipelines Minimum	MGD	70	70	Same as WSIP
San Joaquin Pipelines Flow Rate Changes		11 Stepwise	17 Stepwise	Same as WSIP
		Surrogate minimum changes by allowing only 7 changes in a year	Allow up to 7 changes in a year (surrogate)	Same as WSIP
San Joaquin Pipelines Maintenance		Cycle one pipeline out Nov - Mar each year (average remaining capacity rotation) maximum 210 MGD	Cyclic 5-year mantenance (see note)	Same as WSIP
TID/MID Operational Parameters			Note: Cyclic 5-year maintenance, maximum capacity available Apr - Oct all years 271 MGD available all other months except 0 MGD available Year 5 Nov - Dec and 135.5 MGD available Year 1 and Year 3 Dec	
Districts' Tuolumne Diversion[17]		Varies annually based on land use and water availability Annual average 875 TAF	Set equal to baseline conditions. SFPUC effects measured by the result of reducing inflow to DP and its effect upon La Grange releases to the TR	Same as WSIP
Tuolumne River La Grange Flow Releases				
Don Pedro, 1996 FERC		X	X	X
VAMP - considered but not modeled[18]		X	X	X

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Table 1-2
Summary of Modeling Results (Part 1/2)

HH/LSM Simulation Results	Units	Baseline		WSIP Variants[3]
		Baseline Conditions[1] - Calaveras Constrained	Proposed WSIP	2018 WSIP
Design Drought Production & Disposition[19]				
San Joaquin Pipeline Diversion	MGD	208.7	235.0	212.2
Bay-Area Deliveries	MGD	218.3	248.9	226.8
Added Groveland & Coastside Delivery	MGD	2.6	3.6	2.6
Local Reservoir Evaporation	MGD	10.7	12.5	12.7
Inflow from ACDD	MGD	1.3	1.6	1.6
Flow Recapture	MGD	0	5.3	5.2
Local Reservoir Stream Release	MGD	0.6	5.4	5.5
Desalination	MGD	0	0	0
Westside Basin	MGD	0	5.6	6.4
District Transfer to NDP Water Bank	MGD	0	24.7	1.9
Local Storage - Begin	MG	53,854	77,310	77,310
Local Storage - End	MG	18,403	18,495	18,797
Study Average Production & Disposition (1921-02)[20]				
Tuolumne River System				
Reservoirs				
Hetch Hetchy				
Inflow	AF	749,605	749,605	749,605
River	AF	275,255	267,021	276,837
Stream Minimum Release	AF	65,728	65,593	65,828
Tunnel	AF	470,709	478,932	469,171
Evaporation	AF	3,893	3,869	3,875
Reservoir	AF	281,938	275,235	285,919
Cherry				
Inflow	AF	279,293	279,293	279,293
Eleanor Gravity	AF	289	289	289
Eleanor Pump	AF	118,251	118,274	118,337
River	AF	41,636	41,439	41,360
Stream Minimum Release	AF			
Tunnel	AF	352,692	352,915	353,059
Evaporation	AF	3,505	3,501	3,500
Reservoir	AF	239,971	239,309	239,015
Eleanor				
Inflow	AF	169,617	169,617	169,617
Eleanor Gravity	AF	289	289	289
Eleanor Pump	AF	118,251	118,274	118,337
River	AF	49,171	49,148	49,085
Stream Minimum Release	AF			
Evaporation	AF	1,906	1,906	1,906
Reservoir	AF	22,191	22,191	22,191
Don Pedro Reservoir				
Inflow	AF	1,587,517	1,560,828	1,585,611
MID Diversion	AF	302,054	302,055	302,055
TID Diversion	AF	573,164	573,168	573,168
LaGrange Total Stream	AF	668,876	644,009	667,363
LaGrange Minimum Stream Release	AF	221,477	221,477	221,477
Total Evaporation	AF	43,493	42,604	43,366
Reservoir	AF	1,472,337	1,434,872	1,466,669
Water Bank Account				
Balance	AF	514,299	516,733	513,882
Transfer	AF	0	29,350	2,300
San Joaquin Pipelines				
Volume (AF)	AF	247,763	274,450	249,723
Volume (MG)	MG	80,734	89,429	81,372
Rate (MGD)	MGD	221	245	223
Max Rate (MGD)	MGD	290	313	313
Min Rate (MGD)	MGD	70	0	0
East Bay System				
Reservoirs				
Calaveras				
Inflow	MG	12,368	12,368	12,368
From ACDD	MG	1,316	1,730	1,715
Stream	MG	3,660	4,167	4,224
Stream Flow Recapture	MG	0	1,538	1,539
To SVWTP	MG	9,013	8,244	8,163
To San Antonio	MG	0	0	0
Evaporation	MG	1,023	1,704	1,712
Resevoir	MG	10,969	28,170	28,372
San Antonio				
Inflow	MG	2,468	2,468	2,468
From Calaveras/SJPL	MG	1,173	1,734	1,326
Stream	MG	991	613	962
To SVWTP	MG	1,693	2,628	1,813
Evaporation	MG	1,012	973	1,026
Resevoir	MG	15,323	14,490	15,569
Alameda Creek Diversion Dam				
Inflow	MG	4,197	4,197	4,197
To Calaveras Reservoir	MG	1,316	1,730	1,715
Spill	MG	2,881	2,467	2,482
Alameda Creek Confluence				
Accretion	MG	625	625	625
From ACDD	MG	2,881	2,467	2,482
From Calaveras Dam	MG	3,660	4,167	4,224
At Confluence	MG	7,167	7,259	7,331
Treatment Plants				
SVWTP Total	MG	13,662	15,738	15,720
From Calaveras	MG	9,013	8,244	8,163
From San Antonio	MG	1,693	2,628	1,813
From SJPL	MG	2,956	3,329	4,205
From Recapture	MG	0	1,538	1,539
SVWTP Total MGD	MGD	37	43	43
SVWTP Max MGD	MGD	120	158	158
SVWTP Min MGD	MGD	20	20	20

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Table 1-2
Summary of Modeling Results (Part 2/2)

HH/LSM Simulation Results	Units	Baseline		WSIP Variants[3]
		Baseline Conditions[1] - Calaveras Constrained	Proposed WSIP	2018 WSIP
Peninsula System				
Reservoirs				
Crystal Springs				
Inflow	MG	3,722	3,722	3,722
From San Andreas	MG	0	0	0
From Pilarcitos and SJPL	MG	8,045	7,643	8,093
Stream	MG	773	325	569
Pump to San Andreas	MG	9,438	9,005	9,426
Pump to Coastside	MG	247	591	255
Evaporation	MG	1,323	1,490	1,565
Reservoir	MG	16,360	18,621	19,663
San Andreas				
Inflow	MG	1,428	1,428	1,428
From other Streams	MG	9,954	9,590	9,990
Stream	MG	0	0	0
To HTWTP	MG	10,851	10,487	10,887
Evaporation	MG	530	531	531
Reservoir	MG	5,892	5,882	5,893
Pilarcitos				
Inflow		1,297	1,297	1,297
To San Andreas	MG	516	584	564
For Stone Diversion	MG	262	280	262
Stream other than Diversion	MG	417	332	369
Evaporation	MG	103	102	103
Reservoir	MG	776	767	775
Stone Dam				
Accretion blw Pilarcitos	MG	167	211	168
Pilarcitos non-diversion Release	MG	417	332	369
Pilarcitos Release for Diversions	MG	584	543	537
Diversion to Coastside	MG	167	211	168
Diversion to Crystal Springs	MG	142	180	156
Spill past Stone	MG	860	695	751
Treatment Plants				
HTWTP Total	MG	10,851	10,487	10,887
HTWTP Total MGD	MGD	30	29	30
HTWTP Max MGD	MGD	149	106	107
HTWTP Min MGD	MGD	20	20	20
Other Facilites				
Westside Basin Net	MG	0	11	11
Desalination Input	MG	0	0	0
Additional Information				
Total Local Reservoir Stream Release	MG	5,842	5,437	6,124
Total Local Reservoir Stream Evaporation	MG	3,991	4,800	4,936
Deliveries				
In-City	MG	29,589	26,686	27,487
South Bay	MG	43,106	52,906	45,267
Crystal Springs	MG	15,120	16,931	15,895
San Andreas	MG	5,400	6,604	5,861
Coastside	MG	675	1,082	1,082
Groveland	MG	365	365	365
Total Deliveries	MG	94,255	104,574	95,957
Total Deliveries	MGD	258	287	263
Storage				
Total Local Storage Begin	MG	49,849	71,363	71,873
Total Local Storage End	MG	43,129	65,197	69,957
Residual Difference during 82-year Simulation	MGD	0.22	0.21	0.06
Westside Storage Begin	MG	0	23,474	23,474
Westside Storage End	MG	0	24,363	24,363
Residual Difference during 82-year Simulation	MGD	0.00	-0.03	-0.03

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Notes for Table 1-1 and Table 1-2

1. Baseline condition represents the existing conditions at the time of NOP publication in September 2005. This is the baseline used to assess WSIP program impacts and impact significance. This setting is indicative of DSOD restrictions on Calaveras and Crystal Springs Reservoirs.

2. N/A

3. These scenarios represent CEQA alternatives that vary from the WSIP on key components in a manner expected to avoid or reduce potentially significant effects of the proposed program.

4. The time horizon for the setting of the scenario. The baseline condition scenario is depicted for recent conditions, while the proposed WSIP, variants, and alternatives are depicted for the future at full buildout and implementation (i.e., conditions in the year 2030). The 2018 WSIP variant assesses conditions at the time that full current contract buildout occurs.

5. HH/LSM simulation study name.

6. The customer purchase request (demand) information is based on the demand and request studies prepared by the SFPUC in coordination with the wholesale customers. This demand on the regional water system includes both the SFPUC retail customers and wholesale customers. The current (2005) average annual demand is 265 mgd and the projected 2030 average annual demand is 300 mgd, assuming the SFPUC adopts the updated wholesale customer purchase requests as part of renewing the Master Sales Agreement with these customers (due in 2009).

7. Certain scenarios include development of additional water supply from a combination of recycled water projects, groundwater projects, and conservation, utilized every year and not subject to reduction during drought.

8. The average annual demand for supplies from the combination of SFPUC local watershed, Tuolumne River, and programs not included in the regional water conservation, recycling, and groundwater programs shown.

9. Modeled results for SFPUC deliveries, with supplies added for regional water conservation, recycling, and groundwater programs. Total deliveries and supply will be less than full customer purchase requests due to rationing in some years.

10. Shows only the features that affect hydrologic results of the system operation simulations. Additional projects are included in the WSIP, variants and alternatives.

11. Illustrates the frequency and severity of water supply action or the severity of systemwide rationing. Only years when variable water supply component is implemented or rationing occurs are shown. "DD" illustrates the shortage results for years included in the prospective drought period of the SFPUC design drought. These years contribute to establishing system operation protocols but are not included in the hydrologic assessment analyses.

12. Rationing policy cap: The SFPUC WSIP level of service goal is to maintain rationing on the regional system at no more than 20% during any one year of the drought. Some alternatives do not achieve this level of service goal. Performance is indicated for the Design Drought ("DD") sequence and for the "Historical" hydrologic sequence.

13. Water supply elements develop water in different amounts from year-to-year, and in some instances only develop water during dry years. This information is provided to illustrate a comparison between local watershed supplies, Tuolumne River supplies and other identifiable water supplies used to meet system purchase requests. Values are stated in units of average annual quantities during the simulated historical sequence.

14. Results from HH/LSM analysis of each scenario. Values represent the average annual production of each element of supply during the design drought period.

15. Simplified calculation of system deliveries during the SFPUC design drought. The value represents the application of system-wide shortages to the demand level being met with SFPUC local watershed, Tuolumne River, and other developed supplies and does not include supplies from regional water conservation, recycled water or groundwater projects. Average value may be slightly misstated (up to 3 mgd) due to metric of analysis that does not account for differences in residual storage between studies. "Nominal" Firm Yield represents the yield of each scenario after adjustment for minor residual storage differences.

16. Supplemental releases from Calaveras Reservoir for fisheries (1997 CDFG MOU) of up to 6,300 acre-feet per year and the Alameda Creek recapture facility project are tied to implementation of the Calaveras Dam Replacement project (SV-2). When the dam is replaced and capacity restored, the flow release and recapture will both occur. The release requirement is based on supplementing other occurring flows below Calaveras Reservoir, sometimes not requiring the full 6,300 acre-feet.

17. SFPUC actions are assumed to not change TID/MID diversions so as to isolate and possibly overstate the WSIP's effects on the Tuolumne River below La Grange Dam. The Districts' diversions are assumed to be constant among the scenarios to provide comparable results of the WSIP-alone effects. The exception is for the Modified WSIP Alternative, in which the TID/MID diversion is reduced by the amount of SFPUC transfer.

18. Participation in the San Joaquin River Agreement is assumed. Although the agreement expires after 2010, it is assumed that a subsequent similar agreement or requirement of the Districts will occur. The HH/LSM does not explicitly model the Districts' participation in the agreement; however, their participation if modeled would result in only minor differences in results and would not change impact conclusions.

19. From HH/LSM results for modeling the SFPUC design drought period.

20. From HH/LSM results for modeling the system operations for the historical hydrologic period 1921-2002. Values indicate average annual quantities during simulated historical period.

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2. WSIP Variant – 2018 WSIP

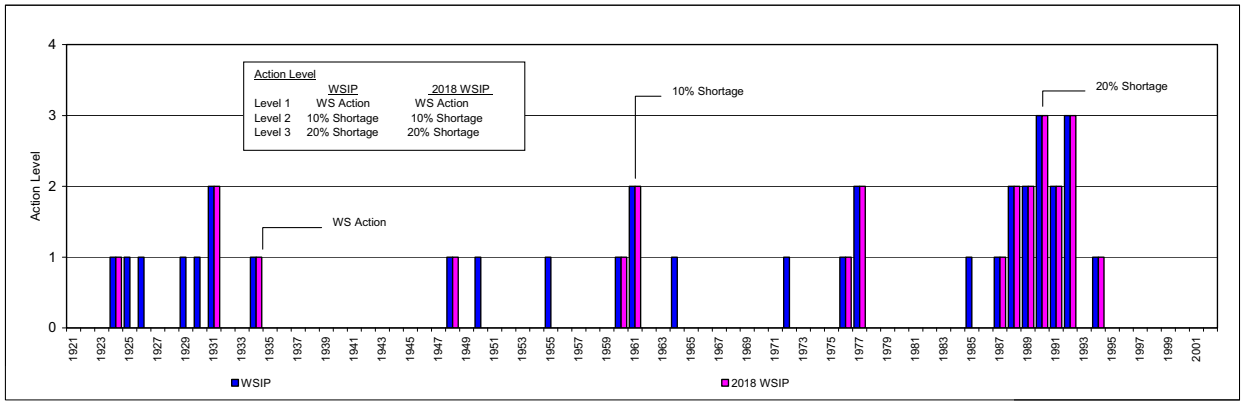
The 2018 WSIP variant would in effect be a combination of the proposed WSIP and the water purchase request of the CEQA No Purchase Request Increase Alternative applicable for the period through the year 2018. This variant would limit the SFPUC wholesale customers' interim future purchases to the terms of the existing Master Water Sales Agreement through 2018. Under that agreement, the wholesale customers may purchase up to 184 mgd on an average annual basis, subject to reductions in the event of a drought, water shortage, earthquake, other natural disaster, or rehabilitation and maintenance of the system. Under the variant, the customer purchase requests through 2018 would not exceed 184 mgd for the wholesale customers. It is assumed that the total customer purchase requests to be served by the regional system through 2018 would be 275 mgd, consisting of 184 mgd for the wholesale customers and 91 mgd for the retail customers. The increased water demand would be offset with 10 mgd from recycled water, groundwater, and conservation projects in San Francisco. Although the net demand through 2018 on the regional water system would be the same as the current demand (265 mgd), the improvement in delivery reliability requires development of additional system yield. The additional deliveries would be served through additional Tuolumne River diversions and increased use of local watershed supplies from restoration of Calaveras Reservoir and Crystal Springs Reservoir. Supplemental supplies would include implementation of the Westside Basin Groundwater Program and a water transfer with TID/MID.

In the context of the WSIP planning horizon for the year 2030, this analysis provides insight into the hydrologic effects of the program at an interim point in time (2018), or it provides a depiction of the WSIP if a delivery limitation is continued through 2030. Should the deliveries of the regional system be allowed to increase after 2018, the analysis described for the WSIP depicts the hydrologic effects associated with increased deliveries. The following description focuses on the time at which the variant's net demand of 265 mgd would occur.

2.1 Water Deliveries and Drought Response Actions

Compared to the WSIP setting for 2030, the regional system's resources are required to serve a net 265 mgd demand (275 mgd purchase request less 10 mgd of recycled water, groundwater, and conservation projects) instead of a net 290 mgd demand. As part of the formulation of this variant, the water transfer from TID/MID was sized to provide the same frequency and severity of water shortages (percentage-wise) for the variant as that occurring in the WSIP setting during the design drought, although systemwide water deliveries would be a net 265 mgd in the variant setting as compared to the WSIP setting delivery of a net 290 mgd. This objective required the water transfer to be sized at 2,300 acre-feet per year. With a water supply formulated about comparable to that provided for the WSIP setting (only proportionately smaller for a lesser demand), the implementation of rationing and the severity of rationing from the SFPUC system during drought periods would be the same. Table 1-1 compares the drought response actions for the proposed program and the variant. Figure 2.1-1 illustrates the occurrence of drought response actions for the simulated 82-year historical period (1921-2002).

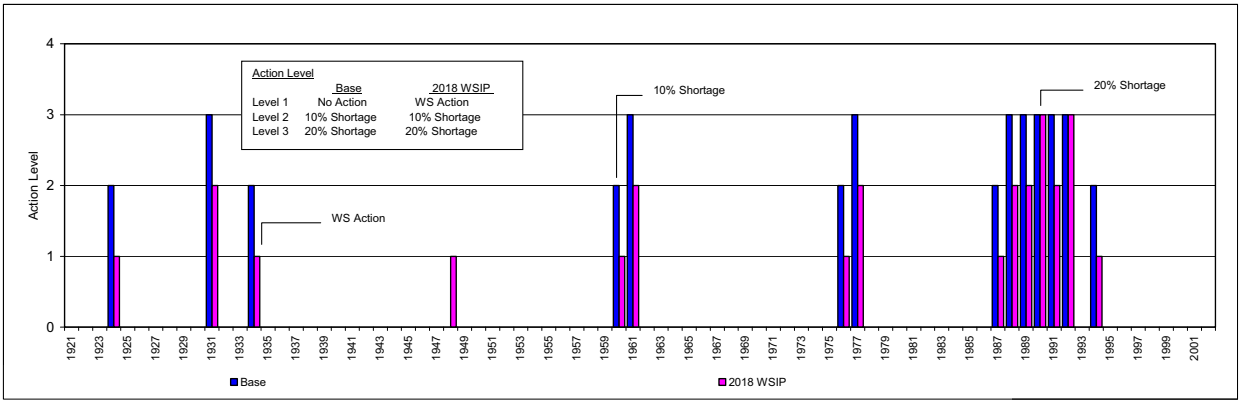
Figure 2.1-1
Drought Response Actions – WSIP and 2018 WSIP



In Figure 2.1-1, years with bars showing a “1” or greater level of action indicate periods when a supplemental water supply action is initiated. In both settings, the water supply action is the use of the Westside Groundwater Basin Program to supplement SFPUC water deliveries. Also occurring in both settings is the water transfer supplemental supply from TID/MID every year. Action levels greater than “1” indicate the imposition of delivery shortages (rationing) to SFPUC customers. SFPUC customers would experience the same frequency and severity of shortages (percentage-wise). The triggering of the Westside Basin Groundwater Program supplemental supply would occur more frequently in the WSIP setting, typically as a precautionary response to potential prolonged drought or to retain local area storage. With the lesser demand of the variant, a less frequent precautionary response would be needed.

The same form of information is shown in Figure 2.1-2 for the comparison between the variant and the base (existing) settings. There is not a level 1 action in the base setting. Without supplemental resources, the existing system only has delivery shortage measures available to cope with drought. In the base setting, the shortage measure is imposed during level 2 (10 percent) and level 3 (20 percent). These percentages of shortage are applied to both the variant and the base settings for these action levels, and they are applied to the same level of net water demand (265 mgd). During this simulation period, rationing would not need to exceed 20 percent in either setting; however, in the variant setting the occurrence of additional water supplies lessens the frequency and severity of water delivery shortages.

Figure 2.1-2
Drought Response Actions – Base and 2018 WSIP



Not illustrated in Figure 2.1-2 but shown in Table 1-1 are the delivery shortages anticipated during the entire SFPUC design drought. During the design drought, the base setting does not have a viable operation without exceeding a 20 percent shortage level. The base setting exceeds the 20 percent shortage level (requires 25 percent rationing) during the last 18 months of the design drought. The variant would viably provide deliveries without exceeding a 20 percent shortage level.

The difference in water deliveries between the proposed program and the variant is shown chronologically for the 82-year simulation in Table 2.1-1. There would be less water delivered to the region by the SFPUC in all years, a result of serving a lesser purchase request (275 mgd instead of 300 mgd, and a lesser net demand of 265 mgd instead of 290 mgd).

Comparing the variant setting to the base setting, Table 2.1-2 illustrates the difference in water deliveries between the two settings. The increases in deliveries under the variant setting occur due to an improvement in water delivery reliability, which reduces the severity of water shortages. The shifting in the pattern of deliveries (most evident during years when there is no increase in total annual delivery) is indicative of the anticipated seasonal effect of recycled water, groundwater, and conservation projects within the pattern of the projected future, albeit limited, purchase request. The 82-year average increase in deliveries amounts to approximately 3.5 mgd.

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Table 2.1-1

Difference in Total System-wide Delivery (MG) 2018 WSIP minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
1921	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1922	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1923	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1924	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1925	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1926	-801	-620	-508	-433	-479	-637	-745	-901	-985	-1,074	-1,036	-907	-9,124	-9,124
1927	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1928	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1929	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1930	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1931	-801	-620	-508	-433	-479	-637	-745	-901	-984	-940	-906	-806	-8,759	-9,124
1932	-720	-577	-485	-426	-448	-589	-667	-796	-861	-1,074	-1,036	-907	-8,586	-8,220
1933	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1934	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1935	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1936	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1937	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1938	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1939	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1940	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1941	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1942	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1943	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1944	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1945	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1946	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1947	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1948	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1949	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1950	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1951	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1952	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1953	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1954	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1955	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1956	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1957	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1958	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1959	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1960	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1961	-801	-620	-508	-433	-479	-637	-745	-901	-984	-940	-906	-806	-8,759	-9,124
1962	-720	-577	-485	-426	-448	-589	-667	-796	-861	-1,074	-1,036	-907	-8,586	-8,220
1963	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1964	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1965	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1966	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1967	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1968	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1969	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1970	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1971	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1972	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1973	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1974	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1975	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1976	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1977	-801	-620	-508	-433	-479	-637	-745	-901	-984	-940	-906	-806	-8,759	-9,124
1978	-720	-577	-485	-426	-448	-589	-667	-796	-861	-1,074	-1,036	-907	-8,586	-8,220
1979	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1980	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1981	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1982	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1983	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1984	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1985	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1986	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1987	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1988	-801	-620	-508	-433	-479	-637	-745	-901	-984	-940	-906	-806	-8,759	-9,124
1989	-720	-577	-485	-426	-448	-589	-667	-796	-861	-940	-906	-806	-8,220	-8,220
1990	-720	-577	-485	-426	-448	-589	-667	-796	-861	-832	-808	-708	-7,918	-8,220
1991	-643	-512	-430	-381	-406	-522	-598	-705	-760	-940	-906	-806	-7,608	-7,306
1992	-720	-577	-485	-426	-448	-589	-667	-796	-861	-832	-808	-708	-7,918	-8,220
1993	-643	-512	-430	-381	-406	-522	-598	-705	-760	-1,074	-1,036	-907	-7,973	-7,306
1994	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1995	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1996	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1997	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1998	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1999	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
2000	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
2001	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
2002	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
Avg (21-02)	-791	-614	-504	-431	-475	-631	-736	-888	-970	-1,058	-1,021	-895	-9,013	-9,013

APPENDIX O3

Table 2.1-2

Difference in Total System-wide Delivery (MG) 2018 WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
1921	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1922	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1923	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1924	9	-9	-47	-59	-42	-28	-18	6	24	1,273	1,226	1,002	3,339	0
1925	827	578	386	262	390	641	839	1,035	24	71	59	33	5,145	8,483
1926	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1927	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1928	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1929	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1930	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1931	9	-9	-47	-59	-42	-28	-18	6	24	1,069	1,040	905	2,851	0
1932	827	682	590	521	558	720	812	925	986	71	59	33	6,785	9,636
1933	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1934	9	-9	-47	-59	-42	-28	-18	6	24	1,273	1,226	1,002	3,339	0
1935	827	578	386	262	390	641	839	1,035	24	71	59	33	5,145	8,483
1936	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1937	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1938	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1939	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1940	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1941	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1942	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1943	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1944	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1945	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1946	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1947	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1948	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	1	0
1949	9	-9	-46	-59	-42	-28	-18	6	24	71	59	33	0	1
1950	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1951	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1952	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1953	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1954	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1955	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1956	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1957	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1958	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1959	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1960	9	-9	-47	-59	-42	-28	-18	6	24	1,273	1,226	1,002	3,339	0
1961	827	578	386	262	390	641	839	1,035	1,166	1,069	1,040	905	9,137	9,625
1962	827	682	590	521	558	720	812	925	986	71	59	33	6,785	9,636
1963	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1964	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1965	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1966	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1967	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1968	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1969	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1970	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1971	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1972	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1973	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1974	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1975	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1976	9	-9	-47	-59	-42	-28	-18	6	24	1,273	1,226	1,002	3,339	0
1977	827	578	386	262	390	641	839	1,035	1,166	1,069	1,040	905	9,137	9,625
1978	827	682	590	521	558	720	812	925	-1,124	71	59	33	4,675	7,525
1979	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1980	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1981	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1982	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1983	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1984	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1985	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1986	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1987	9	-9	-47	-59	-42	-28	-18	6	24	1,273	1,226	1,002	3,339	0
1988	827	578	386	262	390	641	839	1,035	1,166	1,069	1,040	905	9,137	9,625
1989	827	682	590	521	558	720	812	925	986	1,069	1,040	905	9,636	9,636
1990	827	682	590	521	558	720	812	925	986	53	37	24	6,736	9,636
1991	3	-3	-28	-43	-25	-19	-12	3	15	1,069	1,040	905	2,905	5
1992	827	682	590	521	558	720	812	925	986	53	37	24	6,736	9,636
1993	3	-3	-28	-43	-25	-19	-12	3	-2,095	71	59	33	-2,056	-2,105
1994	9	-9	-47	-59	-42	-28	-18	6	24	1,273	1,226	1,002	3,338	0
1995	827	578	386	262	390	641	-18	6	24	71	59	33	3,259	6,597
1996	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1997	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1998	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1999	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
2000	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
2001	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
2002	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
Avg (21-02)	129	85	32	7	34	76	95	136	84	232	216	167	1,293	1,293

2.2 Diversions from the Tuolumne River

The metric for illustrating the SFPUC diversions from the Tuolumne River Basin (Tuolumne) is the flow through the San Joaquin Pipeline (SJPL). Inherent in the variant is a net water demand that is essentially equal to that under the base setting, which is less than the demand served by the proposed program. Table 2.2-1 illustrates the difference in diversions to the SJPL between the proposed program and the variant settings. In both settings, the conveyance capacity of the SJPL is increased compared to the base setting. During the summer, the SJPL would essentially operate at the same maximum rate in both the variant and WSIP settings to minimize drawdown of Bay Area reservoir storage. A few exceptions occur during the summer of drought periods when the variant would serve a lesser demand than the WSIP. Overall, compared to the WSIP setting, the variant setting would divert less water from the Tuolumne.

Table 2.2-2 illustrates the difference in diversions to the SJPL between the variant and base settings. Evident in the operation is the increase in summer diversions associated with an increase in the conveyance capacity of the SJPL. As described above, with the increase in SJPL conveyance capacity, summer diversions would increase to retain storage in the Bay Area reservoirs. With the demand of the variant being approximately the same as the base setting, the increase in summer diversions to the SJPL would result in reduced diversions during the late summer and fall. The differences in December diversions are largely the result of maintenance in the variant setting (lessening available conveyance capacity) that would not occur in the base setting. The increased diversions during the winter and spring result from the need to replenish Bay Area reservoir storage after the maintenance, and then the operation of topping off Bay Area reservoir storage prior to summer. There would be an overall increase in average annual diversions to the SJPL in the variant setting associated with the improvement in water delivery reliability. The 82-year average annual increase in diversions from the Tuolumne amounts to approximately 1,900 acre-feet per year (1.7 mgd).

Table 2.2-3 illustrates the average monthly diversions through the SJPL by year type for the 82-year simulation for the proposed program and the variant settings and the difference between the two settings. Table 2.3-4 shows the same information for the variant and base settings.

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Table 2.2-1

Difference in Total San Joaquin Pipeline (Acre-feet) 2018 WSIP minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
1921	-3,806	-1,841	0	0	0	-3,806	0	0	0	0	0	-4,880	-14,333	-17,095
1922	-9,514	-6,444	-3,045	-952	0	0	-2,762	-2,189	-2,118	0	0	-4,880	-31,904	-31,904
1923	-7,611	-1,841	0	0	0	-3,901	-1,197	-1,237	-1,197	0	0	-6,721	-23,705	-21,864
1924	-7,611	-2,762	-2,854	-1,903	-1,719	0	0	0	0	0	0	-2,118	-18,967	-23,570
1925	-6,945	0	0	0	-2,664	0	0	0	0	0	0	0	-9,609	-11,727
1926	-5,043	-2,854	0	-5,803	-9,452	0	-2,118	0	0	0	0	-6,721	-31,991	-25,270
1927	-7,611	-3,683	-952	-952	0	-1,902	-921	-1,237	-1,197	0	0	-6,721	-25,176	-25,176
1928	-6,755	-4,603	-523	-1,903	-1,719	-3,045	-2,762	-1,237	-1,197	0	0	-6,721	-30,465	-30,465
1929	-8,562	-4,603	-2,854	-1,902	-1,718	0	0	0	0	0	0	-2,118	-21,757	-26,360
1930	-6,945	0	0	0	0	0	0	0	0	0	0	-1,197	-8,142	-9,063
1931	-5,043	-6,537	0	-6,755	-6,101	0	0	0	0	0	-2,664	-9,483	-36,583	-25,633
1932	-8,562	-3,683	-4,757	-1,903	0	-2,854	0	-3,996	-3,867	0	0	-4,880	-34,502	-41,769
1933	-3,805	-2,762	-523	-2,854	-2,578	0	0	0	0	0	0	0	-12,522	-17,402
1934	-5,043	-3,775	-8,658	-7,611	-6,875	0	0	0	0	0	0	-3,867	-35,829	-31,962
1935	-7,897	0	0	-1,047	-2,664	0	-3,038	-3,996	-3,867	0	0	-3,038	-25,547	-26,376
1936	-10,751	-7,365	0	-3,806	0	-5,803	0	-1,237	-1,197	0	0	-4,880	-35,039	-33,197
1937	-11,417	-4,603	-2,854	-3,805	0	-951	-3,683	-2,664	-2,578	0	0	-4,880	-37,435	-37,435
1938	-7,611	-4,603	-2,854	-3,045	0	0	-2,762	-3,140	-3,038	0	0	-4,880	-31,933	-31,933
1939	-5,709	-1,841	-1,902	-1,902	-1,718	0	0	0	0	0	0	-1,197	-14,269	-17,952
1940	-6,945	0	0	0	-7,734	-7,611	-2,762	-2,664	-2,578	0	0	-4,880	-35,174	-31,491
1941	-5,709	-1,841	-1,142	0	0	0	0	-2,854	-2,762	0	0	-2,118	-16,426	-19,188
1942	-7,135	-2,762	-2,663	0	0	-2,663	-921	-2,854	-2,762	0	0	-3,038	-24,798	-23,878
1943	-6,659	-3,682	-523	0	0	-3,805	-1,197	-2,664	-2,578	0	0	-4,880	-25,988	-24,146
1944	-7,611	-1,841	-2,855	0	-1,718	-2,949	0	0	0	0	0	-6,721	-23,695	-21,854
1945	-8,087	0	0	0	-8,593	0	0	0	0	0	0	-4,880	-21,560	-23,401
1946	-10,751	-6,444	0	0	0	-2,949	0	0	0	0	0	-4,880	-25,024	-25,024
1947	-9,514	-7,365	-2,855	-3,805	-3,437	0	0	0	0	0	0	-2,118	-29,094	-31,856
1948	-5,043	-5,616	-523	-5,708	-3,437	0	0	0	0	0	0	-4,880	-25,207	-22,445
1949	-7,897	-5,616	-3,806	-3,805	-3,437	-4,756	0	-1,237	-1,197	0	0	-4,880	-36,631	-36,631
1950	-7,611	0	0	0	-945	0	0	0	0	0	0	0	-8,556	-13,436
1951	-3,996	-11,969	0	0	0	-8,562	0	-1,237	-1,197	0	0	-6,721	-33,682	-26,961
1952	-6,755	-4,603	-2,663	0	0	0	-2,762	-3,140	-3,038	0	0	-4,880	-27,841	-29,682
1953	-7,611	-1,841	0	0	0	-5,803	0	0	0	0	0	-7,642	-22,897	-20,135
1954	-6,755	-4,603	-952	-2,854	-860	-2,949	0	0	0	0	0	-7,642	-26,615	-26,615
1955	-7,611	0	0	0	-2,664	0	0	0	0	0	0	0	-10,275	-17,917
1956	-5,043	-3,775	0	0	0	-1,712	0	-1,237	-1,197	0	0	-7,642	-20,606	-12,964
1957	-6,755	-4,603	-2,854	-3,805	-1,718	0	0	0	0	0	0	-3,867	-23,602	-27,377
1958	-9,514	-5,524	-523	-4,757	0	0	0	-2,949	-2,854	0	0	-3,867	-29,988	-29,988
1959	-5,708	-2,762	-952	-1,902	0	-1,047	0	0	0	0	0	-3,867	-16,238	-16,238
1960	-7,897	0	0	0	-945	0	0	0	0	0	0	0	-8,842	-12,709
1961	-5,043	-5,616	0	-6,755	-6,101	0	0	0	0	0	-5,043	-9,483	-38,041	-23,515
1962	-10,751	-6,537	-2,855	-4,757	-2,578	-1,902	0	-5,043	-4,880	0	0	-4,880	-44,183	-53,829
1963	-3,901	-4,603	-523	0	0	-3,805	-2,762	-2,854	-2,762	0	0	0	-21,210	-26,090
1964	-7,897	-4,603	-952	-2,854	-2,578	0	0	0	0	0	0	0	-18,884	-18,884
1965	-3,996	0	0	-5,708	-5,156	0	-8,286	-952	-921	0	0	-6,721	-31,740	-25,019
1966	-6,755	-2,762	-523	-4,757	-4,297	0	0	0	0	0	0	-2,578	-21,672	-25,815
1967	-6,945	-8,378	-6,659	0	0	0	-2,762	-2,855	-2,762	0	0	-1,197	-31,558	-32,939
1968	-7,897	-2,762	0	-2,854	-2,578	0	0	0	0	0	0	-2,578	-18,669	-17,288
1969	-9,799	-7,365	-3,805	0	0	-951	-2,118	-2,189	-2,118	0	0	-6,721	-35,066	-30,923
1970	-3,806	0	0	-4,757	-4,297	-2,949	0	0	0	0	0	-4,880	-20,689	-22,530
1971	-8,087	-6,444	0	0	0	0	0	0	0	0	0	-2,118	-16,649	-19,411
1972	-7,897	-8,378	-5,709	-3,805	-3,437	0	0	0	0	0	0	-1,197	-30,423	-31,344
1973	-5,043	-6,537	-523	0	0	0	-2,118	-1,237	-1,197	0	0	-6,721	-23,376	-17,852
1974	-7,611	-2,762	0	0	0	-6,659	-1,841	-3,140	-3,038	0	0	-6,721	-31,772	-31,772
1975	-3,806	0	0	0	-4,297	-1,142	-921	-3,140	-3,038	0	0	-6,721	-23,065	-23,065
1976	-3,806	-3,682	-523	-952	-859	0	0	0	0	0	0	-1,197	-11,019	-16,543
1977	-6,945	-3,775	-7,611	-2,855	-2,578	0	0	0	0	6,945	2,949	-2,762	-16,632	-24,961
1978	-3,806	0	523	-5,708	-5,156	-10,464	-6,444	-1,047	-1,013	0	0	-4,880	-37,995	-25,983
1979	-5,708	-2,762	-2,854	-1,902	0	-2,854	0	0	0	0	0	-3,038	-19,118	-20,960
1980	-10,751	0	0	-7,611	0	-6,659	0	-1,237	-1,197	0	0	-6,721	-34,176	-30,493
1981	-5,708	-4,603	-523	-1,902	-1,718	0	0	0	0	0	0	-6,721	-21,175	-21,175
1982	-10,751	-4,603	-3,805	0	0	0	0	-2,854	-2,762	0	0	-3,038	-27,813	-31,496
1983	-5,803	-2,762	-951	0	0	0	-1,841	-3,805	-3,682	0	0	-1,197	-20,041	-21,882
1984	-6,660	-2,762	0	0	0	0	0	0	0	0	0	-2,578	-12,000	-10,619
1985	-6,945	0	0	0	-945	0	0	0	0	0	0	0	-7,890	-10,468
1986	-5,043	-3,775	0	-6,755	-3,437	-7,610	-5,524	-2,189	-2,118	0	0	-6,721	-43,172	-36,451
1987	-5,708	-2,762	-2,854	-3,805	-3,437	0	0	0	0	0	0	-2,118	-20,684	-25,287
1988	-6,945	-3,775	0	-7,611	-5,156	0	0	0	0	0	-3,140	-9,483	-36,110	-25,605
1989	-4,756	-2,762	-1,903	-2,854	-2,578	0	0	0	-2,118	-3,996	-3,806	-5,524	-30,297	-29,594
1990	-4,757	0	0	0	-945	0	0	0	0	-5,043	-7,610	-4,603	-22,958	-19,028
1991	-1,903	-3,682	-523	-952	-860	-2,854	-1,197	-2,854	-2,762	-2,664	-1,903	-4,603	-26,757	-34,843
1992	-2,855	-921	-1,903	0	-1,547	0	0	-5,043	-4,880	-1,047	-2,854	-1,841	-22,891	-26,319
1993	-1,902	-1,841	0	0	0	0	-2,762	-2,854	-2,762	0	0	-3,867	-15,988	-17,863
1994	-5,708	-2,762	-952	-1,903	-1,719	0	0	0	0	0	0	-3,867	-16,911	-16,911
1995	-6,945	0	0	-7,610	-6,874	0	-4,603	-1,903	-1,842	0	0	-4,880	-34,657	-33,644
1996	-5,708	-2,762	-523	0	0	0	0	-2,189	-2,118	0	0	-3,867	-17,167	-18,180
1997	-7,611	-4,604	0	0	0	-2,854	0	0	0	0	0	-2,118	-17,187	-18,936
1998	-9,799	-5,524	-523	0	0	-951	-6,444	-2,949	-2,854	0	0	-4,880	-33,924	-31,162
1999	-5,708	-1,841	-2,855	-1,902	0	-3,805	-2,762	-3,140	-3,038	0	0	-3,867	-28,918	-29,931
2000	-5,708	0	0	0	-5,328	-2,854	0	0	0	0	0	-3,867	-17,757	-17,757
2001	-9,514	-5,524	-523	-3,806	-1,718	-3,901	0	0	0	0	0	-4,880	-29,866	-28,853
2002	-9,514	-2,762	-4,757	-2,854	-2,578	0	0	0	0	0	0	-2,578	-25,043	-27,345
Avg (21-02)	-6,745	-3,361	-1,326	-2,073	-1,896	-1,577	-967	-1,162	-1,150	-71	-294	-4,107	-24,727	-24,788

APPENDIX O3

Table 2.2-2

Difference in Total San Joaquin Pipeline (Acre-feet) 2018 WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
1921	-3,806	-2,762	0	0	0	8,562	2,118	2,189	2,118	2,189	2,189	-2,762	10,035	10,035
1922	-8,562	-4,603	-4,947	0	0	0	4,603	2,854	2,762	2,189	2,189	-2,762	-6,277	-6,277
1923	-7,611	-4,603	0	0	0	11,416	921	952	921	2,189	2,189	-4,603	1,771	3,612
1924	-8,562	-2,762	-952	-2,855	-2,578	5,803	2,118	2,189	2,118	2,189	2,189	0	-1,103	-5,706
1925	-4,756	-19,334	-19,979	5,803	14,608	11,512	2,118	2,189	2,118	2,189	2,189	2,118	775	-1,343
1926	0	2,762	-7,088	0	0	15,317	2,762	2,189	2,118	2,189	2,189	-4,603	17,835	24,556
1927	-5,708	-4,604	-952	3,805	0	4,757	1,841	952	921	2,189	2,189	-4,603	787	787
1928	-3,806	-4,603	-2,854	1,902	2,578	2,663	1,841	952	921	2,189	2,189	-4,603	-631	-631
1929	-3,806	-2,762	-952	0	0	5,803	2,118	2,189	2,118	2,189	2,189	0	9,086	4,483
1930	-4,756	-19,334	-19,979	5,803	9,538	11,512	2,118	2,189	2,118	2,189	2,189	921	-5,492	-6,413
1931	-2,854	-921	-7,088	-952	-859	5,803	2,118	2,189	2,118	2,189	-475	-2,762	-1,494	4,853
1932	0	-921	951	3,805	0	12,558	4,880	2,949	2,854	2,189	2,189	-2,762	28,692	26,028
1933	-4,756	-2,762	-7,611	4,757	4,297	5,803	2,118	2,189	2,118	2,189	2,189	2,118	12,649	7,769
1934	-2,854	1,841	-2,855	-952	-860	5,803	2,118	2,189	2,118	2,189	2,189	-1,749	9,177	13,044
1935	-2,854	-19,334	-19,979	18,075	14,608	10,560	6,445	3,901	3,775	2,189	2,189	-920	18,655	17,826
1936	-8,562	-2,762	-7,088	3,805	0	9,514	2,118	952	921	2,189	2,189	-2,762	514	2,356
1937	-7,611	-2,762	-952	0	0	0	2,762	2,379	2,302	2,189	2,189	-2,762	-2,266	-2,266
1938	-5,708	-4,603	-2,854	2,663	0	0	2,762	1,903	1,842	2,189	2,189	-2,762	-2,379	-2,379
1939	-7,611	-2,762	-4,757	952	860	5,803	2,118	2,189	2,118	2,189	2,189	921	4,209	526
1940	-4,756	-19,334	-19,979	15,317	0	5,708	5,524	2,379	2,302	2,189	2,189	-2,762	-11,223	-7,540
1941	-7,611	-2,762	-1,142	0	0	0	0	-1,902	-1,841	2,189	2,189	0	-10,880	-13,642
1942	-4,756	-2,762	-3,805	0	0	0	4,603	0	0	2,189	2,189	-920	-3,262	-2,342
1943	-4,756	-4,603	-7,611	0	0	0	5,524	-475	-460	2,189	2,189	-2,762	-10,765	-8,923
1944	-5,709	-2,762	-2,855	1,902	5,328	12,368	2,118	2,189	2,118	2,189	2,189	-4,603	14,472	16,313
1945	-8,562	-19,334	-19,979	5,803	5,156	15,317	2,118	2,189	2,118	2,189	2,189	-2,762	-13,558	-15,399
1946	-5,708	-4,603	0	0	0	7,611	2,118	2,189	2,118	2,189	2,189	-2,762	5,341	5,341
1947	-8,562	-5,524	-2,855	-4,757	0	10,560	2,118	2,189	2,118	2,189	2,189	0	-335	-3,097
1948	-2,854	0	-7,611	-952	-859	5,803	2,118	2,189	2,118	2,189	2,189	-2,762	1,568	4,330
1949	-5,708	0	-952	-4,757	-4,296	-2,854	2,118	952	921	2,189	2,189	-2,762	-12,960	-12,960
1950	-3,806	-19,334	-19,979	16,459	15,468	5,803	2,118	2,189	2,118	2,189	2,189	2,118	7,532	2,652
1951	-1,807	-4,604	0	0	0	0	2,118	952	921	2,189	2,189	-4,603	-2,645	4,076
1952	-3,806	-4,603	-951	0	0	0	6,444	-951	-920	2,189	2,189	-2,762	-3,171	-5,012
1953	-5,709	-2,762	0	0	0	9,514	2,118	2,189	2,118	2,189	2,189	-5,524	6,322	9,084
1954	-8,562	-4,603	-952	0	4,468	7,611	2,118	2,189	2,118	2,189	2,189	-5,524	3,241	3,241
1955	-8,562	-19,334	-15,222	16,459	12,202	5,803	2,118	2,189	2,118	2,189	2,189	2,118	4,267	-3,375
1956	-2,854	1,841	0	0	0	951	2,118	952	921	2,189	2,189	-5,524	2,783	10,425
1957	-3,806	-4,603	-952	0	5,328	10,560	2,118	2,189	2,118	2,189	2,189	-1,749	15,581	11,806
1958	-8,562	-2,762	-7,611	4,757	0	0	0	-1,902	-1,841	2,189	2,189	-1,749	-15,292	-15,292
1959	-5,708	-2,762	-952	952	0	14,270	2,118	2,189	2,118	2,189	2,189	-1,749	14,854	14,854
1960	-5,708	-19,334	-19,979	5,803	9,453	5,803	2,118	2,189	2,118	2,189	2,189	2,118	-11,041	-14,908
1961	-2,854	0	-7,088	-952	3,437	5,803	2,118	2,189	2,118	2,189	0	0	6,960	11,267
1962	-952	3,682	1,902	-952	859	16,173	7,642	2,854	2,762	2,189	2,189	-2,762	35,586	36,159
1963	-952	-2,762	-7,611	0	0	3,805	2,762	-952	-921	2,189	2,189	2,118	-135	-5,015
1964	-5,708	-4,603	-952	4,757	4,297	5,803	2,118	2,189	2,118	2,189	2,189	2,118	16,515	16,515
1965	-1,807	-19,334	-14,270	0	0	11,512	4,603	0	0	2,189	2,189	-4,603	-19,521	-12,800
1966	-3,806	-5,524	-1,902	4,947	4,468	5,803	2,118	2,189	2,118	2,189	2,189	-460	14,329	10,186
1967	-4,756	-2,762	-9,514	0	0	0	3,683	-2,855	-2,762	2,189	2,189	921	-13,667	-15,048
1968	-5,708	-2,762	-7,088	5,708	5,156	5,803	2,118	2,189	2,118	2,189	2,189	-460	11,452	12,833
1969	-7,610	-2,762	-4,757	0	0	0	5,524	0	0	2,189	2,189	-4,603	-9,830	-5,687
1970	-3,806	-19,334	-19,979	7,610	6,874	16,173	2,118	2,189	2,118	2,189	2,189	-2,762	-4,421	-6,262
1971	-5,708	-7,365	0	0	0	10,560	2,118	2,189	2,118	2,189	2,189	0	8,290	5,528
1972	-5,708	-2,762	-5,709	-4,757	0	5,803	2,118	2,189	2,118	2,189	2,189	921	-1,409	-2,330
1973	-2,854	-921	-7,611	0	0	0	4,603	952	921	2,189	2,189	-4,603	-5,135	389
1974	-5,709	-2,762	0	0	0	3,805	2,762	1,903	1,842	2,189	2,189	-4,603	1,616	1,616
1975	-5,708	-19,334	-19,979	11,512	859	2,663	7,365	1,903	1,842	2,189	2,189	-4,603	-19,102	-19,102
1976	-5,708	-4,603	-7,611	-952	-859	5,803	2,118	2,189	2,118	2,189	2,189	921	-2,206	-7,730
1977	-1,902	1,841	-2,855	-2,855	-2,578	5,803	2,118	2,189	2,118	2,189	1,047	4,603	11,718	9,178
1978	3,805	-921	-2,331	0	0	0	5,708	4,756	4,603	2,189	2,189	-2,762	17,236	23,459
1979	-8,562	-2,762	-952	952	0	8,562	2,118	2,189	2,118	2,189	2,189	-920	7,121	5,279
1980	-5,708	-19,334	-15,222	5,708	0	951	4,880	952	921	2,189	2,189	-4,603	-27,077	-23,394
1981	-3,806	-4,603	-7,611	5,708	5,156	11,512	2,118	2,189	2,118	2,189	2,189	-4,603	12,556	12,556
1982	-8,562	-5,524	-3,805	0	0	0	0	-952	-921	2,189	2,189	-920	-16,306	-19,989
1983	-4,756	-5,524	0	0	0	0	2,946	952	921	2,189	2,189	921	-162	-2,003
1984	-5,708	-7,365	0	0	0	5,803	2,118	2,189	2,118	2,189	2,189	-460	3,073	4,454
1985	-4,756	-19,334	-19,979	10,560	8,593	5,803	2,118	2,189	2,118	2,189	2,189	2,118	-6,192	-8,770
1986	-2,854	1,841	-7,088	-952	0	0	1,841	2,854	2,762	2,189	2,189	-4,603	-1,821	4,900
1987	-5,708	-2,762	-952	-4,757	-4,296	5,803	2,118	2,189	2,118	2,189	2,189	0	-1,869	-6,472
1988	-1,902	1,841	-7,088	2,854	2,578	5,803	2,118	2,189	2,118	2,189	-951	0	11,749	14,889
1989	0	-921	2,854	0	0	5,803	2,118	5,043	2,762	1,047	0	1,841	20,547	18,897
1990	1,902	-19,334	-15,222	10,560	8,593	5,803	2,118	2,189	2,118	0	-2,854	1,841	-2,286	1,615
1991	1,902	-4,603	-2,854	-952	-860	7,611	3,683	0	0	-475	1,902	-2,762	2,592	2,914
1992	-2,855	3,682	1,902	952	859	18,075	6,721	1,902	1,841	0	-4,756	0	28,323	31,744
1993	0	-2,762	-1,379	0	0	0	1,841	0	0	2,189	2,189	-1,749	329	-7,056
1994	-8,562	-2,762	-952	-2,855	8,593	5,803	2,118	2,189	2,118	2,189	2,189	-1,749	8,319	8,319
1995	-1,902	-19,334	-19,979	0	0	0	4,603	0	0	2,189	2,189	-2,762	-34,996	-33,983
1996	-3,806	-2,762	-2,854	0	0	0	4,880	2,854	2,762	2,189	2,189	-1,749	3,703	2,690
1997	-5,708	-4,604	0	0	0	7,611	2,118	2,189	2,118	2,189	2,189	0	8,102	6,353
1998	-7,610	-2,762	-7,611	0	0	0	4,604	952	921	2,189	2,189	0	-7,128	-7,128
1999	-3,806	-2,762	-2,855	4,757	0	4,757	6,444	-951	-920	2,189	2,189	-1,749	7,293	9,042
2000	-3,806	-19,334	-19,979	15,317	2,406	13,319	2,118	2,189	2,118	2,189	2,189	-1,749	-3,023	-3,023
2001	-5,708	-2,762	-7,611	3,805	6,875	11,416	2,118	2,189	2,118	2,189	2,189	-2,762	14,056	15,069
2002	-8,562	-2,762	-6,659	3,805	3,437	10,560	2,118	2,189	2,118	2,189	2,189	-460	10,162	7,860
Avg (21-02)	-4,638	-5,883	-6,178	2,233	1,938	5,955	2,897	1,635	1,556	2,089	1,901	-1,546	1,960	1,932

APPENDIX O3

Table 2.2-3

Total San Joaquin Pipeline (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) 2018 WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	20,579	13,177	8,363	8,491	6,015	8,925	18,753	24,515	23,724	29,778	29,778	24,179	216,278	215,562
Above Normal	20,096	11,265	7,899	13,280	7,228	13,493	23,006	26,291	25,443	29,778	29,778	24,425	231,981	231,792
Normal	19,265	11,911	8,741	13,872	10,032	19,812	27,712	29,064	28,126	29,778	29,778	24,352	252,444	251,317
Below Normal	20,874	12,781	11,615	18,434	15,371	24,361	28,622	29,241	28,172	29,386	29,185	25,080	273,122	272,085
Dry	20,395	16,572	14,580	16,655	14,071	25,651	28,817	29,463	28,512	29,148	27,625	22,948	274,435	277,265
All Years	20,248	13,114	10,228	14,188	10,562	18,460	25,393	27,716	26,796	29,574	29,235	24,210	249,723	249,661

Total San Joaquin Pipeline (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	27,584	16,762	9,692	11,066	7,304	10,875	21,647	26,722	25,859	29,778	29,778	28,817	245,884	243,146
Above Normal	26,935	14,568	8,898	13,901	8,598	16,352	24,176	28,608	27,685	29,778	29,778	28,817	258,095	258,095
Normal	26,632	15,087	9,698	15,299	11,343	21,935	28,322	29,778	28,817	29,778	29,778	28,817	275,285	275,285
Below Normal	27,567	16,214	13,000	21,070	18,065	25,211	28,817	29,481	28,530	29,778	29,521	27,972	295,227	295,751
Dry	26,210	19,881	16,554	19,818	16,869	25,717	28,817	29,778	28,817	29,094	28,773	27,154	297,481	299,662
All Years	26,992	16,475	11,553	16,261	12,458	20,037	26,359	28,878	27,946	29,645	29,529	28,317	274,450	274,450

Difference in Total San Joaquin Pipeline (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) 2018 WSIP minus WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	-7,005	-3,585	-1,329	-2,575	-1,289	-1,950	-2,894	-2,206	-2,135	0	0	-4,638	-29,605	-27,585
Above Normal	-6,839	-3,303	-999	-621	-1,370	-2,859	-1,170	-2,317	-2,242	0	0	-4,392	-26,113	-26,303
Normal	-7,367	-3,176	-957	-1,427	-1,311	-2,123	-610	-714	-691	0	0	-4,466	-22,841	-23,968
Below Normal	-6,693	-3,433	-1,385	-2,636	-2,694	-851	-195	-241	-357	-392	-336	-2,892	-22,105	-23,666
Dry	-5,816	-3,309	-1,974	-3,163	-2,798	-65	0	-315	-305	53	-1,148	-4,206	-23,046	-22,397
All Years	-6,745	-3,361	-1,326	-2,073	-1,896	-1,577	-967	-1,162	-1,150	-71	-294	-4,107	-24,727	-24,788

Table 2.3-4

Total San Joaquin Pipeline (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) 2018 WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	20,579	13,177	8,363	8,491	6,015	8,925	18,753	24,515	23,724	29,778	29,778	24,179	216,278	215,562
Above Normal	20,096	11,265	7,899	13,280	7,228	13,493	23,006	26,291	25,443	29,778	29,778	24,425	231,981	231,792
Normal	19,265	11,911	8,741	13,872	10,032	19,812	27,712	29,064	28,126	29,778	29,778	24,352	252,444	251,317
Below Normal	20,874	12,781	11,615	18,434	15,371	24,361	28,622	29,241	28,172	29,386	29,185	25,080	273,122	272,085
Dry	20,395	16,572	14,580	16,655	14,071	25,651	28,817	29,463	28,512	29,148	27,625	22,948	274,435	277,265
All Years	20,248	13,114	10,228	14,188	10,562	18,460	25,393	27,716	26,796	29,574	29,235	24,210	249,723	249,661

Total San Joaquin Pipeline (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	24,854	19,046	14,449	7,730	6,015	7,611	15,398	23,962	23,189	27,589	27,589	26,526	223,960	222,101
Above Normal	25,015	18,522	14,830	9,346	6,015	8,831	19,117	25,015	24,208	27,589	27,589	26,699	232,776	232,343
Normal	24,616	19,046	14,865	10,691	6,864	11,060	25,145	27,054	26,181	27,589	27,589	26,699	247,400	246,589
Below Normal	25,239	19,334	18,748	15,927	11,585	16,789	26,374	27,085	26,212	27,421	27,141	25,562	267,417	267,585
Dry	24,676	19,046	19,087	15,995	12,621	18,195	26,411	27,292	26,411	27,232	26,757	23,247	266,970	269,749
All Years	24,886	18,997	16,405	11,955	8,624	12,505	22,496	26,081	25,239	27,485	27,334	25,756	247,763	247,729

Difference in Total San Joaquin Pipeline (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) 2018 WSIP minus Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	-4,275	-5,869	-6,086	761	0	1,314	3,355	553	535	2,189	2,189	-2,348	-7,681	-6,540
Above Normal	-4,919	-7,257	-6,931	3,934	1,213	4,662	3,889	1,276	1,235	2,189	2,189	-2,274	-795	-551
Normal	-5,352	-7,135	-6,125	3,181	3,169	8,752	2,567	2,011	1,945	2,189	2,189	-2,348	5,044	4,728
Below Normal	-4,365	-6,553	-7,133	2,507	3,786	7,572	2,248	2,155	1,961	1,965	2,043	-482	5,705	4,500
Dry	-4,281	-2,474	-4,508	660	1,450	7,456	2,406	2,171	2,101	1,915	869	-299	7,465	7,516
All Years	-4,638	-5,883	-6,178	2,233	1,938	5,955	2,897	1,635	1,556	2,089	1,901	-1,546	1,960	1,932

2.3 Hetch Hetchy Reservoir and Releases

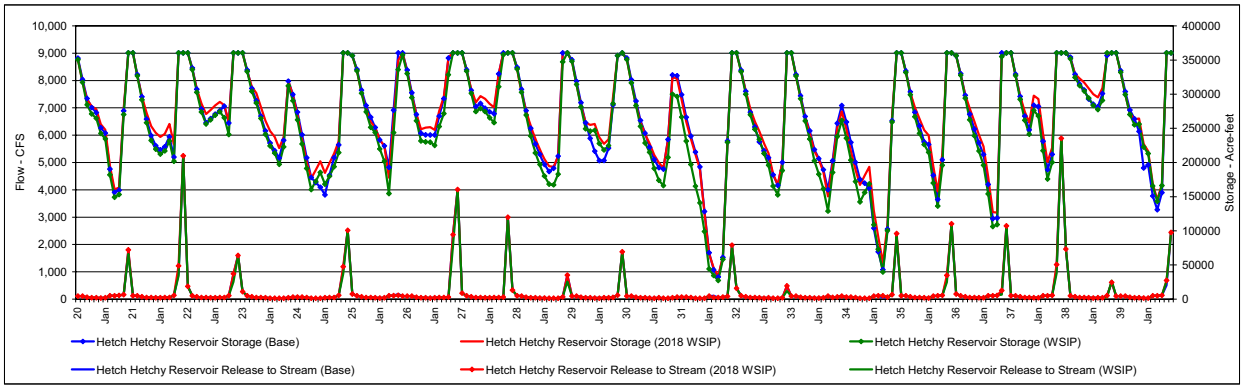
Compared to the WSIP setting, the variant setting would draw less water from the Tuolumne due to the lesser demand. This circumstance would lead to less draw from Hetch Hetchy Reservoir in the variant setting in most years. Figure 2.3-1 illustrates a chronological trace of the simulation of Hetch Hetchy Reservoir storage and stream releases. Shown in Figure 2.3-1 are the results for the WSIP, variant (2018 WSIP), and base settings. Supplementing the Figure 2.3-1 representation of Hetch Hetchy Reservoir storage are Table 2.3-1, Hetch Hetchy Reservoir Storage (2018 WSIP); Table 2.3-2, Hetch Hetchy Reservoir Storage (WSIP); and Table 2.3-3, Difference in Hetch Hetchy Reservoir Storage (2018 WSIP minus WSIP). Table 2.3-4 is provided to illustrate the difference in Hetch Hetchy Reservoir storage between the base and variant settings.

Table 2.3-3 shows that, by the end of summer, storage in Hetch Hetchy Reservoir associated with the variant setting would be greater than the storage in the WSIP setting in about 20 percent of the years, ranging from a minor increase to over 31,000 acre-feet in a year. The relatively minor increases in storage are attributable to years when summer diversions would be the same in both settings (SJPL operating at maximum capacity) but less water would be diverted in the fall due to the lesser water demand. The larger increases in storage are associated with drought periods, during which the differences in underlying demand and water delivery shortages between the WSIP and variant settings are greater.

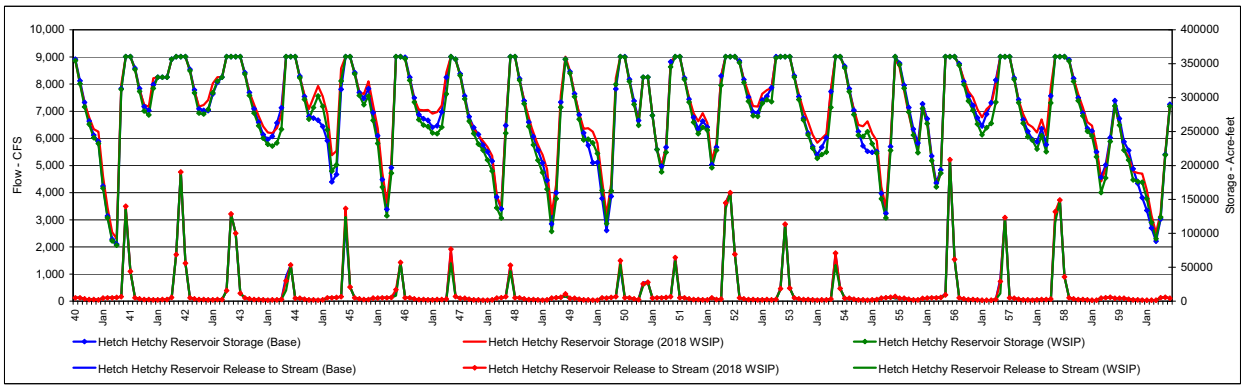
APPENDIX O3

Figure 2.3-1
Hetch Hetchy Reservoir Storage and Stream Release

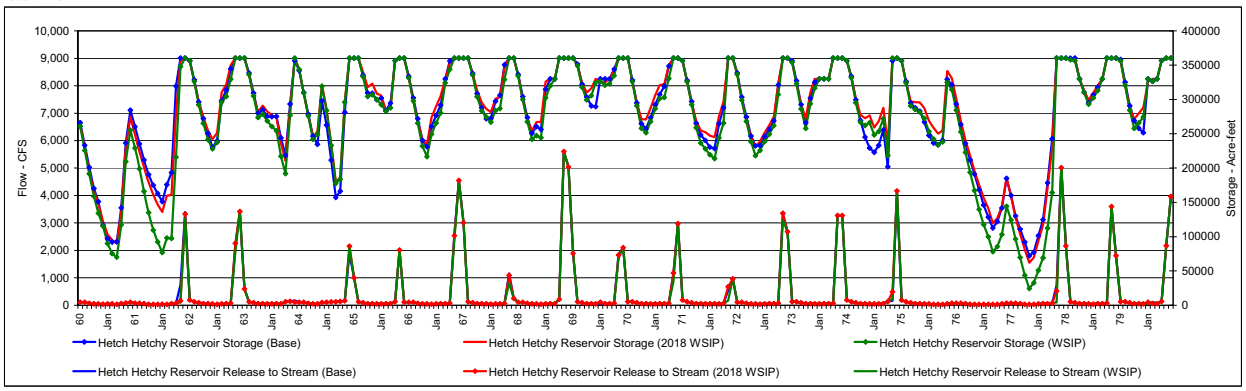
1920 - 1939



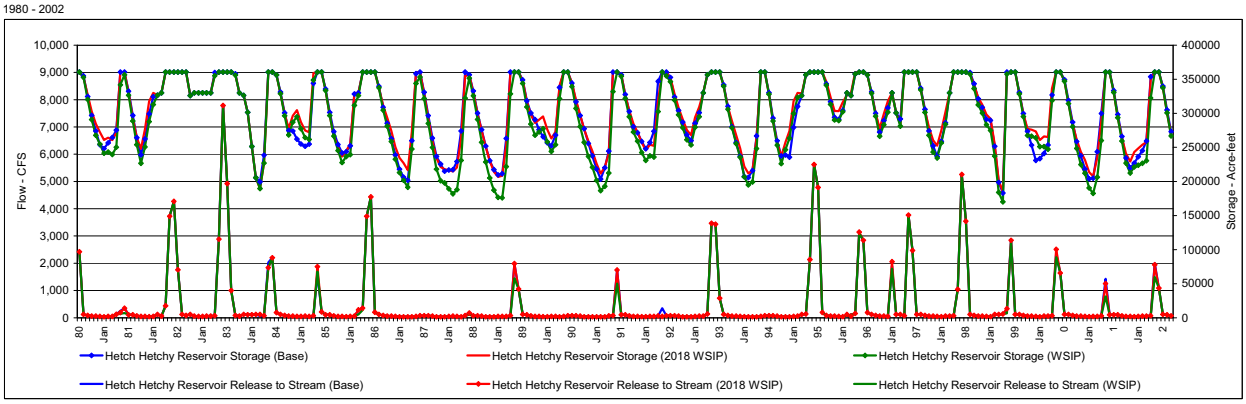
1940 - 1959



1960 - 1979



1980 - 2002



APPENDIX O3

Table 2.3-1

Hetch Hetchy Reservoir Storage (Acre-feet) 2018 WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	282,609	278,092	255,917	247,975	195,384	160,826	163,128	278,579	360,400	360,400	326,811	296,708
1922	272,692	253,215	243,432	237,356	241,830	256,406	226,719	360,400	360,400	360,400	336,082	307,732
1923	286,405	270,794	276,871	283,590	288,738	283,923	259,278	360,400	360,400	360,400	333,186	310,962
1924	301,568	281,696	261,164	246,096	237,579	221,011	237,619	319,528	297,781	269,833	234,563	200,811
1925	176,725	188,760	201,798	184,735	199,033	213,024	231,155	360,400	360,400	356,465	334,210	301,427
1926	279,127	259,324	251,245	233,085	224,213	177,698	263,211	349,832	360,400	333,232	297,804	270,576
1927	248,777	251,050	251,687	247,855	275,438	296,429	354,032	360,400	360,400	360,400	333,718	307,952
1928	287,960	297,217	293,099	286,032	280,760	330,000	360,400	360,400	360,400	337,096	302,689	276,165
1929	254,035	233,992	219,838	204,878	194,666	193,633	209,190	360,400	360,400	348,102	314,426	283,355
1930	258,555	254,985	256,315	236,814	227,387	233,865	295,228	356,465	360,400	350,768	316,726	284,621
1931	259,237	241,452	227,760	210,946	199,767	191,885	233,170	325,434	322,155	292,228	259,610	234,867
1932	211,484	190,881	126,425	66,408	45,476	34,111	62,131	232,474	360,400	360,400	333,089	304,798
1933	278,840	260,094	245,851	228,098	213,520	182,969	167,504	200,819	360,400	360,400	326,593	293,382
1934	266,003	243,161	216,797	204,346	186,085	150,440	198,562	251,067	274,860	248,611	216,584	189,190
1935	167,090	180,813	193,600	130,416	91,354	53,449	109,363	266,254	360,400	360,400	331,788	302,361
1936	280,873	263,851	247,502	239,843	194,673	157,609	213,898	360,400	360,400	356,465	327,853	298,989
1937	278,787	260,055	240,667	223,486	179,093	127,495	126,725	360,400	360,400	360,400	327,212	297,350
1938	274,407	258,610	297,772	293,013	242,112	200,609	221,893	360,400	360,400	360,400	352,029	329,594
1939	323,052	317,095	308,612	299,875	295,466	308,950	356,592	360,400	360,400	332,157	299,492	271,524
1940	263,350	264,386	227,268	216,494	168,677	145,755	168,357	360,400	360,400	354,451	320,313	291,190
1941	271,263	253,545	249,892	184,092	138,160	101,885	92,264	319,429	360,400	360,400	341,291	311,165
1942	289,497	286,480	328,368	330,000	330,000	330,000	356,592	360,400	360,400	360,400	339,529	310,000
1943	286,861	289,159	296,594	321,028	330,000	330,000	360,400	360,400	360,400	360,400	334,820	307,969
1944	289,730	272,775	257,390	248,581	247,526	255,151	275,226	360,400	360,400	360,400	329,290	304,166
1945	283,254	300,146	317,051	301,901	275,964	215,180	221,432	342,932	360,400	360,400	334,928	308,047
1946	305,207	324,081	288,649	254,722	190,265	144,978	204,939	360,400	360,400	357,267	325,581	298,114
1947	281,975	281,245	281,849	276,388	278,587	288,395	337,342	360,400	356,592	332,847	297,991	267,446
1948	254,417	244,294	235,928	226,952	214,085	155,433	137,737	260,228	360,400	360,400	325,774	295,942
1949	270,211	248,715	229,974	215,741	194,598	128,217	171,843	303,299	360,400	339,844	305,128	276,849
1950	254,009	254,979	249,960	232,946	178,360	126,993	173,245	328,608	360,400	359,600	323,849	289,929
1951	263,034	330,000	330,000	273,739	223,537	199,065	226,940	352,902	360,400	360,400	326,780	299,924
1952	277,192	265,107	276,984	262,472	207,037	232,744	331,312	360,400	360,400	360,400	351,651	327,090
1953	306,915	287,555	286,634	305,694	311,161	314,290	360,400	360,400	360,400	360,400	330,136	304,813
1954	281,411	264,084	245,293	233,461	239,810	246,445	312,245	360,400	360,400	343,956	308,827	282,584
1955	259,833	257,884	265,101	247,276	236,225	168,911	137,956	234,795	356,592	344,694	309,939	275,067
1956	246,064	223,824	286,092	264,022	209,194	170,223	190,121	360,400	360,400	360,400	347,791	326,931
1957	309,473	300,247	282,855	271,022	283,025	289,326	320,587	360,400	360,400	360,400	326,823	296,564
1958	275,676	261,117	256,620	248,538	268,060	244,553	316,356	360,400	360,400	360,400	353,900	327,777
1959	305,000	285,354	263,804	258,795	228,073	176,551	195,296	236,053	288,523	260,077	223,494	212,535
1960	191,220	189,064	187,908	163,510	126,394	100,465	130,282	218,504	290,266	264,021	228,814	194,592
1961	166,799	147,604	122,185	103,560	94,937	89,820	136,861	229,076	274,760	248,652	223,685	200,188
1962	179,904	160,807	146,608	135,879	159,757	160,943	279,470	356,465	360,400	356,465	326,379	297,010
1963	273,823	254,662	242,067	251,423	310,058	322,016	350,074	360,400	360,400	360,400	336,396	305,026
1964	281,564	290,995	282,306	277,015	273,190	235,968	210,684	286,406	360,400	343,750	309,409	275,896
1965	245,809	253,115	321,455	286,120	235,159	179,819	185,636	297,805	360,400	360,400	360,400	339,909
1966	317,826	322,951	308,583	305,796	283,349	288,162	356,592	360,400	360,400	331,450	297,972	267,899
1967	241,427	234,658	273,811	290,049	304,992	330,000	352,295	360,400	360,400	360,400	360,400	336,965
1968	313,146	295,351	286,381	281,571	301,117	304,173	346,380	360,400	360,400	334,325	299,837	270,029
1969	254,522	266,986	267,609	326,006	330,000	330,000	360,400	360,400	360,400	360,400	349,426	324,498
1970	309,819	316,182	330,000	326,065	325,142	330,000	341,873	360,400	360,400	360,400	326,016	295,639
1971	270,928	270,971	287,195	306,077	320,804	322,357	349,749	360,400	360,400	356,465	325,764	294,564
1972	268,852	254,761	252,261	247,271	245,191	275,403	296,867	360,400	360,400	336,426	299,001	269,162
1973	244,428	230,983	238,924	251,779	262,465	275,113	322,681	360,400	360,400	353,990	322,828	292,848
1974	272,123	310,590	330,000	330,000	330,000	330,000	360,400	360,400	360,400	356,465	331,550	301,908
1975	277,436	272,650	276,651	258,972	268,065	287,929	234,337	360,400	360,400	356,465	324,162	297,200
1976	295,909	295,723	287,208	268,903	258,610	250,311	254,661	341,485	330,919	300,830	269,106	240,387
1977	218,384	195,661	175,732	156,532	141,297	119,701	126,961	144,655	185,682	158,583	127,611	103,776
1978	81,190	62,065	69,663	93,807	117,052	170,753	229,138	360,400	360,400	360,400	357,869	360,400
1979	330,000	313,085	298,796	309,602	320,487	330,000	360,400	360,400	360,400	356,097	320,734	287,352
1980	271,512	279,664	288,323	326,065	330,000	330,000	356,592	360,400	360,400	360,400	352,729	327,134
1981	303,223	284,771	272,418	260,876	264,288	260,790	271,414	360,400	360,400	330,185	292,628	264,472
1982	248,006	276,645	317,405	330,000	326,446	330,000	360,400	360,400	360,400	360,400	360,400	360,400
1983	326,065	330,000	330,000	330,000	330,000	330,000	356,951	360,400	360,400	360,400	360,400	357,167
1984	330,000	326,192	301,515	251,330	205,725	189,676	227,004	360,400	360,400	356,465	328,962	299,035
1985	277,894	296,425	304,499	286,883	274,950	272,162	359,303	360,400	360,400	333,535	296,865	266,723
1986	250,445	236,469	245,291	254,917	330,000	330,000	360,400	360,400	360,400	360,400	337,490	311,318
1987	293,620	273,938	250,752	234,807	227,102	216,794	272,945	360,400	360,400	328,763	292,248	259,162
1988	234,316	221,153	217,898	216,791	214,588	220,681	263,542	355,022	356,592	330,735	299,096	274,941
1989	250,690	230,116	214,166	206,589	208,221	254,241	360,400	360,400	360,400	347,970	317,138	297,556
1990	286,000	290,721	295,500	276,136	263,108	272,917	340,617	360,400	360,400	344,204	319,777	297,881
1991	276,582	259,570	244,114	225,926	211,787	220,991	241,549	360,400	360,400	357,093	326,278	304,043
1992	284,649	272,088	257,248	245,762	253,949	252,395	318,919	360,400	359,902	352,164	328,215	308,305
1993	291,250	275,503	268,001	293,942	309,264	330,000	356,592	360,400	360,400	360,400	339,684	309,861
1994	288,288	268,035	248,867	222,053	211,917	216,211	265,068	360,400	360,400	328,106	288,504	257,165
1995	236,917	257,505	274,105	318,014	330,000	329,098	356,592	360,400	360,400	360,400	360,400	346,115
1996	323,688	303,528	303,270	316,260	326,446	330,000	360,400	360,400	360,400	356,465	329,269	299,674
1997	277,861	299,279	317,856	330,000	300,695	283,968	360,400	360,400	360,400	360,400	334,509	303,667
1998	279,663	260,551	252,471	274,673	301,923	330,000	360,400	360,400	360,400	360,400	357,575	341,243
1999	322,965	312,973	298,470	292,088	254,288	201,103	185,376	360,400	360,400	360,400	328,523	299,272
2000	277,088	276,001	273,476	260,779	266,000	265,151	336,457	360,400	360,400	347,257	314,429	284,299
2001	261,745	243,718	231,697	213,737	207,523	235,058	289,029	360,400	360,186	330,828	293,698	264,148
2002	241,297	229,484	243,063	248,705	254,002	257,704	349,922	360,400	360,400	337,536	300,566	269,362
Avg (21-02)	268,676	262,479	259,859	252,012	243,600	235,735	269,224	338,182	352,712	343,017	316,086	289,447

APPENDIX O3

Table 2.3-2

Hetch Hetchy Reservoir Storage (Acre-feet) WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	271,165	264,808	242,632	234,683	182,084	149,183	153,305	270,347	360,400	360,400	326,811	291,828
1922	258,301	232,379	219,552	212,511	216,970	231,546	201,859	360,400	360,400	360,400	336,082	302,853
1923	273,916	256,464	262,541	269,252	274,392	265,677	241,032	360,400	360,400	360,400	333,186	304,241
1924	287,239	264,605	241,219	224,237	213,989	197,420	222,900	312,177	290,436	262,497	227,241	191,379
1925	160,353	172,388	185,426	168,354	179,977	193,968	214,415	360,400	360,400	356,465	334,210	301,427
1926	274,085	251,427	243,883	219,916	201,778	154,687	243,705	336,096	357,554	330,389	294,965	261,018
1927	231,614	230,204	229,890	225,094	252,663	271,751	328,434	360,400	360,400	360,400	333,718	301,231
1928	274,488	279,141	274,500	265,521	258,520	310,981	357,818	360,400	360,400	337,096	302,689	269,444
1929	238,756	214,109	197,101	180,226	168,280	167,248	182,805	347,340	360,400	348,102	314,426	281,237
1930	249,493	245,923	247,253	227,747	218,315	224,793	286,156	356,465	360,400	350,768	316,726	283,424
1931	252,998	228,677	214,984	191,409	174,118	166,236	207,521	299,800	296,541	266,646	231,402	197,210
1932	165,286	141,000	99,154	44,357	34,477	27,305	58,254	229,673	360,400	360,400	333,089	299,918
1933	270,157	248,649	233,883	213,269	196,104	165,553	152,529	188,275	360,400	360,400	326,593	293,382
1934	260,961	234,344	202,598	182,895	161,604	129,002	185,456	237,968	261,776	235,550	203,546	172,300
1935	142,314	156,037	168,825	108,936	73,089	39,750	100,334	259,346	360,400	360,400	331,788	299,322
1936	267,086	242,699	226,345	214,884	170,029	136,212	195,836	360,400	360,400	356,465	327,853	294,110
1937	262,493	239,158	216,925	195,925	154,023	106,324	109,133	355,146	360,400	360,400	327,212	292,471
1938	261,919	241,518	276,115	268,301	217,388	175,924	200,166	360,400	360,400	360,400	352,029	324,714
1939	312,466	304,668	294,282	283,636	277,502	290,985	360,400	360,400	360,400	332,157	299,492	270,327
1940	255,209	256,245	222,760	213,012	165,616	143,200	166,203	360,400	360,400	354,451	320,313	286,310
1941	260,678	241,118	232,444	166,634	122,924	89,103	82,492	312,086	360,400	360,400	341,291	309,048
1942	280,245	274,466	313,690	330,000	330,000	330,000	356,592	360,400	360,400	360,400	339,529	306,962
1943	277,164	275,780	282,691	307,119	324,209	330,000	360,400	360,400	360,400	360,400	334,820	303,090
1944	277,241	258,445	240,206	231,387	228,604	233,279	253,354	360,400	360,400	360,400	329,290	297,445
1945	268,450	285,342	302,246	287,091	252,554	191,770	200,884	324,552	360,400	360,400	334,928	303,168
1946	289,579	302,009	266,576	232,638	168,168	125,876	188,823	360,400	360,400	357,267	325,581	293,235
1947	267,584	259,488	257,238	247,959	246,704	256,512	305,459	360,400	356,592	332,847	297,991	265,329
1948	247,258	231,519	222,630	208,209	191,894	137,570	122,657	247,597	360,400	360,400	325,774	291,062
1949	257,437	230,325	207,779	189,698	165,102	102,768	150,930	285,781	356,592	336,040	301,328	268,173
1950	237,728	238,697	233,120	217,888	163,294	114,244	162,551	319,659	360,400	359,600	323,849	289,929
1951	259,038	330,000	330,000	273,739	223,537	190,502	219,413	345,379	360,400	360,400	326,780	293,203
1952	263,719	247,031	256,244	252,090	196,649	222,356	318,163	360,400	360,400	360,400	351,651	322,211
1953	294,426	273,225	272,304	291,357	296,819	294,144	358,469	360,400	360,400	360,400	330,136	297,172
1954	267,018	245,088	225,346	210,648	216,124	219,810	285,610	360,400	360,400	343,956	308,827	274,943
1955	244,584	242,635	249,852	232,018	218,294	150,980	122,826	222,121	360,400	348,498	313,738	278,863
1956	244,816	218,801	283,964	261,892	207,063	168,360	188,550	360,400	360,400	360,400	347,791	319,290
1957	295,080	281,251	261,004	245,354	255,623	261,924	293,186	360,400	360,400	360,400	326,823	292,697
1958	262,298	242,214	237,194	224,344	243,852	220,345	292,148	360,400	360,400	360,400	353,900	323,910
1959	295,427	273,019	250,518	243,597	212,867	160,299	181,528	235,211	287,682	259,237	222,655	207,831
1960	178,623	176,466	175,310	150,905	115,966	92,114	123,900	215,531	287,296	261,055	225,853	191,635
1961	158,801	133,990	115,379	89,989	75,248	70,132	117,173	209,414	255,120	229,047	199,072	166,120
1962	135,106	109,472	92,419	76,863	98,093	97,377	215,903	347,784	360,400	356,465	326,379	292,131
1963	265,044	241,281	228,162	237,510	296,137	304,290	329,586	360,400	360,400	360,400	336,396	305,026
1964	273,668	278,495	268,855	260,703	254,291	217,069	191,863	276,888	360,400	343,750	309,409	275,896
1965	241,813	249,120	319,261	283,925	232,964	177,623	183,699	296,108	360,400	360,400	360,400	333,188
1966	304,353	306,716	299,942	292,395	282,814	287,628	356,592	360,400	360,400	331,450	297,972	265,321
1967	231,906	216,758	249,252	265,475	280,406	324,014	343,546	360,400	360,400	360,400	360,400	335,768
1968	304,053	283,496	274,527	266,857	283,817	286,873	329,080	360,400	360,400	334,325	299,837	267,451
1969	242,147	247,245	244,063	302,446	320,114	330,000	360,400	360,400	360,400	360,400	349,426	317,777
1970	299,296	305,659	324,435	326,065	320,846	322,797	334,670	360,400	360,400	360,400	326,016	290,760
1971	257,964	251,563	267,786	286,658	301,378	302,930	330,322	360,400	360,400	356,465	325,764	292,446
1972	258,839	236,370	228,162	219,353	213,819	244,031	265,495	360,400	360,400	336,426	299,001	267,965
1973	238,190	218,208	225,626	238,473	249,151	261,799	307,249	360,400	360,400	353,990	322,828	286,127
1974	257,794	293,500	316,503	330,000	330,000	330,000	360,400	360,400	360,400	356,465	331,550	295,187
1975	266,912	262,126	266,128	248,443	253,233	271,955	218,363	360,400	360,400	356,465	324,162	290,479
1976	285,385	281,517	272,478	253,215	242,054	233,754	238,104	324,938	314,385	284,316	252,614	222,717
1977	193,779	167,282	139,742	117,657	99,799	78,202	85,462	103,210	144,346	124,287	96,380	69,868
1978	43,507	24,382	32,503	50,915	68,975	112,212	164,152	360,400	360,400	360,400	357,869	356,406
1979	329,957	310,280	293,137	302,038	312,919	330,000	360,400	360,400	360,400	356,097	320,734	284,314
1980	257,725	265,877	274,536	330,000	326,446	330,000	356,592	360,400	360,400	360,400	352,729	320,413
1981	290,796	267,741	254,865	241,410	243,092	239,594	250,218	341,900	356,592	326,381	288,829	253,955
1982	226,746	250,781	287,735	312,861	326,446	330,000	360,400	360,400	360,400	360,400	360,400	360,400
1983	326,065	330,000	330,000	330,000	330,000	330,000	355,110	360,400	360,400	360,400	360,400	355,970
1984	330,000	326,192	301,515	251,330	205,725	189,676	227,004	360,400	360,400	356,465	328,962	296,457
1985	268,372	286,904	294,977	277,357	264,474	261,687	348,828	360,400	360,400	333,535	296,865	266,723
1986	245,402	227,652	236,474	239,341	311,791	326,065	360,400	360,400	360,400	360,400	337,490	304,597
1987	281,194	258,749	232,710	212,948	201,794	191,486	247,637	343,806	353,248	321,619	285,112	249,916
1988	218,130	201,193	197,937	189,208	181,835	187,927	230,788	322,288	351,731	325,880	291,107	257,476
1989	228,478	205,142	187,290	176,843	175,880	221,901	328,424	360,400	360,400	343,974	309,341	284,242
1990	267,935	272,656	277,435	258,063	244,079	253,888	321,588	360,400	360,400	339,162	307,130	280,640
1991	257,447	236,752	220,773	201,620	186,608	192,958	212,319	331,748	360,400	354,429	321,715	294,880
1992	272,636	259,154	242,411	230,916	237,549	235,995	302,519	360,400	355,022	346,244	319,447	297,703
1993	278,750	261,161	253,660	279,592	294,907	330,000	356,592	360,400	360,400	360,400	339,684	305,994
1994	278,714	255,699	235,580	206,856	194,993	199,287	248,143	360,400	360,400	328,106	288,504	253,299
1995	226,108	246,696	263,295	299,588	323,326	326,065	356,592	360,400	360,400	360,400	360,400	341,235
1996	313,102	290,180	289,399	302,383	330,000	326,065	357,776	360,400	360,400	356,465	329,269	295,808
1997	266,385	283,200	301,776	330,000	300,695	281,114	360,400	360,400	360,400	360,400	334,509	301,549
1998	267,747	243,111	234,508	256,700	283,939	330,000	360,400	360,400	360,400	360,400	357,575	336,363
1999	312,379	300,546	283,189	274,898	237,089	183,904	170,253	357,615	360,400	360,400	328,523	295,405
2000	267,514	266,427	263,903	251,200	251,088	247,384	318,690	360,400	360,400	347,257	314,429	280,432
2001	248,366	224,815	212,272	190,495	182,549	206,184	260,155	360,400	360,186	330,828	293,698	259,268
2002	226,907	212,332	221,154	223,929	226,634	230,337	322,554	360,400	360,400	337,536	300,566	266,784
Avg (21-02)	255,904	246,607	243,366	234,942	226,197	219,194	254,171	333,374	350,872	341,109	313,888	283,193

APPENDIX O3

Table 2.3-3

Difference in Hetch Hetchy Reservoir Storage (Acre-feet) 2018 WSIP minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	11,444	13,284	13,285	13,292	13,300	11,643	9,823	8,232	0	0	0	4,880
1922	14,391	20,836	23,880	24,845	24,860	24,860	24,860	0	0	0	0	4,879
1923	12,489	14,330	14,330	14,338	14,346	18,246	18,246	0	0	0	0	6,721
1924	14,329	17,091	19,945	21,859	23,590	23,591	14,719	7,351	7,345	7,336	7,322	9,432
1925	16,372	16,372	16,372	16,381	19,056	19,056	16,740	0	0	0	0	0
1926	5,042	7,897	7,362	13,169	22,435	23,011	19,506	13,736	2,846	2,843	2,839	9,558
1927	17,163	20,846	21,797	22,761	22,775	24,678	25,598	0	0	0	0	6,721
1928	13,472	18,076	18,599	20,511	22,240	19,019	2,582	0	0	0	0	6,721
1929	15,279	19,883	22,737	24,652	26,386	26,385	26,385	13,060	0	0	0	2,118
1930	9,062	9,062	9,062	9,067	9,072	9,072	9,072	0	0	0	0	1,197
1931	6,239	12,775	12,776	19,537	25,649	25,649	25,649	25,634	25,614	25,582	28,208	37,657
1932	46,198	49,881	27,271	22,051	10,999	6,806	3,877	2,801	0	0	0	4,880
1933	8,683	11,445	11,968	14,829	17,416	17,416	14,975	12,544	0	0	0	0
1934	5,042	8,817	14,199	21,451	24,481	21,438	13,106	13,099	13,084	13,061	13,038	16,890
1935	24,776	24,776	24,775	21,480	18,265	13,699	9,029	6,908	0	0	0	3,039
1936	13,787	21,152	21,157	24,959	24,644	21,397	18,062	0	0	0	0	4,879
1937	16,294	20,897	23,742	27,561	25,070	21,171	17,592	5,254	0	0	0	4,879
1938	12,488	17,092	21,657	24,712	24,724	24,685	21,727	0	0	0	0	4,880
1939	10,586	12,427	14,330	16,239	17,964	17,965	-3,808	0	0	0	0	1,197
1940	8,141	8,141	4,508	3,482	3,061	2,555	2,154	0	0	0	0	4,880
1941	10,585	12,427	17,448	17,458	15,236	12,782	9,772	7,343	0	0	0	2,117
1942	9,252	12,014	14,678	0	0	0	0	0	0	0	0	3,038
1943	9,697	13,379	13,903	13,909	5,791	0	0	0	0	0	0	4,879
1944	12,489	14,330	17,184	17,194	18,922	21,872	21,872	0	0	0	0	6,721
1945	14,804	14,804	14,805	14,810	23,410	23,410	20,548	18,380	0	0	0	4,879
1946	15,628	22,072	22,073	22,084	22,097	19,102	16,116	0	0	0	0	4,879
1947	14,391	21,757	24,611	28,429	31,883	31,883	31,883	0	0	0	0	2,117
1948	7,159	12,775	13,298	18,743	22,191	17,863	15,080	12,631	0	0	0	4,880
1949	12,774	18,390	22,195	26,043	29,496	25,449	20,913	17,518	3,808	3,804	3,800	8,676
1950	16,281	16,282	16,840	15,058	15,066	12,749	10,694	8,949	0	0	0	0
1951	3,996	0	0	0	0	8,563	7,527	7,523	0	0	0	6,721
1952	13,473	18,076	20,740	10,382	10,388	10,388	13,149	0	0	0	0	4,879
1953	12,489	14,330	14,330	14,337	14,342	20,146	1,931	0	0	0	0	7,641
1954	14,393	18,996	19,947	22,813	23,686	26,635	26,635	0	0	0	0	7,641
1955	15,249	15,249	15,249	15,258	17,931	17,931	15,130	12,674	-3,808	-3,804	-3,799	-3,796
1956	1,248	5,023	2,128	2,130	2,131	1,863	1,571	0	0	0	0	7,641
1957	14,393	18,996	21,851	25,668	27,402	27,402	27,401	0	0	0	0	3,867
1958	13,378	18,903	19,426	24,194	24,208	24,208	24,208	0	0	0	0	3,867
1959	9,573	12,335	13,286	15,198	15,206	16,252	13,768	842	841	840	839	4,704
1960	12,597	12,598	12,598	12,605	10,428	8,351	6,382	2,973	2,970	2,966	2,961	2,957
1961	7,998	13,614	6,806	13,571	19,689	19,688	19,688	19,662	19,640	19,605	24,613	34,068
1962	44,798	51,335	54,189	59,016	61,664	63,566	63,567	8,681	0	0	0	4,879
1963	8,779	13,381	13,905	13,913	13,921	17,726	20,488	0	0	0	0	0
1964	7,896	12,500	13,451	16,312	18,899	18,899	18,821	9,518	0	0	0	0
1965	3,996	3,995	2,194	2,195	2,195	2,196	1,937	1,697	0	0	0	6,721
1966	13,473	16,235	8,641	13,401	535	534	0	0	0	0	0	2,578
1967	9,521	17,900	24,559	24,574	24,586	5,986	8,749	0	0	0	0	1,197
1968	9,093	11,855	11,854	14,714	17,300	17,300	17,300	0	0	0	0	2,578
1969	12,375	19,741	23,546	23,560	9,886	0	0	0	0	0	0	6,721
1970	10,523	10,523	5,565	0	4,296	7,203	7,203	0	0	0	0	4,879
1971	12,964	19,408	19,409	19,419	19,426	19,427	19,427	0	0	0	0	2,118
1972	10,013	18,391	24,099	27,918	31,372	31,372	31,372	0	0	0	0	1,197
1973	6,238	12,775	13,298	13,306	13,314	13,314	15,432	0	0	0	0	6,721
1974	14,329	17,090	13,497	0	0	0	0	0	0	0	0	6,721
1975	10,524	10,524	10,523	10,529	14,832	15,974	15,974	0	0	0	0	6,721
1976	10,524	14,206	14,730	15,688	16,556	16,557	16,557	16,547	16,534	16,514	16,492	17,670
1977	24,605	28,379	35,990	38,875	41,498	41,499	41,499	41,445	41,336	34,296	31,231	33,908
1978	37,683	37,683	37,160	42,892	48,077	58,541	64,986	0	0	0	0	3,994
1979	43	2,805	5,659	7,564	7,568	0	0	0	0	0	0	3,038
1980	13,787	13,787	13,787	-3,935	3,554	0	0	0	0	0	0	6,721
1981	12,427	17,030	17,553	19,466	21,196	21,196	21,196	18,500	3,808	3,804	3,799	10,517
1982	21,260	25,864	29,670	17,139	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	1,841	0	0	0	0	1,197
1984	0	0	0	0	0	0	0	0	0	0	0	2,578
1985	9,522	9,521	9,522	9,526	10,476	10,475	10,475	0	0	0	0	0
1986	5,043	8,817	8,817	15,576	18,209	3,935	0	0	0	0	0	6,721
1987	12,426	15,189	18,042	21,859	25,308	25,308	25,308	16,594	7,152	7,144	7,136	9,246
1988	16,186	19,960	19,961	27,583	32,753	32,754	32,754	32,734	4,861	4,855	7,989	17,465
1989	22,212	24,974	26,876	29,746	32,341	32,340	31,976	0	0	3,996	7,797	13,314
1990	18,065	18,065	18,065	18,073	19,029	19,029	19,029	0	0	5,042	12,647	17,241
1991	19,135	22,818	23,341	24,306	25,179	28,033	29,230	28,652	0	2,664	4,563	9,163
1992	12,013	12,934	14,837	14,846	16,400	16,400	16,400	0	4,880	5,920	8,768	10,602
1993	12,500	14,342	14,341	14,350	14,357	0	0	0	0	0	0	3,867
1994	9,574	12,336	13,287	15,197	16,924	16,924	16,925	0	0	0	0	3,866
1995	10,809	10,809	10,810	18,426	6,674	3,033	0	0	0	0	0	4,880
1996	10,586	13,348	13,871	13,877	-3,554	3,935	2,624	0	0	0	0	3,866
1997	11,476	16,079	16,080	0	0	2,854	0	0	0	0	0	2,118
1998	11,916	17,440	17,963	17,973	17,984	0	0	0	0	0	0	4,880
1999	10,586	12,427	15,281	17,190	17,199	17,199	15,123	2,785	0	0	0	3,867
2000	9,574	9,574	9,573	9,579	14,912	17,767	17,767	0	0	0	0	3,867
2001	13,379	18,903	19,425	23,242	24,974	28,874	28,874	0	0	0	0	4,880
2002	14,390	17,152	21,909	24,776	27,368	27,367	27,368	0	0	0	0	2,578
Avg (21-02)	12,773	15,872	16,493	17,070	17,403	16,541	15,053	4,808	1,840	1,908	2,198	6,254

APPENDIX O3

Table 2.3-4

Difference in Hetch Hetchy Reservoir Storage (Acre-feet) 2018 WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	2,198	4,959	4,960	4,963	4,966	4,342	3,658	3,076	0	0	-2,188	576
1922	9,138	13,741	18,688	18,699	18,710	18,710	18,710	0	0	0	-2,188	575
1923	8,186	12,790	12,790	12,797	12,804	1,387	1,387	0	0	0	-2,188	2,417
1924	10,978	13,740	14,691	17,554	20,142	14,339	5,052	335	-1,783	-3,969	-6,150	-6,143
1925	-1,383	17,951	37,930	32,150	17,566	6,055	5,313	0	0	0	-2,188	-4,304
1926	-4,302	-7,064	-16	-16	-13	-15,330	-13,488	-10,568	0	-2,188	-4,374	233
1927	5,941	10,544	11,496	7,697	7,702	2,945	1,104	0	0	0	-2,188	2,417
1928	6,221	10,824	13,679	11,783	9,210	281	0	0	0	-2,188	-4,373	234
1929	4,038	6,800	7,752	7,756	7,761	1,957	-160	0	0	-2,188	-4,374	-4,370
1930	389	19,723	39,701	33,921	24,402	12,891	10,773	0	0	-2,188	-4,373	-5,291
1931	-2,434	-1,514	5,574	6,528	7,391	1,588	-529	-2,717	-4,832	-7,015	-6,530	-3,761
1932	-3,759	-2,838	-1,897	-1,591	2,645	1,691	1,046	754	0	0	-2,188	576
1933	5,332	8,094	15,705	10,957	6,667	864	761	638	0	0	-2,188	-4,304
1934	-1,448	-3,290	-2,195	-1,415	-3,522	-9,788	-4,179	-6,364	-8,474	-10,650	-12,820	-11,056
1935	-8,196	11,138	31,116	26,406	22,153	10,358	6,874	5,270	0	0	-2,188	-1,265
1936	7,297	10,059	17,258	13,364	13,372	11,707	9,889	0	0	0	-2,188	575
1937	8,186	10,948	11,900	11,907	11,185	9,529	8,018	0	0	0	-2,188	575
1938	6,283	10,887	13,741	11,084	11,089	11,088	9,748	0	0	0	-2,188	576
1939	8,187	10,948	15,705	14,761	13,907	8,104	0	0	0	-2,188	-4,373	-5,291
1940	-531	18,803	35,223	19,926	17,643	14,796	12,490	0	0	-2,188	-4,374	-1,608
1941	6,003	8,766	14,397	14,405	12,626	10,593	8,102	6,094	0	0	-2,188	-2,187
1942	2,571	5,333	9,139	0	0	0	0	0	0	0	-2,188	-1,266
1943	3,492	8,095	15,706	15,713	7,596	0	0	0	0	0	-2,188	575
1944	6,284	9,046	11,900	10,004	4,682	-7,685	-9,803	0	0	0	-2,188	2,417
1945	10,978	30,312	50,291	44,510	39,377	39,377	34,600	30,669	0	0	-2,188	575
1946	6,284	10,887	10,887	10,892	10,898	9,551	8,059	0	0	-2,188	-4,374	-1,608
1947	6,955	12,479	15,333	20,097	20,109	9,549	7,432	0	0	-2,188	-4,374	-4,370
1948	-1,513	-1,513	6,097	6,782	7,645	1,841	1,554	1,305	0	0	-2,188	576
1949	6,283	6,284	7,235	12,020	16,324	14,297	11,995	10,054	3,808	1,616	-574	2,188
1950	5,992	25,326	45,993	28,530	27,001	22,763	18,761	15,708	0	-800	-2,988	-5,103
1951	-3,293	0	0	0	0	0	0	0	0	0	-2,188	2,417
1952	6,221	10,825	11,776	5,895	5,898	5,898	-547	0	0	0	-2,188	575
1953	6,284	9,046	9,046	9,050	9,053	-460	0	0	0	0	-2,188	3,337
1954	11,898	16,502	17,453	17,463	13,005	5,394	3,276	0	0	-2,188	-4,373	1,154
1955	9,716	29,050	44,271	27,839	15,653	9,850	8,315	6,974	-3,808	-5,992	-8,173	-10,284
1956	-7,425	-9,266	-4,758	-4,760	-4,763	-4,139	-3,481	0	0	0	-2,188	3,337
1957	7,141	11,745	12,697	12,703	7,383	-3,177	-5,295	0	0	0	-2,188	-437
1958	8,125	10,887	18,498	13,752	13,760	13,760	13,760	0	0	0	-2,188	-437
1959	5,271	8,033	8,984	8,039	8,043	-6,227	-5,492	-4,932	-7,044	-9,222	-11,394	-9,632
1960	-3,918	15,416	35,395	29,617	18,587	12,000	9,167	2,173	54	-2,134	-4,318	-6,432
1961	-3,574	-3,574	5,300	6,260	2,831	-2,973	-5,090	-7,272	-9,381	-11,556	-11,536	-11,523
1962	-10,565	-14,248	-16,150	-15,212	-16,089	-32,262	-39,903	-3,935	0	0	-2,188	575
1963	1,527	4,288	11,900	11,907	11,914	8,108	5,346	0	0	0	-2,188	-4,304
1964	1,406	6,010	6,961	2,207	-2,088	-7,892	-7,892	-6,967	3,808	1,616	-574	-2,692
1965	-882	18,451	23,517	23,527	23,538	22,738	19,359	16,610	0	0	0	4,603
1966	8,407	13,931	8,868	3,925	-542	-6,346	0	0	0	-2,188	-4,373	-3,910
1967	849	3,612	13,125	13,133	13,139	0	-3,683	0	0	0	0	-921
1968	4,788	7,550	14,637	8,936	3,786	-2,018	-4,136	0	0	-2,188	-4,374	-3,910
1969	3,703	6,466	11,222	11,229	0	0	0	0	0	0	-2,188	2,417
1970	6,221	25,555	40,575	-3,935	-4,858	0	-2,117	0	0	0	-2,188	575
1971	6,283	13,649	13,649	13,656	13,661	3,101	983	0	0	0	-2,188	-2,186
1972	3,523	6,285	11,993	16,756	16,766	10,963	8,846	0	0	-2,188	-4,373	-5,290
1973	-2,433	-1,513	6,098	6,101	6,105	6,105	1,502	0	0	-2,188	-4,374	234
1974	5,941	8,703	5,109	0	0	0	0	0	0	0	-2,188	2,417
1975	8,124	27,459	47,437	35,952	35,115	32,451	32,451	3,935	0	0	-2,188	2,417
1976	8,125	12,728	20,339	21,301	22,172	16,369	14,252	12,055	9,928	7,728	5,530	4,603
1977	6,503	4,661	7,516	10,375	12,962	7,159	5,041	2,846	722	-1,468	-2,510	-7,107
1978	-10,902	-9,981	-7,651	-7,655	-7,664	-7,665	-13,372	0	0	0	-2,188	0
1979	0	2,762	3,713	2,764	2,765	0	0	0	0	-2,188	-4,373	-3,450
1980	2,260	21,594	36,816	-3,935	3,554	0	0	0	0	0	-2,188	2,417
1981	6,222	10,825	18,436	12,738	7,590	-3,922	-3,921	0	0	-2,188	-4,374	233
1982	8,795	14,319	18,125	5,589	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	-2,946	0	0	0	0	-921
1984	0	0	0	0	0	-9,738	-11,659	0	0	0	-2,188	-1,726
1985	3,032	22,365	42,344	31,805	23,229	17,426	15,308	0	0	-2,188	-4,374	-6,487
1986	-3,629	-5,471	1,617	2,568	1,757	0	0	0	0	0	-2,188	2,417
1987	8,124	10,886	11,837	16,602	20,907	15,104	12,987	2,092	0	-2,188	-4,373	-4,370
1988	-2,465	-4,306	2,782	-71	-2,649	-8,452	-10,570	-5,378	0	-2,188	-1,234	-1,233
1989	-1,232	-312	-3,166	-3,168	-3,169	-8,973	0	0	0	-1,046	-1,045	-2,886
1990	-4,787	14,547	29,769	19,223	10,642	4,838	2,720	0	0	0	2,854	1,011
1991	-893	3,710	6,565	7,520	8,383	772	-2,910	0	0	476	-1,428	1,335
1992	4,189	507	-1,396	-2,348	-3,210	-21,285	-28,006	0	-498	-498	4,260	4,256
1993	4,254	7,017	8,396	8,401	8,405	0	0	0	0	0	-2,188	-437
1994	8,126	10,888	11,839	14,699	6,115	312	-1,806	0	0	-2,188	-4,374	-2,621
1995	-717	18,618	38,597	38,619	20,001	3,033	0	0	0	0	0	2,762
1996	6,566	9,328	12,183	12,187	-3,554	3,935	2,624	0	0	0	-2,188	-438
1997	5,271	9,875	9,875	0	0	-7,611	0	0	0	0	-2,188	-2,186
1998	5,426	8,188	15,798	15,807	15,817	0	0	0	0	0	-2,188	-2,186
1999	1,620	4,382	7,236	2,482	2,484	2,483	2,183	0	0	0	-2,188	-437
2000	3,369	22,703	42,681	27,389	24,999	11,680	9,563	0	0	-2,188	-4,373	-2,621
2001	3,089	5,851	13,461	9,663	2,795	-8,622	-10,739	0	-214	-2,402	-4,587	-1,821
2002	6,742	9,504	16,163	12,368	8,938	-1,623	-3,741	0	0	-2,188	-4,374	-3,910
Avg (21-02)	3,098	8,809	14,784	11,355	9,088	3,389	1,921	884	-216	-1,113	-2,878	-1,348

Through the fall and winter, storage in Hetch Hetchy Reservoir would be the same or higher under the variant setting. Hetch Hetchy Reservoir would fill by the end of May during approximately 82 percent of the years, which would prevent any difference in storage from affecting the next summer's reservoir storage. Figure 2.3-2 illustrates the difference in reservoir storage, averaged by year type, for the variant and WSIP settings. Also shown is the average difference in storage for the two settings during the 82-year simulation.

Table 2.3-4 illustrates the difference in Hetch Hetchy Reservoir storage between the variant and base settings. Immediately after filling Hetch Hetchy Reservoir (May or June, and then continuing through July), there would only be occasional differences in storage at the reservoir, typically a decrease of less than 12,000 acre-feet. This is indicative of the same amount of water being passed through the reservoir regardless of the size of the conveyance capacity of the SJPL. Water not diverted to the SJPL would return to the Tuolumne River and flow to Don Pedro Reservoir. In the late summer and early fall, there would consistently be a slight difference (lower) in storage levels between the two settings, as additional diversions to the SJPL would retain Bay Area reservoir storage. Some of this additional Hetch Hetchy Reservoir storage depletion would be ameliorated later in the fall and into winter as SJPL diversions are reduced due to less Bay Area reservoir replenishment needs and conveyance system maintenance. Storage becomes greater in November and December of the variant setting due to the assumed systemwide maintenance that would occur in the variant setting but not in the base setting. After December, the storage gain occurring in the variant setting would again be affected as replenishment of Bay Area reservoir storage resumes. In non-wet years, there is a difference in storage between the variant and base settings; the variant setting sometimes results in a lower storage in the reservoir by the end of April. Figure 2.3-3 illustrates the difference in reservoir storage, averaged by year type, between the variant and base settings. Also shown is the average difference in storage for the two settings during the 82-year simulation. Figure 2.3-4 illustrates the average monthly storage in Hetch Hetchy Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings.

The difference in storage in Hetch Hetchy Reservoir attributed to the diversion effects of the variant would manifest in differences in releases from O'Shaughnessy Dam to the stream. A different amount of available reservoir space in the winter and spring due to the variant would lead to a different ability to regulate inflow, thus potentially changing the amount of water released to the stream that is in excess of minimum release requirements. Figure 2.3-1 illustrates the stream release from O'Shaughnessy Dam for the WSIP, variant, and base settings. Table 2.3-5 illustrates the difference in stream releases between the variant and WSIP settings. Compared to the WSIP setting, the variant exhibits an incrementally greater stream release, predominately during May or June, which is reflective of the months when releases to the stream are made in excess of minimum release requirements in anticipation of filling the reservoir. The exceptions to this circumstance, during which incrementally larger reductions in releases to the stream occur, are considered anomalous within the modeling and simply the result of shifting releases from one month to the next. The increase in releases is the result of a less-depleted reservoir, which is the result of lesser SFPUC demands between the settings.

Table 2.3-6 illustrates the difference in stream releases between the variant and base settings. In this comparison, releases could be either greater or less than depicted for the base setting, and these differences would occur predominately during May or June. Generally, Hetch Hetchy Reservoir storage would be slightly lower during non-wet years, leading to a reduction in stream releases during non-wetter years if a release occurs. During wetter years, the releases are projected to increase. The differences, either increases or decreases, are a result of the coincidence of several operational parameters affecting the release of water from the reservoir, including systemwide water demands, conveyance capacity and maintenance assumptions, and the watershed's hydrology.

Table 2.3-5 illustrates the difference in stream releases between the variant and WSIP settings, expressed in terms of a monthly volume (acre-feet) of flow. Table 2.3-7 illustrates the same information and the average monthly stream release for the variant and WSIP setting, expressed in average monthly flow (cfs). Table 2.3-5 shows an increase in monthly flow below O'Shaughnessy Dam of up to approximately 32,000 acre-feet. Considering the manner in which releases are determined and made to the stream, it is not always meaningful to quantify the effect of these changes in terms of average monthly

APPENDIX O3

Figure 2.3-2

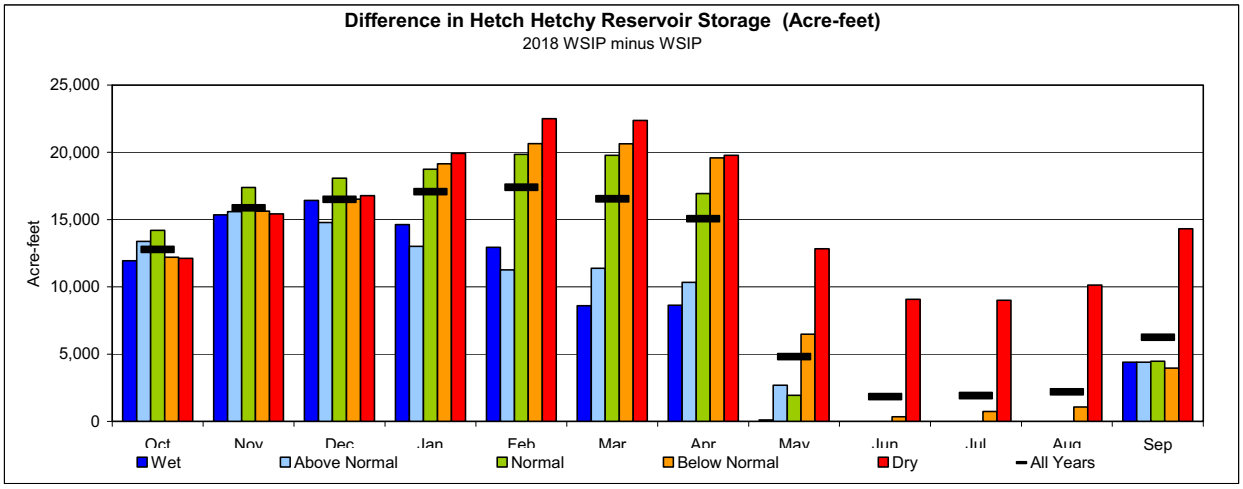


Figure 2.3-3

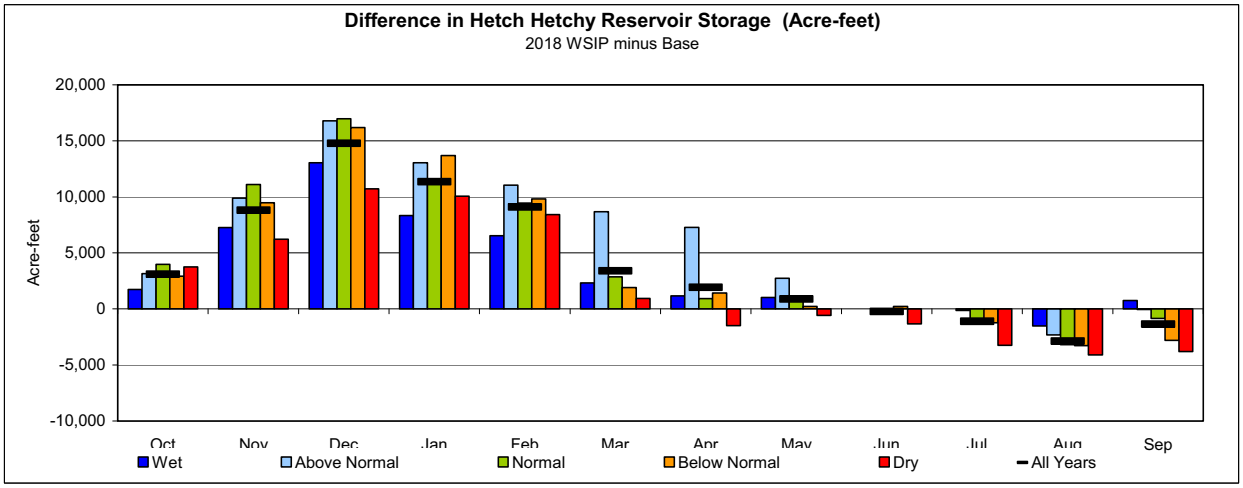
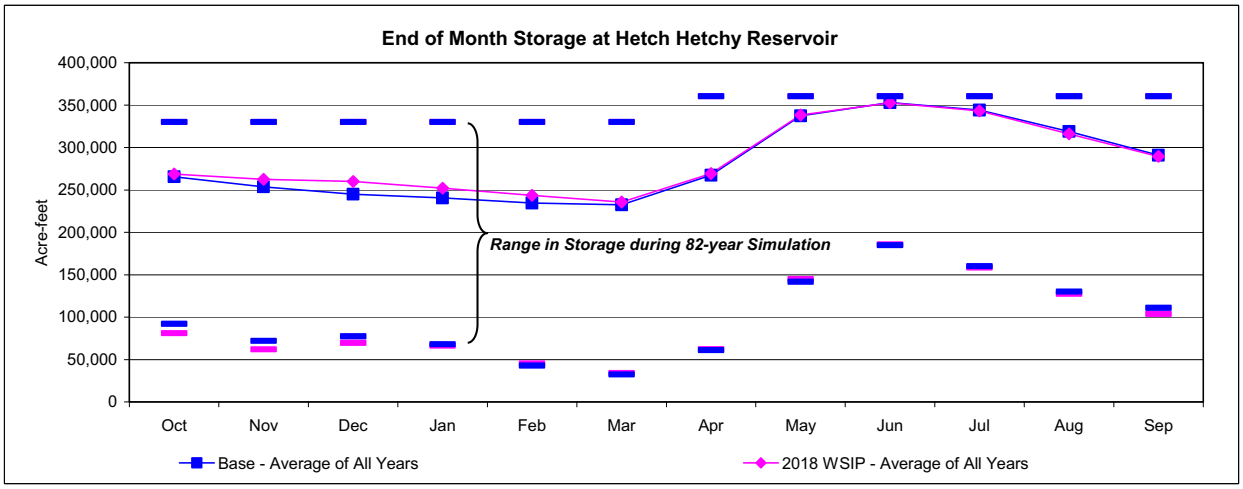


Figure 2.3-4



APPENDIX O3

Table 2.3-5

Difference in Hetch Hetchy Reservoir Release to Stream (Acre-feet) 2018 WSIP minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	8,224	0	0	0	8,224
1922	0	0	0	0	0	0	0	22,812	0	0	0	0	22,812
1923	0	0	0	0	0	0	0	18,235	0	0	0	0	18,235
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	16,306	0	0	0	0	16,306
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	26,265	0	0	0	0	26,265
1928	0	0	0	0	0	0	0	2,741	0	0	0	0	2,741
1929	0	0	0	0	0	0	0	0	13,872	0	0	0	13,872
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	2,798	0	0	0	2,798
1933	0	0	0	0	0	0	0	0	11,014	0	0	0	11,014
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	6,899	0	0	0	6,899
1936	0	0	0	0	0	0	0	15,759	0	0	0	0	15,759
1937	0	0	0	0	0	0	0	9,359	5,570	0	0	0	14,929
1938	0	0	0	0	0	0	0	19,469	0	0	0	0	19,469
1939	0	0	0	0	0	0	3,808	-4,045	0	0	0	0	-237
1940	0	0	0	0	0	0	0	1,791	0	0	0	0	1,791
1941	0	0	0	0	0	0	0	0	7,337	0	0	0	7,337
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	21,859	0	0	0	0	21,859
1945	0	0	0	0	0	0	0	0	18,365	0	0	0	18,365
1946	0	0	0	0	0	0	0	14,088	0	0	0	0	14,088
1947	0	0	0	0	0	0	0	31,870	0	0	0	0	31,870
1948	0	0	0	0	0	0	0	0	12,616	0	0	0	12,616
1949	0	0	0	0	0	0	0	0	5,408	0	0	0	5,408
1950	0	0	0	0	0	0	0	0	8,943	0	0	0	8,943
1951	0	3,996	0	0	0	0	0	0	8,010	0	0	0	12,006
1952	0	0	0	0	0	0	0	13,144	0	0	0	0	13,144
1953	0	0	0	0	0	0	0	2,049	0	0	0	0	2,049
1954	0	0	0	0	0	0	0	26,624	0	0	0	0	26,624
1955	0	0	0	0	0	0	0	0	3,808	0	0	0	3,808
1956	0	0	0	0	0	0	0	1,373	0	0	0	0	1,373
1957	0	0	0	0	0	0	0	27,391	0	0	0	0	27,391
1958	0	0	0	0	0	0	0	24,198	0	0	0	0	24,198
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	3,935	9,227	0	0	0	13,162
1963	0	0	0	0	0	0	0	20,897	0	0	0	0	20,897
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	1,695	0	0	0	1,695
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	9,309	0	0	0	0	9,309
1968	0	0	0	0	0	0	0	17,457	0	0	0	0	17,457
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	43	0	7,200	0	0	0	0	7,243
1971	0	0	0	0	0	0	0	19,814	0	0	0	0	19,814
1972	0	0	0	0	0	0	0	31,356	0	0	0	0	31,356
1973	0	0	0	0	0	0	0	15,425	0	0	0	0	15,425
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	15,964	0	0	0	0	15,964
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	25,740	0	0	0	0	25,740
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	3,935	-3,554	0	0	0	0	0	0	0	381
1981	0	0	0	0	0	0	0	2,684	10,310	0	0	0	12,994
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	1,959	0	0	0	0	1,959
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	11,152	0	0	0	0	11,152
1986	0	0	0	0	0	10,235	3,935	0	0	0	0	0	14,170
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	3,808	0	0	0	3,808
1989	0	0	0	0	0	0	364	33,044	0	0	0	0	33,408
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	29,675	0	0	0	29,675
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	3,554	-3,935	1,311	2,785	0	0	0	0	3,715
1997	0	0	0	16,086	0	0	0	0	0	0	0	0	16,086
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	10,281	2,950	0	0	0	13,231
2000	0	0	0	0	0	0	0	17,759	0	0	0	0	17,759
2001	0	0	0	0	0	0	0	28,859	0	0	0	0	28,859
2002	0	0	0	0	0	0	0	27,763	0	0	0	0	27,763
Avg (21-02)	0	49	0	244	0	77	115	7,252	2,080	0	0	0	9,817

APPENDIX O3

Table 2.3-6

Difference in Hetch Hetchy Reservoir Release to Stream (Acre-feet) 2018 WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	3,073	0	0	0	3,073
1922	0	0	0	0	0	0	0	17,442	0	0	0	0	17,442
1923	0	0	0	0	0	0	0	1,386	0	0	0	0	1,386
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	5,311	0	0	0	0	5,311
1926	0	0	0	0	0	0	0	-2,913	0	0	0	0	-2,913
1927	0	0	0	0	0	0	0	1,175	0	0	0	0	1,175
1928	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	-3,554	0	0	0	753	0	0	0	-2,801
1933	0	0	0	0	0	0	0	0	561	0	0	0	561
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	3,935	0	0	5,263	0	0	0	9,198
1936	0	0	0	0	0	0	0	8,614	0	0	0	0	8,614
1937	0	0	0	0	0	0	0	6,700	0	0	0	0	6,700
1938	0	0	0	0	0	0	0	9,009	0	0	0	0	9,009
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	0	0	10,463	0	0	0	0	10,463
1941	0	0	0	0	0	0	0	0	6,089	0	0	0	6,089
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	-9,799	0	0	0	0	-9,799
1945	0	0	0	0	0	0	0	0	30,644	0	0	0	30,644
1946	0	0	0	0	0	0	0	7,043	0	0	0	0	7,043
1947	0	0	0	0	0	0	0	7,429	0	0	0	0	7,429
1948	0	0	0	0	0	0	0	0	1,304	0	0	0	1,304
1949	0	0	0	0	0	0	0	0	5,408	0	0	0	5,408
1950	0	0	0	0	0	0	0	0	15,695	0	0	0	15,695
1951	0	-3,293	0	0	0	0	0	0	0	0	0	0	-3,293
1952	0	0	0	0	0	0	0	-547	0	0	0	0	-547
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	3,276	0	0	0	0	3,276
1955	0	0	0	0	0	0	0	0	3,808	0	0	0	3,808
1956	0	0	0	0	0	0	0	-3,039	0	0	0	0	-3,039
1957	0	0	0	0	0	0	0	-5,292	0	0	0	0	-5,292
1958	0	0	0	0	0	0	0	13,755	0	0	0	0	13,755
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	-35,603	-4,171	0	0	0	-39,774
1963	0	0	0	0	0	0	0	5,712	0	0	0	0	5,712
1964	0	0	0	0	0	0	0	0	-3,808	0	0	0	-3,808
1965	0	0	0	0	0	0	0	0	16,595	0	0	0	16,595
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	-3,920	0	0	0	0	-3,920
1968	0	0	0	0	0	0	0	-4,416	0	0	0	0	-4,416
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	3,935	0	43	0	-2,117	0	0	0	0	1,861
1971	0	0	0	0	0	0	0	1,049	0	0	0	0	1,049
1972	0	0	0	0	0	0	0	8,841	0	0	0	0	8,841
1973	0	0	0	0	0	0	0	1,501	0	0	0	0	1,501
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	19,987	4,171	0	0	0	24,158
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	-13,365	0	0	0	-310	-13,675
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	3,935	-3,554	0	0	0	0	0	0	0	381
1981	0	0	0	0	0	0	0	-3,919	0	0	0	0	-3,919
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	-3,131	0	0	0	0	-3,131
1984	0	0	0	0	0	3,935	0	-11,653	0	0	0	0	-7,718
1985	0	0	0	0	0	0	0	16,315	0	0	0	0	16,315
1986	0	0	0	0	0	1,757	0	0	0	0	0	0	1,757
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	364	0	0	0	0	0	364
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	-18,433	0	0	0	0	-18,433
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	3,554	-3,935	1,311	2,785	0	0	0	0	3,715
1997	0	0	0	9,878	0	0	0	0	0	0	0	0	9,878
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	1,912	0	0	0	0	1,912
2000	0	0	0	0	0	0	0	9,558	0	0	0	0	9,558
2001	0	0	0	0	0	0	0	-10,735	0	0	0	0	-10,735
2002	0	0	0	0	0	0	0	-3,985	0	0	0	0	-3,985
Avg (21-02)	0	-40	0	216	-43	70	20	322	1,041	0	0	-4	1,583

Table 2.3-7

Hetch Hetchy Reservoir Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) 2018 WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	55	51	51	187	85	94	148	2,509	4,551	2,034	184	89
Above Normal	55	93	88	66	93	90	133	1,303	3,139	379	125	89
Normal	54	54	50	55	74	74	98	1,437	1,924	167	122	86
Below Normal	55	55	46	43	51	63	92	727	770	113	111	73
Dry	53	53	44	40	44	50	60	172	168	86	86	65
All Years	54	62	56	77	70	75	106	1,224	2,107	548	125	81

Hetch Hetchy Reservoir Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	55	51	51	167	89	84	144	2,412	4,550	2,034	184	89
Above Normal	55	89	88	66	89	94	131	1,192	3,093	379	125	89
Normal	54	54	50	55	74	74	98	1,253	1,890	167	122	86
Below Normal	55	55	46	43	51	63	91	550	709	113	111	73
Dry	53	53	44	40	44	50	56	156	139	86	86	65
All Years	54	61	56	73	70	73	104	1,107	2,072	548	125	81

Difference in Hetch Hetchy Reservoir Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) 2018 WSIP minus WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	0	20	-4	10	4	97	2	0	0	0
Above Normal	0	4	0	0	4	-4	1	112	46	0	0	0
Normal	0	0	0	0	0	0	0	184	34	0	0	0
Below Normal	0	0	0	0	0	0	0	177	62	0	0	0
Dry	0	0	0	0	0	0	4	16	29	0	0	0
All Years	0	1	0	4	0	1	2	118	35	0	0	0

flow (cfs).[1] When comparing the variant to the WSIP setting, a change in the volume of release from O'Shaughnessy Dam to the stream would likely result in the release being delayed or initiated earlier by a matter of days. Typical springtime releases, when initiated, amount to a release of up to 3,000 cfs (approximately 6,000 acre-feet over the span of a day). Using the assumption that a change in release volume equates to a delay or an earlier initiation of releasing 6,000 acre-feet per day means that the difference in stream release between the variant and WSIP would be up to an added five days of release. Normally, this change in release would not affect the peak stream release rate during a year. Table 2.3-8 illustrates the average monthly stream release for the variant and base settings, and the differences, expressed in average monthly flow (cfs). Table 2.3-6 illustrates that the difference in monthly flow below O'Shaughnessy Dam between the variant and base settings could range from an increase of approximately 30,000 acre-feet to a decrease of approximately 36,000 acre-feet. Using the same metric as described above to estimate the delay or addition in the number days of release to the stream, the variant could lead to an effect ranging from an increase of five days of release to a decrease of up to 6 days compared to the base setting.

Table 2.3-8

Hetch Hetchy Reservoir Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) 2018 WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	55	51	51	187	85	94	148	2,509	4,551	2,034	184	89
Above Normal	55	93	88	66	93	90	133	1,303	3,139	379	125	89
Normal	54	54	50	55	74	74	98	1,437	1,924	167	122	86
Below Normal	55	55	46	43	51	63	92	727	770	113	111	73
Dry	53	53	44	40	44	50	60	172	168	86	86	65
All Years	54	62	56	77	70	75	106	1,224	2,107	548	125	81

Hetch Hetchy Reservoir Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	55	51	51	173	89	93	148	2,510	4,534	2,034	184	90
Above Normal	55	96	88	66	93	86	131	1,249	3,092	379	125	89
Normal	54	54	50	51	74	74	98	1,443	1,909	167	122	86
Below Normal	55	55	46	43	51	63	91	723	763	113	111	73
Dry	53	53	44	40	44	50	60	199	168	86	86	65
All Years	54	62	56	74	70	73	106	1,219	2,089	548	125	81

Difference in Hetch Hetchy Reservoir Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) 2018 WSIP minus Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	0	14	-4	2	0	-1	17	0	0	0
Above Normal	0	-3	0	0	0	4	1	54	46	0	0	0
Normal	0	0	0	4	0	0	0	-6	15	0	0	0
Below Normal	0	0	0	0	0	0	0	4	7	0	0	0
Dry	0	0	0	0	0	0	0	-27	0	0	0	0
All Years	0	-1	0	4	-1	1	0	5	17	0	0	0

[1] See *Estimated Affect of WSIP on Daily Releases below Hetch Hetchy Reservoir*, Memorandum by Daniel B. Steiner, December 31, 2006.

2.4 Lake Lloyd and Lake Eleanor

Compared to the operation of the WSIP, the operation of Lake Lloyd and Lake Eleanor are simulated to be only slightly different for the variant. Figure 2.4-1 illustrates a chronological trace of the simulation of Lake Lloyd storage and stream releases. Shown in Figure 2.4-1 are the results for the WSIP, variant, and base settings. The operation resulting from the variant is essentially the same as the WSIP setting, including during drought. Although the level of delivery between the variant and base settings is essentially the same (net 265 mgd demand) during the 1987-1992 drought, water delivery reliability has been improved in the variant setting; as a result, the drawdown of Lake Lloyd during this period looks closer to that in the WSIP setting. Although there is less water delivered during this period in the variant setting compared to the WSIP setting, more water is delivered in the variant setting than in the base setting. The additional draw of water reduced the amount of water released from Hetch Hetchy Reservoir to Don Pedro Reservoir in the variant setting, which, in order to satisfy TID/MID entitlements to inflow, was met with additional releases from Lake Lloyd, similar to the WSIP setting. The additional release from Lake Lloyd associated with the variant appears to be approximately the same as in the WSIP setting in this instance, which is partially a factor of modeling discretion in that the HH/LSM makes release decisions in the form of block amounts of releases. Additional refinement of modeling assumptions would likely produce a result that places Lake Lloyd storage during this drought period more between the base setting and WSIP setting results. Otherwise, the results for Lake Lloyd storage are essentially the same between the WSIP and variant settings.

Figure 2.4-2 illustrates the almost identical operation of Lake Eleanor for the variant and WSIP settings. Also shown in Figure 2.4-2 is the operation for the base setting. Any difference in the Lake Eleanor operation would be caused by a small change in operation at Lake Lloyd that would affect the operation of the Cherry-Eleanor Tunnel between the two watersheds. Any difference that occurs in the simulations is more likely the result of modeling discretion as opposed to any substantive difference in operation.

Supplementing the Figure 2.4-1 representation of Lake Lloyd stream releases is Table 2.4-1, which illustrates releases for the variant and WSIP settings, and the difference in releases between the two settings. Table 2.4-2 provides the same form of information for the variant and base settings. With essentially no change in reservoir operations, stream releases will not be different.

2.5 Don Pedro Reservoir and La Grange Releases

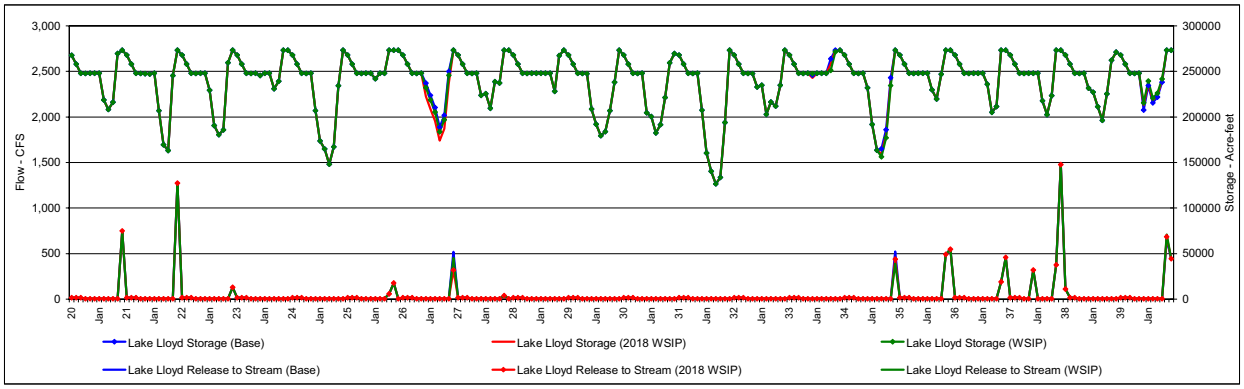
A change in Don Pedro Reservoir operation is caused by changes in inflow to the reservoir. The changes in inflow to the reservoir are the result of net changes within the operation of the upstream SFPUC facilities described previously, and other changes in SFPUC operations associated with diversions to the Holm, Kirkwood, and Moccasin Powerhouses. Figure 2.5-1 illustrates a chronological trace of the simulation of Don Pedro Reservoir storage and Tuolumne River stream releases from La Grange Dam. Shown in Figure 2.5-1 are the results for the WSIP, variant, and base settings. Supplementing the Figure 2.5-1 representation of Don Pedro Reservoir storage are Table 2.5-1, Don Pedro Reservoir Storage (2018 WSIP); Table 2.5-2, Don Pedro Reservoir Storage (WSIP); and Table 2.5-3, Difference in Don Pedro Reservoir Storage (2018 WSIP minus WSIP). Table 2.5-4 is provided to illustrate the difference in Don Pedro Reservoir storage between the base and variant settings.

Table 2.5-3 shows that, throughout many years, the storage in Don Pedro Reservoir associated with the variant setting would differ from the storage in the WSIP setting, and this difference would always be more storage. Table 2.5-4 illustrates that the variant setting results for Don Pedro Reservoir storage are close to the storage results depicted for the base setting, although typically lower than the base setting. Compared to the WSIP setting, the differences in storage are indicative of the increases to the inflow of Don Pedro Reservoir that are due to lesser demands and SJPL diversions in the variant setting. The increases in inflow typically occur during the winter through early summer period. Comparing to the base setting, the variant would result in typically less inflow to Don Pedro Reservoir during non-wet years and particularly during drought periods when more water is diverted to the SJPL in the variant setting. Less inflow leads to less reservoir storage.

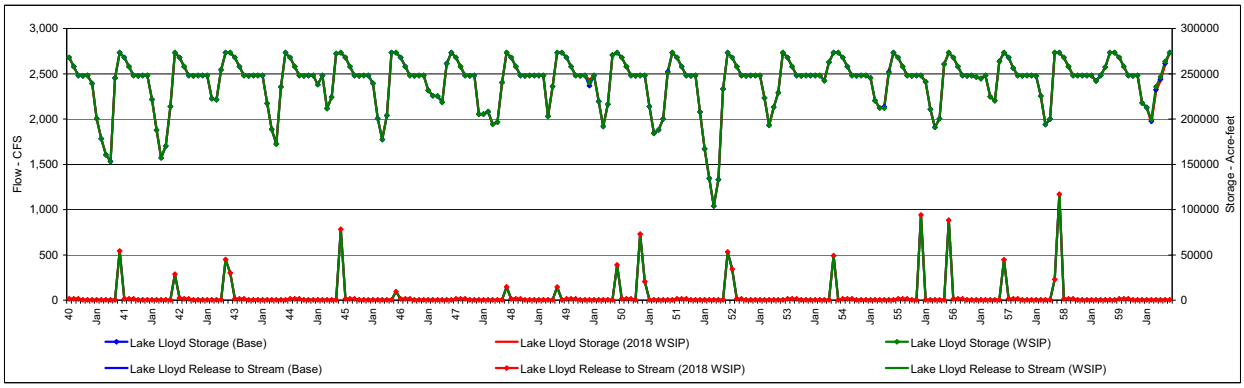
APPENDIX O3

Figure 2.4-1
Lake Lloyd Storage and Stream Release

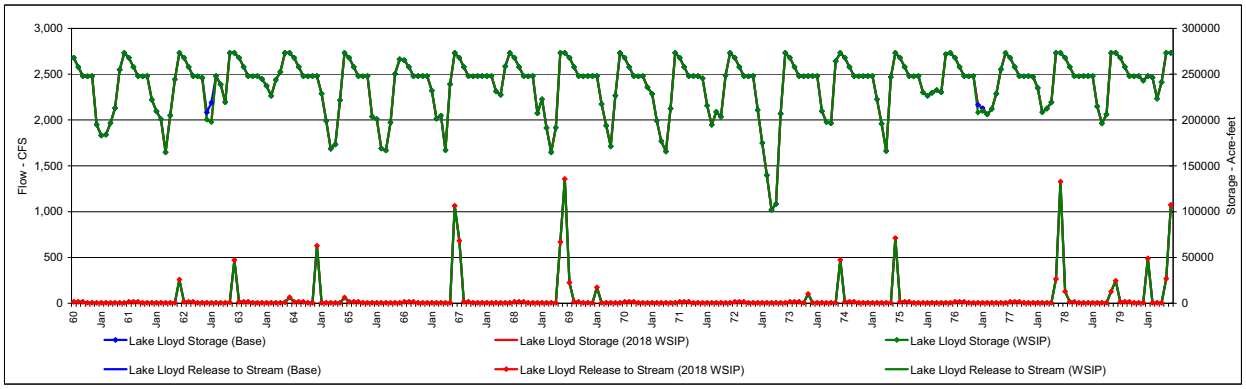
1920 - 1939



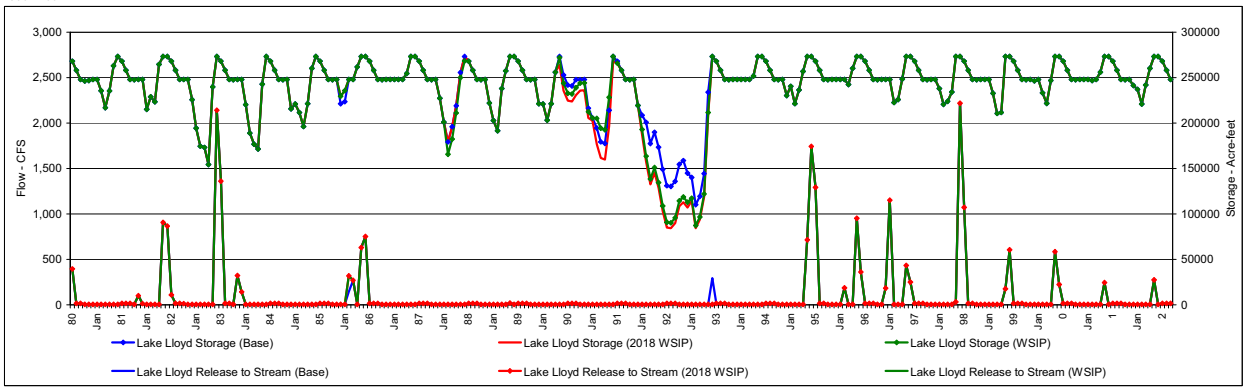
1940 - 1959



1960 - 1979



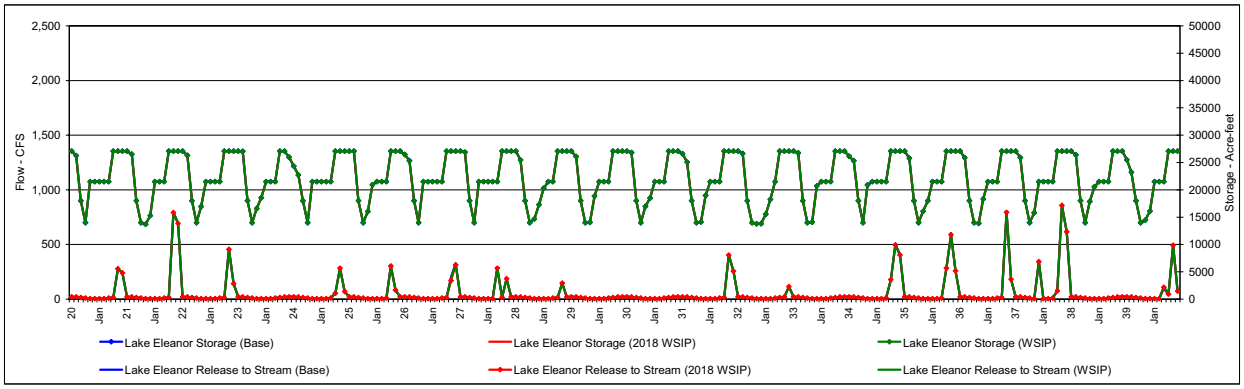
1980 - 2002



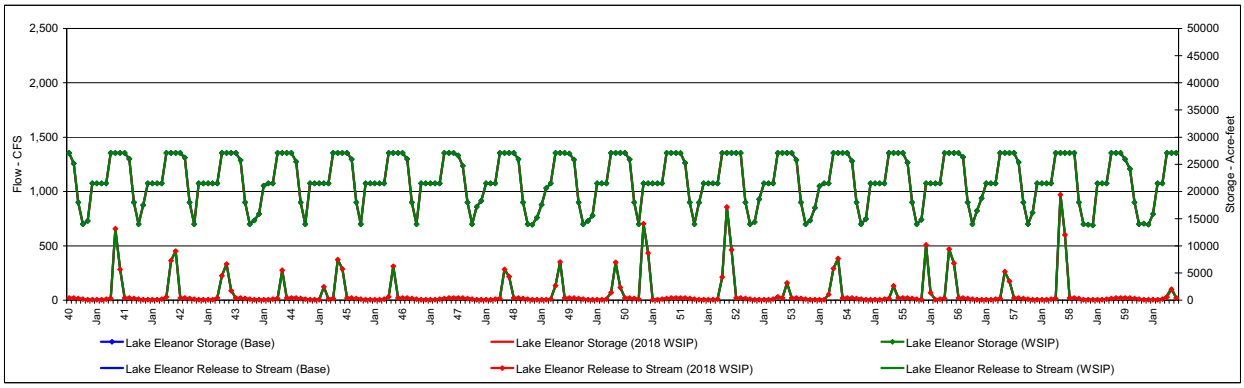
APPENDIX O3

Figure 2.4-2
Lake Eleanor Storage and Stream Release

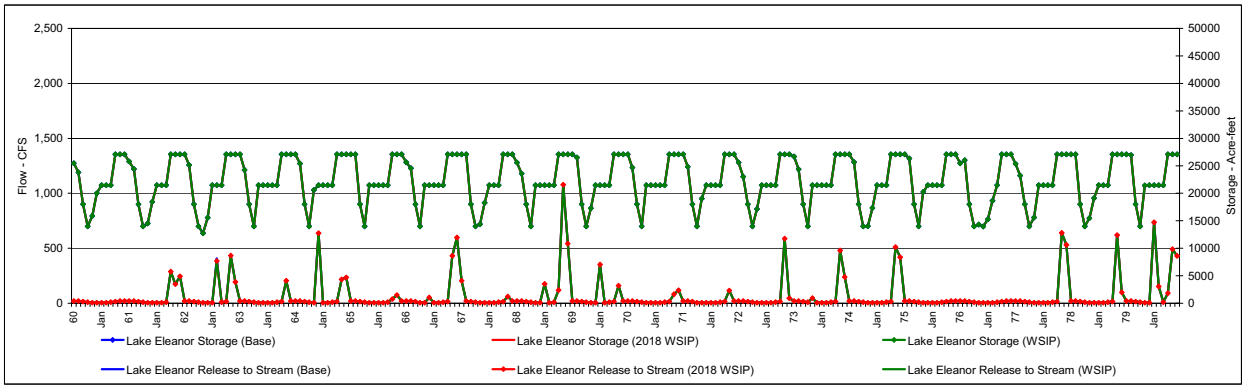
1920 - 1939



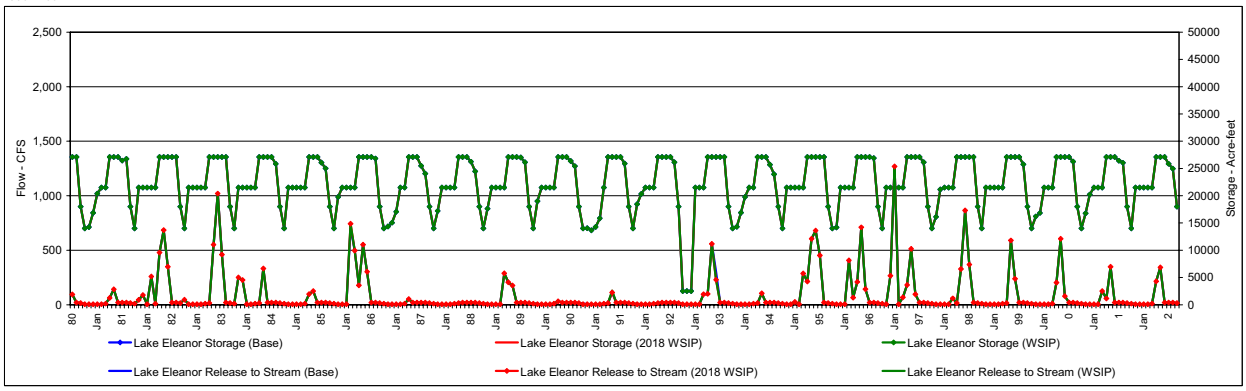
1940 - 1959



1960 - 1979



1980 - 2002



APPENDIX O3

Table 2.4-1

Lake Lloyd Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — 2018 WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	25	21	5	284	1,058	363	15	15
Above Normal	5	72	25	5	16	5	5	166	446	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	16	15	15
Dry	5	5	5	5	5	5	5	5	5	16	15	15
All Years	5	20	34	27	11	8	6	120	340	83	15	15

Lake Lloyd Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	25	21	5	284	1,058	363	15	15
Above Normal	5	72	25	5	16	5	5	167	451	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	16	15	15
Dry	5	5	5	5	5	5	5	5	5	16	15	15
All Years	5	20	34	27	11	8	6	121	341	83	15	15

Difference in Lake Lloyd Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — 2018 WSIP minus WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	-1	-5	0	0	0
Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	0	0	0	0	0	-1	0	0	0

Table 2.4-2

Lake Lloyd Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — 2018 WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	25	21	5	284	1,058	363	15	15
Above Normal	5	72	25	5	16	5	5	166	446	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	16	15	15
Dry	5	5	5	5	5	5	5	5	5	16	15	15
All Years	5	20	34	27	11	8	6	120	340	83	15	15

Lake Lloyd Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	14	21	5	284	1,076	363	15	15
Above Normal	5	72	25	5	16	5	5	164	462	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	15	15	15
Dry	5	5	5	5	5	5	5	5	5	16	15	15
All Years	5	20	34	27	9	8	6	120	347	83	15	15

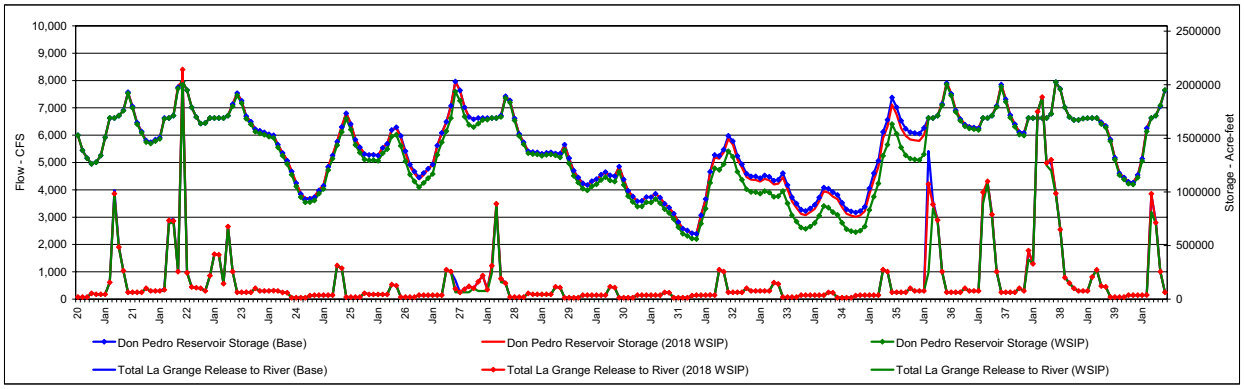
Difference in Lake Lloyd Release to Stream (CFS)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange) — 2018 WSIP minus Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	0	0	11	0	0	0	-18	0	0	0
Above Normal	0	0	0	0	0	0	0	2	-17	0	0	0
Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	0	2	0	0	0	-7	0	0	0

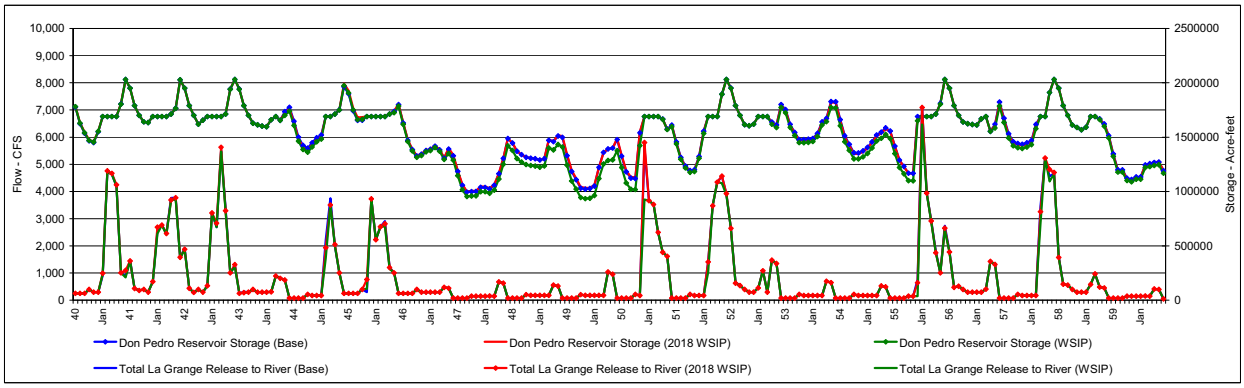
APPENDIX O3

Figure 2.5-1
Don Pedro Reservoir Storage and Release below La Grange Dam

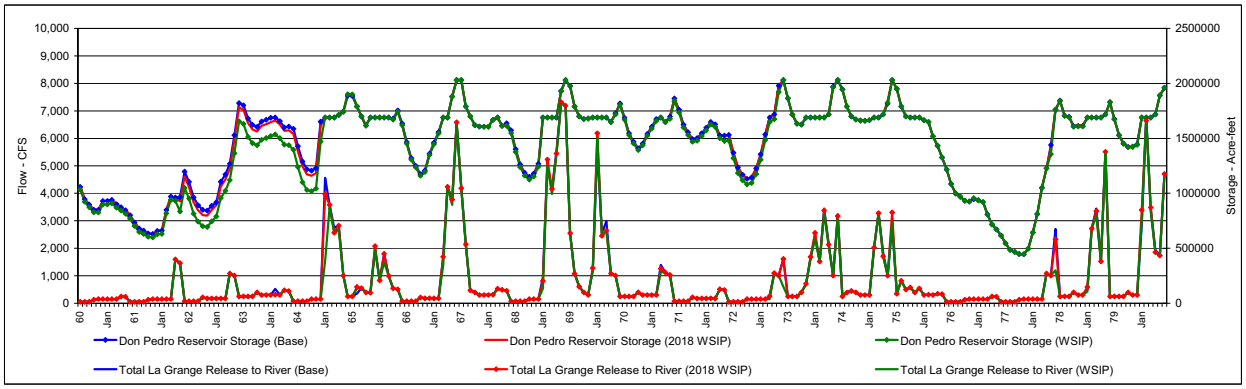
1920 - 1939



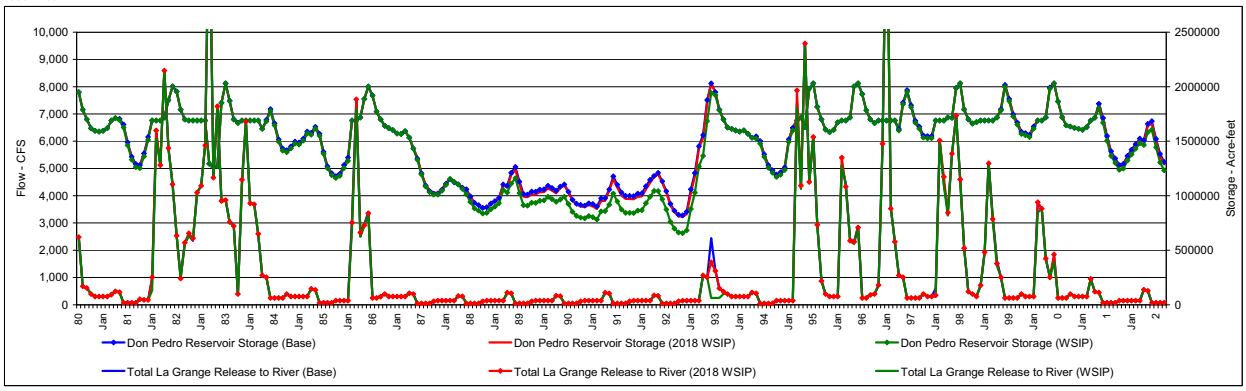
1940 - 1959



1960 - 1979



1980 - 2002



APPENDIX O3

Table 2.5-1

Don Pedro Reservoir Storage (Acre-feet) 2018 WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	1,262,860	1,277,365	1,340,344	1,508,876	1,689,999	1,690,000	1,713,000	1,759,836	1,929,872	1,795,122	1,642,903	1,561,467
1922	1,476,098	1,461,286	1,485,580	1,505,746	1,690,000	1,690,000	1,713,000	1,992,236	2,030,000	1,950,094	1,790,026	1,700,016
1923	1,638,028	1,643,364	1,689,999	1,689,989	1,689,997	1,690,000	1,713,000	1,818,811	1,921,545	1,849,358	1,703,848	1,652,705
1924	1,583,462	1,568,125	1,554,108	1,535,704	1,526,296	1,437,843	1,367,530	1,299,008	1,198,414	1,088,618	987,802	939,989
1925	942,530	956,806	1,020,799	1,064,510	1,240,998	1,347,397	1,474,470	1,615,182	1,739,010	1,636,396	1,492,869	1,421,142
1926	1,357,759	1,349,705	1,350,678	1,344,610	1,415,467	1,453,841	1,577,587	1,597,384	1,505,811	1,362,452	1,237,529	1,173,931
1927	1,119,098	1,158,716	1,213,376	1,252,953	1,430,873	1,547,483	1,651,730	1,798,260	2,030,000	1,945,826	1,790,015	1,700,021
1928	1,678,968	1,690,000	1,689,999	1,690,000	1,689,998	1,690,000	1,713,000	1,892,918	1,852,213	1,684,386	1,539,110	1,461,648
1929	1,378,684	1,370,354	1,367,461	1,354,252	1,363,106	1,367,611	1,358,042	1,353,385	1,435,177	1,308,957	1,193,211	1,129,770
1930	1,074,149	1,058,505	1,094,019	1,114,013	1,154,900	1,180,553	1,149,383	1,149,171	1,237,597	1,117,703	1,010,832	958,391
1931	914,265	916,605	954,041	952,219	983,746	946,664	889,656	854,795	796,687	720,808	659,664	640,497
1932	614,702	609,573	780,705	928,191	1,178,848	1,323,183	1,310,061	1,368,137	1,494,132	1,442,497	1,303,910	1,227,394
1933	1,138,926	1,114,464	1,112,164	1,097,635	1,122,288	1,109,608	1,071,071	1,077,986	1,137,667	1,024,295	911,286	852,616
1934	795,676	784,435	812,878	843,182	913,663	1,007,422	994,677	957,730	932,400	858,181	796,665	778,406
1935	768,307	781,950	821,496	980,113	1,110,056	1,235,130	1,500,457	1,610,736	1,815,196	1,722,464	1,596,472	1,522,899
1936	1,490,506	1,482,448	1,476,914	1,530,941	1,689,992	1,690,000	1,713,000	1,828,205	2,023,492	1,920,902	1,768,102	1,685,847
1937	1,633,138	1,612,431	1,605,906	1,599,838	1,689,993	1,690,000	1,713,000	1,807,790	2,004,824	1,865,944	1,716,966	1,632,686
1938	1,559,162	1,550,594	1,689,998	1,689,992	1,689,987	1,690,000	1,690,000	1,730,000	2,025,000	1,959,369	1,790,073	1,700,032
1939	1,672,242	1,671,809	1,685,673	1,689,024	1,689,999	1,690,000	1,656,392	1,619,603	1,491,554	1,319,580	1,175,055	1,136,817
1940	1,095,214	1,088,278	1,158,283	1,313,203	1,598,290	1,690,000	1,713,000	1,811,156	1,956,231	1,786,375	1,633,362	1,545,380
1941	1,475,404	1,460,051	1,555,484	1,689,994	1,689,991	1,690,000	1,690,000	1,809,501	2,030,000	1,950,157	1,790,024	1,700,010
1942	1,641,462	1,634,171	1,689,999	1,689,980	1,689,995	1,690,000	1,713,000	1,765,000	2,027,000	1,950,170	1,790,025	1,700,004
1943	1,619,298	1,656,980	1,690,000	1,689,976	1,689,995	1,690,000	1,713,000	1,942,900	2,030,000	1,940,444	1,790,004	1,700,004
1944	1,627,652	1,614,506	1,602,762	1,595,713	1,659,696	1,690,000	1,654,802	1,722,440	1,760,597	1,629,785	1,485,295	1,408,489
1945	1,383,848	1,431,872	1,478,308	1,504,602	1,689,996	1,690,000	1,713,000	1,752,531	1,994,151	1,926,860	1,769,823	1,682,382
1946	1,684,536	1,690,000	1,689,996	1,689,984	1,689,995	1,690,000	1,713,000	1,742,418	1,802,336	1,633,975	1,475,548	1,389,609
1947	1,330,399	1,346,833	1,380,160	1,392,380	1,420,980	1,386,364	1,311,268	1,398,938	1,336,215	1,192,020	1,064,241	1,001,385
1948	1,005,411	1,006,673	1,045,296	1,044,695	1,030,810	1,064,961	1,168,301	1,307,352	1,488,934	1,446,256	1,371,345	1,339,394
1949	1,315,662	1,306,917	1,302,086	1,290,976	1,302,671	1,476,867	1,464,005	1,518,090	1,509,235	1,342,135	1,195,742	1,120,908
1950	1,043,199	1,033,376	1,032,790	1,062,133	1,220,402	1,356,178	1,390,070	1,398,269	1,490,152	1,336,013	1,192,427	1,134,118
1951	1,131,198	1,551,572	1,689,993	1,689,971	1,689,993	1,690,000	1,665,120	1,572,653	1,607,282	1,449,711	1,307,131	1,228,274
1952	1,187,272	1,194,984	1,316,576	1,555,164	1,689,998	1,690,000	1,690,000	1,895,000	2,030,000	1,951,049	1,790,051	1,700,027
1953	1,614,775	1,604,850	1,619,190	1,689,999	1,689,998	1,688,681	1,637,424	1,608,420	1,793,686	1,744,750	1,609,064	1,534,706
1954	1,469,539	1,468,740	1,472,382	1,479,183	1,525,624	1,631,571	1,663,552	1,819,798	1,815,534	1,651,299	1,502,531	1,424,559
1955	1,345,778	1,345,529	1,363,813	1,396,390	1,446,662	1,510,333	1,535,054	1,574,478	1,553,856	1,414,751	1,287,229	1,228,969
1956	1,166,559	1,165,186	1,689,999	1,689,941	1,689,992	1,690,000	1,713,000	1,807,502	2,030,000	1,950,170	1,790,030	1,700,025
1957	1,639,825	1,624,492	1,616,539	1,610,979	1,668,413	1,690,000	1,553,124	1,611,430	1,813,966	1,662,502	1,519,752	1,446,510
1958	1,430,457	1,423,228	1,435,937	1,458,900	1,605,471	1,690,000	1,690,000	1,910,000	2,030,000	1,950,170	1,790,046	1,700,029
1959	1,611,062	1,589,728	1,567,833	1,592,273	1,689,999	1,690,000	1,664,890	1,615,856	1,508,807	1,339,502	1,193,352	1,193,577
1960	1,116,301	1,105,497	1,128,724	1,128,413	1,242,827	1,254,357	1,266,792	1,274,965	1,193,674	1,059,552	948,479	899,812
1961	852,490	851,707	929,711	931,404	940,474	902,104	874,430	846,491	801,180	734,666	679,786	660,893
1962	635,317	630,243	657,977	661,913	849,011	970,130	962,682	926,491	1,152,410	1,057,459	917,799	845,534
1963	803,072	797,354	847,675	892,734	1,059,917	1,125,577	1,221,773	1,488,662	1,782,245	1,759,044	1,640,421	1,582,051
1964	1,563,592	1,613,138	1,628,805	1,646,921	1,661,438	1,628,214	1,569,664	1,573,364	1,540,885	1,381,791	1,243,865	1,173,355
1965	1,160,424	1,183,720	1,615,220	1,689,968	1,689,993	1,690,000	1,713,000	1,745,042	1,904,664	1,902,728	1,790,047	1,700,028
1966	1,615,736	1,690,000	1,689,998	1,689,996	1,689,997	1,690,000	1,671,267	1,742,980	1,621,208	1,453,063	1,306,695	1,236,619
1967	1,161,360	1,194,898	1,348,589	1,447,600	1,545,433	1,690,000	1,690,000	1,880,000	2,030,000	2,030,000	1,790,252	1,700,021
1968	1,619,820	1,607,624	1,605,760	1,605,959	1,668,870	1,690,000	1,614,396	1,631,582	1,564,347	1,393,113	1,255,040	1,177,814
1969	1,141,689	1,171,002	1,260,484	1,689,994	1,689,990	1,690,000	1,690,000	1,930,000	2,030,000	1,975,279	1,790,111	1,700,033
1970	1,676,114	1,681,553	1,689,999	1,689,951	1,689,996	1,690,000	1,649,691	1,725,267	1,812,130	1,677,976	1,538,175	1,460,554
1971	1,401,168	1,444,087	1,531,135	1,597,040	1,666,233	1,690,000	1,647,943	1,696,251	1,859,604	1,755,286	1,618,891	1,549,928
1972	1,488,330	1,496,877	1,540,474	1,590,945	1,644,402	1,622,344	1,520,665	1,526,251	1,530,960	1,368,983	1,234,744	1,168,506
1973	1,130,407	1,143,406	1,225,477	1,354,278	1,533,895	1,690,000	1,717,600	1,980,428	2,030,000	1,863,873	1,716,891	1,634,144
1974	1,625,114	1,690,000	1,689,998	1,689,981	1,689,998	1,690,000	1,717,600	1,967,320	2,030,000	1,943,894	1,790,018	1,700,018
1975	1,671,620	1,661,732	1,660,185	1,665,519	1,689,996	1,690,000	1,717,600	1,843,935	2,030,000	1,950,013	1,790,077	1,700,024
1976	1,690,000	1,690,000	1,690,000	1,664,706	1,649,459	1,519,032	1,432,156	1,326,070	1,216,796	1,085,092	998,502	968,734
1977	932,654	925,543	947,434	935,499	920,302	807,861	717,614	671,985	616,188	544,088	486,063	467,590
1978	447,587	445,349	497,632	642,722	811,608	1,050,474	1,227,234	1,422,184	1,761,000	1,841,159	1,704,419	1,693,810
1979	1,616,809	1,619,882	1,618,938	1,689,998	1,689,995	1,690,000	1,690,000	1,717,600	1,827,795	1,673,824	1,527,042	1,450,952
1980	1,419,903	1,422,622	1,442,656	1,689,973	1,689,987	1,690,000	1,717,600	1,890,400	1,960,200	1,950,171	1,790,057	1,700,035
1981	1,617,942	1,596,204	1,588,406	1,595,955	1,619,607	1,690,000	1,710,315	1,696,762	1,643,753	1,478,587	1,347,280	1,279,582
1982	1,270,713	1,377,626	1,528,369	1,689,993	1,689,988	1,690,000	1,717,600	1,876,400	2,002,900	1,954,718	1,790,097	1,700,116
1983	1,690,000	1,690,000	1,689,995	1,689,966	1,689,989	1,294,700	1,264,000	1,270,800	1,851,400	2,030,000	1,869,137	1,700,118
1984	1,674,768	1,690,000	1,689,992	1,689,972	1,689,993	1,690,000	1,614,072	1,682,328	1,778,205	1,646,266	1,496,949	1,414,071
1985	1,399,091	1,434,211	1,478,590	1,469,173	1,504,226	1,570,360	1,558,812	1,627,178	1,560,993	1,396,489	1,262,208	1,199,021
1986	1,172,425	1,193,632	1,265,216	1,330,216	1,689,994	1,690,000	1,717,600	1,888,300	2,001,400	1,917,776	1,770,749	1,700,004
1987	1,641,221	1,619,848	1,601,298	1,570,175	1,566,241	1,592,870	1,533,147	1,441,899	1,348,658	1,213,978	1,103,276	1,050,438
1988	1,028,266	1,027,370	1,063,553	1,117,369	1,159,268	1,132,506	1,113,585	1,075,240	1,052,478	988,685	929,322	907,745
1989	881,458	888,956	921,637	945,294	974,852	1,096,511	1,074,781	1,187,792	1,239,357	1,103,491	991,217	986,561
1990	1,013,158	1,011,804	1,031,860	1,034,571	1,067,161	1,046,506	1,022,267	1,069,558	1,094,928	1,028,132	955,187	917,736
1991	901,946	896,655	915,575	900,825	878,053	952,682	954,166	1,046,829	1,153,735	1,074,822	1,001,810	970,239
1992	970,401	967,882	990,041	994,631	1,057,963	1,117,256	1,170,798	1,196,794	1,119,765	1,026,824	912,751	848,997
1993	812,849	806,440	832,269	1,025,300	1,175,081	1,428,792	1,529,484	1,851,088	2,030,000	1,950,131	1,790,048	1,700,022
1994	1,627,183	1,612,977	1,599,160	1,589,203	1,599,265	1,567,690	1,531,912	1,540,588	1,495,756	1,373,248	1,273,406	1,227,849
1995	1,188,744	1,208,544	1,253,327	1,510,846	1,634,353	1,690,000	1,717,600	1,629,700	1,982,800	2,030,000	1,814,001	1,700,059
1996	1,608,079	1,583,093	1,604,410	1,672,573	1,689,990	1,690,000	1,717,600	2,002,400	2,030,000	1,930,383	1,782,384	1,700,010
1997	1,667,198	1,690,000	1,689,993	1,689,873	1,689,994	1,690,000	1,601,041	1,842,832	1,954,413	1,813,753	1,671,658	1,617,925
1998	1,536,645	1,530,258	1,531,663	1,690,000	1,689,989	1,690,000	1,717,600	1,714,000	1,987,500	2,030,000	1,790,242	1,700,022
1999	1,662,014	1,675,303	1,690,000	1,689,986	1,689,990	1,690,000	1,717,600	1,796,699	2,019,661	1,889,630	1,747,778	1,673,732
2000	1,587,403	1,575,740	1,560,094	1,636,019	1,689,993	1,690,000	1,717,600	1,999,588	2,030,000	1,864,407	1,719,364	1,644,682
2001	1,634,728	1,622,232	1,613,706	1,605,692	1,629,054	1,690,000	1,716,911	1,830,206	1,697,383	1,532,770	1,393,883	1,328,387
2002	1,266,574	1,278,191	1,351,666	1,407,098	1,459,264	1,509,787	1,494,576	1,639,080	1,661,806	1,498,519	1,360,085	1,287,271
Avg (21-02)	1,323,652	1,333,411	1,376,601	1,422,420	1,482,772	1,507,579	1,511,798	1,590,588	1,673,668	1,573,106	1,436,385	1,368,045

APPENDIX O3

Table 2.5-2

Don Pedro Reservoir Storage (Acre-feet) WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	1,262,860	1,277,365	1,340,344	1,508,876	1,689,999	1,690,000	1,713,000	1,758,255	1,920,087	1,785,379	1,633,202	1,551,799
1922	1,466,449	1,451,643	1,475,936	1,496,100	1,682,686	1,690,000	1,713,000	1,965,236	2,030,000	1,950,094	1,790,026	1,700,016
1923	1,638,028	1,643,364	1,689,999	1,689,989	1,689,997	1,690,000	1,713,000	1,799,363	1,900,966	1,828,869	1,683,448	1,632,370
1924	1,563,169	1,547,842	1,533,824	1,515,415	1,506,005	1,417,560	1,338,399	1,262,605	1,162,134	1,052,503	951,855	904,167
1925	906,788	921,085	985,076	1,028,777	1,205,262	1,311,674	1,436,468	1,560,568	1,684,578	1,582,202	1,438,920	1,367,376
1926	1,304,106	1,296,082	1,296,519	1,290,435	1,361,093	1,400,064	1,518,241	1,532,438	1,430,226	1,287,212	1,162,635	1,099,288
1927	1,044,610	1,084,270	1,129,224	1,168,777	1,346,690	1,463,332	1,567,658	1,688,723	1,936,134	1,852,362	1,703,718	1,627,130
1928	1,606,224	1,637,560	1,672,026	1,675,150	1,689,999	1,690,000	1,701,151	1,877,285	1,835,437	1,667,682	1,522,481	1,445,074
1929	1,362,145	1,353,824	1,350,930	1,337,716	1,346,569	1,351,080	1,341,527	1,323,621	1,392,489	1,266,466	1,150,912	1,087,613
1930	1,032,080	1,016,460	1,051,972	1,071,954	1,112,838	1,138,506	1,107,377	1,098,218	1,186,818	1,067,154	960,515	908,251
1931	864,235	866,605	904,039	902,201	933,725	896,662	839,706	804,980	747,051	671,410	610,497	591,503
1932	565,821	560,723	704,485	844,787	1,084,372	1,221,695	1,205,745	1,259,030	1,378,752	1,327,642	1,189,590	1,113,456
1933	1,025,224	1,000,826	998,521	983,959	1,008,603	995,965	955,100	959,906	1,007,489	894,719	782,336	724,120
1934	667,461	656,295	676,788	711,356	777,968	868,739	854,724	813,053	786,448	712,923	652,109	634,358
1935	624,570	638,297	677,837	832,051	956,075	1,079,921	1,337,695	1,442,297	1,633,298	1,541,356	1,416,179	1,343,212
1936	1,311,194	1,303,236	1,297,699	1,351,659	1,689,999	1,690,000	1,713,000	1,808,939	2,003,094	1,900,592	1,747,881	1,665,690
1937	1,613,022	1,592,326	1,585,791	1,579,717	1,689,994	1,690,000	1,713,000	1,792,830	1,982,099	1,843,316	1,694,437	1,610,230
1938	1,536,751	1,528,196	1,689,998	1,689,992	1,689,987	1,690,000	1,690,000	1,730,000	2,025,000	1,959,369	1,790,073	1,700,032
1939	1,672,242	1,671,809	1,685,673	1,689,024	1,689,999	1,690,000	1,634,629	1,601,698	1,473,709	1,301,817	1,157,373	1,119,194
1940	1,077,628	1,070,702	1,134,704	1,288,559	1,565,488	1,690,000	1,713,000	1,808,008	1,950,520	1,780,688	1,627,700	1,539,737
1941	1,469,773	1,454,423	1,553,735	1,689,994	1,689,991	1,690,000	1,690,000	1,804,234	2,030,000	1,950,157	1,790,024	1,700,010
1942	1,641,462	1,634,171	1,689,999	1,689,982	1,689,995	1,690,000	1,713,000	1,765,000	2,027,000	1,950,170	1,790,025	1,700,004
1943	1,619,298	1,656,980	1,690,000	1,689,976	1,689,995	1,690,000	1,713,000	1,940,240	2,030,000	1,940,444	1,790,004	1,700,004
1944	1,627,652	1,614,506	1,602,762	1,595,713	1,659,696	1,690,000	1,654,802	1,700,608	1,738,836	1,608,117	1,463,726	1,386,992
1945	1,362,396	1,410,433	1,456,868	1,483,156	1,689,997	1,690,000	1,713,000	1,750,377	1,973,670	1,906,466	1,749,519	1,662,142
1946	1,664,336	1,690,000	1,689,996	1,689,984	1,689,995	1,690,000	1,713,000	1,726,331	1,786,301	1,618,009	1,459,654	1,373,770
1947	1,314,592	1,331,036	1,364,362	1,376,577	1,405,177	1,370,566	1,295,486	1,351,369	1,288,812	1,144,830	1,017,268	954,574
1948	958,700	959,989	998,610	997,725	983,836	1,013,678	1,114,286	1,251,048	1,420,232	1,377,867	1,303,272	1,271,554
1949	1,247,966	1,239,259	1,234,425	1,223,326	1,235,015	1,400,436	1,383,115	1,432,798	1,409,371	1,242,728	1,096,786	1,022,286
1950	944,784	935,019	938,337	962,506	1,119,822	1,253,320	1,285,258	1,291,998	1,375,323	1,221,712	1,078,645	1,020,719
1951	1,018,036	1,422,514	1,689,995	1,689,971	1,689,993	1,690,000	1,664,085	1,570,386	1,596,323	1,438,802	1,296,271	1,217,452
1952	1,176,472	1,184,189	1,305,781	1,533,995	1,689,998	1,690,000	1,690,000	1,895,000	2,030,000	1,951,049	1,790,051	1,700,027
1953	1,614,775	1,604,850	1,619,190	1,689,999	1,689,998	1,688,681	1,619,217	1,588,332	1,773,663	1,724,813	1,589,215	1,514,922
1954	1,449,795	1,449,008	1,452,649	1,459,444	1,505,884	1,611,838	1,643,837	1,773,541	1,769,428	1,605,391	1,456,830	1,379,013
1955	1,300,328	1,300,104	1,318,386	1,350,951	1,401,218	1,464,906	1,489,052	1,525,796	1,487,090	1,348,288	1,221,076	1,163,037
1956	1,100,763	1,099,427	1,651,474	1,689,947	1,689,993	1,690,000	1,713,000	1,804,698	2,030,000	1,950,170	1,790,030	1,700,025
1957	1,639,825	1,624,492	1,616,539	1,610,979	1,668,413	1,690,000	1,553,124	1,584,074	1,786,699	1,635,352	1,492,723	1,419,571
1958	1,403,575	1,396,361	1,409,069	1,432,024	1,578,593	1,690,000	1,690,000	1,910,000	2,030,000	1,950,170	1,790,046	1,700,029
1959	1,611,062	1,589,728	1,567,833	1,592,273	1,689,999	1,690,000	1,662,406	1,600,478	1,493,480	1,324,246	1,178,165	1,178,441
1960	1,101,196	1,090,401	1,113,627	1,113,311	1,220,539	1,228,588	1,240,002	1,245,830	1,168,185	1,034,178	923,226	874,650
1961	827,383	826,615	897,810	899,493	908,561	870,204	842,562	814,709	769,512	703,148	648,423	629,635
1962	604,125	599,069	626,802	630,729	817,825	938,956	931,539	835,624	1,048,335	953,860	814,699	742,797
1963	700,558	694,902	745,217	790,246	957,421	1,023,119	1,119,414	1,363,268	1,654,516	1,631,866	1,513,806	1,455,856
1964	1,437,657	1,487,272	1,502,934	1,521,014	1,535,522	1,502,343	1,443,836	1,438,577	1,397,068	1,238,632	1,101,362	1,031,330
1965	1,018,694	1,042,070	1,471,762	1,689,988	1,689,993	1,690,000	1,713,000	1,743,852	1,900,867	1,898,947	1,790,038	1,700,028
1966	1,615,736	1,690,000	1,689,998	1,689,996	1,689,998	1,690,000	1,670,732	1,742,447	1,620,676	1,452,534	1,306,169	1,236,095
1967	1,160,837	1,194,375	1,348,066	1,447,078	1,544,910	1,690,000	1,690,000	1,880,000	2,030,000	2,030,000	1,790,252	1,700,021
1968	1,619,820	1,607,624	1,605,760	1,605,959	1,668,870	1,690,000	1,614,396	1,614,311	1,547,133	1,375,977	1,237,984	1,160,815
1969	1,124,725	1,154,047	1,243,529	1,689,996	1,689,990	1,690,000	1,690,000	1,930,000	2,030,000	1,975,279	1,790,111	1,700,033
1970	1,676,114	1,681,553	1,689,999	1,689,952	1,689,996	1,690,000	1,649,691	1,718,076	1,804,962	1,670,839	1,531,070	1,453,473
1971	1,394,102	1,437,025	1,524,073	1,589,976	1,659,167	1,690,000	1,647,943	1,676,856	1,840,272	1,736,038	1,599,726	1,530,826
1972	1,469,268	1,477,826	1,521,421	1,571,887	1,625,342	1,603,292	1,501,630	1,475,950	1,480,830	1,319,081	1,185,074	1,119,002
1973	1,081,006	1,094,033	1,176,102	1,304,888	1,484,502	1,646,959	1,675,219	1,921,511	2,030,000	1,863,873	1,716,891	1,634,144
1974	1,625,114	1,690,000	1,689,998	1,689,983	1,689,998	1,690,000	1,717,600	1,964,185	2,030,000	1,943,894	1,790,018	1,700,018
1975	1,671,620	1,661,732	1,660,185	1,665,519	1,689,996	1,690,000	1,717,600	1,824,854	2,030,000	1,950,013	1,790,077	1,700,024
1976	1,690,000	1,690,000	1,690,000	1,664,706	1,649,459	1,519,032	1,432,156	1,326,070	1,216,796	1,085,092	998,502	968,734
1977	932,654	925,543	955,652	938,503	920,299	807,858	717,610	671,981	616,184	544,084	486,059	467,586
1978	447,583	445,345	497,628	642,718	811,604	1,050,470	1,227,230	1,356,274	1,761,000	1,841,159	1,704,419	1,692,926
1979	1,606,278	1,609,357	1,608,413	1,689,999	1,689,995	1,690,000	1,690,000	1,717,600	1,827,795	1,673,824	1,527,042	1,450,952
1980	1,419,903	1,422,622	1,442,656	1,689,977	1,689,987	1,690,000	1,717,600	1,890,400	1,960,200	1,950,171	1,790,057	1,700,035
1981	1,617,942	1,596,204	1,588,406	1,595,955	1,619,607	1,690,000	1,710,315	1,694,081	1,626,429	1,461,340	1,330,112	1,262,473
1982	1,253,640	1,360,563	1,511,306	1,689,997	1,689,988	1,690,000	1,717,600	1,876,400	2,002,900	1,954,717	1,790,097	1,700,116
1983	1,690,000	1,690,000	1,689,995	1,689,966	1,689,989	1,294,700	1,264,000	1,270,800	1,851,400	2,030,000	1,869,137	1,700,118
1984	1,666,919	1,690,000	1,689,992	1,689,972	1,689,993	1,690,000	1,614,072	1,682,328	1,778,205	1,646,266	1,496,949	1,414,071
1985	1,399,091	1,434,211	1,478,590	1,469,173	1,504,226	1,570,360	1,558,812	1,616,719	1,550,570	1,386,112	1,251,881	1,188,728
1986	1,162,153	1,183,366	1,254,950	1,319,946	1,689,994	1,690,000	1,717,600	1,888,300	2,001,400	1,917,776	1,770,749	1,700,004
1987	1,641,221	1,619,848	1,601,298	1,570,175	1,566,241	1,592,870	1,533,147	1,433,211	1,330,588	1,195,991	1,085,371	1,032,594
1988	1,010,460	1,009,573	1,045,756	1,099,567	1,155,125	1,128,364	1,103,870	1,063,204	1,011,973	943,381	884,236	862,821
1989	836,632	844,157	876,836	900,479	930,034	1,051,709	1,029,659	1,110,864	1,160,578	1,025,069	913,162	908,781
1990	935,547	934,238	954,290	956,979	989,562	968,936	944,775	965,169	990,902	924,588	852,141	815,058
1991	799,492	794,262	814,409	803,540	782,227	856,893	858,476	917,797	1,020,071	946,830	874,711	843,590
1992	844,030	841,586	863,738	868,291	931,612	990,953	1,044,352	1,043,659	967,160	874,930	761,589	698,367
1993	662,549	656,233	682,056	877,956	1,027,740	1,267,172	1,365,280	1,684,448	1,941,790	1,923,275	1,785,144	1,700,014
1994	1,627,176	1,612,969	1,599,152	1,589,196	1,599,258	1,567,682	1,531,904	1,523,687	1,478,913	1,356,482	1,256,718	1,211,217
1995	1,172,146	1,191,956	1,236,737	1,494,252	1,599,122	1,690,000	1,717,600	1,629,700	1,982,800	2,030,000	1,814,001	1,700,059
1996	1,608,079	1,583,093	1,604,410	1,672,573	1,689,990	1,690,000	1,717,600	2,002,400	2,030,000	1,930,383	1,782,384	1,700,010
1997	1,667,198	1,690,000	1,689,993	1,689,875	1,689,994	1,690,000	1,598,189	1,839,987	1,951,576	1,810,929	1,668,846	1,615,122
1998	1,533,848	1,527,463	1,528,868	1,690,000	1,689,989	1,690,000	1,717,600	1,714,000	1,987,500	2,030,000	1,790,242	1,700,022
1999	1,662,014	1,675,303	1,690,000	1,689,986	1,689,990	1,690,000	1,717,600	1,781,250	1,998,452	1,868,511	1,726,752	1,652,772
2000	1,566,486	1,554,834	1,539,188	1,615,107	1,689,994	1,690,000	1,717,600	1,981,851	2,030,000	1,864,407	1,719,364	1,644,682
2001	1,634,728	1,622,232	1,613,706	1,605,692	1,629,054	1,690,000	1,716,911	1,801,382	1,668,653	1,504,167	1,365,411	1,300,012
2002	1,238,260	1,249,893	1,323,366	1,378,790	1,430,954	1,481,487	1,466,303	1,583,557	1,606,470	1,443,430	1,305,249	1,232,624
Avg (21-02)	1,289,807	1,299,980	1,345,245	1,393,639	1,456,995	1,482,690	1,485,599	1,553,787	1,637,503	1,537,849	1,401,689	1,333,676

APPENDIX O3

Table 2.5-3

Difference in Don Pedro Reservoir Storage (Acre-feet) 2018 WSIP minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	0	0	0	0	0	0	0	1,581	9,785	9,743	9,701	9,668
1922	9,649	9,643	9,644	9,646	7,314	0	0	27,000	0	0	0	0
1923	0	0	0	0	0	0	0	19,448	20,579	20,489	20,400	20,335
1924	20,293	20,283	20,284	20,289	20,291	20,283	29,131	36,403	36,280	36,115	35,947	35,822
1925	35,742	35,721	35,723	35,733	35,736	35,723	38,002	54,614	54,432	54,194	53,949	53,766
1926	53,653	53,623	54,159	54,175	54,374	53,777	59,346	64,946	75,585	75,240	74,894	74,643
1927	74,488	74,446	84,152	84,176	84,183	84,151	84,072	109,537	93,866	93,464	86,297	72,891
1928	72,744	52,440	17,973	14,850	-1	0	11,849	15,633	16,776	16,704	16,629	16,574
1929	16,539	16,530	16,531	16,536	16,537	16,531	16,515	29,764	42,688	42,491	42,299	42,157
1930	42,069	42,045	42,047	42,059	42,062	42,047	42,006	50,953	50,779	50,549	50,317	50,140
1931	50,030	50,000	50,002	50,018	50,021	50,002	49,950	49,815	49,636	49,398	49,167	48,994
1932	48,881	48,850	76,220	83,404	94,476	101,488	104,316	109,107	115,380	114,855	114,320	113,938
1933	113,702	113,638	113,643	113,676	113,685	113,643	115,971	118,080	130,178	129,576	128,950	128,496
1934	128,215	128,140	136,090	131,826	135,695	138,683	139,953	144,677	145,952	145,258	144,556	144,048
1935	143,737	143,653	143,659	148,062	153,981	155,209	162,762	168,439	181,898	181,108	180,293	179,687
1936	179,312	179,212	179,215	179,282	-7	0	0	19,266	20,398	20,310	20,221	20,157
1937	20,116	20,105	20,115	20,121	-1	0	0	14,960	22,725	22,628	22,529	22,456
1938	22,411	22,398	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	21,763	17,905	17,845	17,763	17,682	17,623
1940	17,586	17,576	23,579	24,644	32,802	0	0	3,148	5,711	5,687	5,662	5,643
1941	5,631	5,628	1,749	0	0	0	0	5,267	0	0	0	0
1942	0	0	0	-2	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	2,660	0	0	0	0
1944	0	0	0	0	0	0	0	21,832	21,761	21,668	21,569	21,497
1945	21,452	21,439	21,440	21,446	-1	0	0	2,154	20,481	20,394	20,304	20,240
1946	20,200	0	0	0	0	0	0	16,087	16,035	15,966	15,894	15,839
1947	15,807	15,797	15,798	15,803	15,803	15,798	15,782	47,569	47,403	47,190	46,973	46,811
1948	46,711	46,684	46,686	46,970	46,974	51,283	54,015	56,304	68,702	68,389	68,073	67,840
1949	67,696	67,658	67,661	67,650	67,656	76,431	80,890	85,292	99,864	99,407	98,956	98,622
1950	98,415	98,357	94,453	99,627	100,580	102,858	104,812	106,271	114,829	114,301	113,782	113,399
1951	113,162	129,058	-2	0	0	0	1,035	2,267	10,959	10,909	10,860	10,822
1952	10,800	10,795	10,795	21,169	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	18,207	20,088	20,023	19,937	19,849	19,784
1954	19,744	19,732	19,733	19,739	19,740	19,733	19,715	46,257	46,106	45,908	45,701	45,546
1955	45,450	45,425	45,427	45,439	45,444	45,427	46,002	48,682	66,766	66,463	66,153	65,932
1956	65,796	65,759	38,525	-6	-1	0	0	2,804	0	0	0	0
1957	0	0	0	0	0	0	0	27,356	27,267	27,150	27,029	26,939
1958	26,882	26,867	26,868	26,876	26,878	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	2,484	15,378	15,327	15,256	15,187	15,136
1960	15,105	15,096	15,097	15,102	22,288	25,769	26,790	29,135	25,489	25,374	25,253	25,162
1961	25,107	25,092	31,901	31,911	31,913	31,900	31,868	31,782	31,668	31,518	31,363	31,258
1962	31,192	31,174	31,175	31,184	31,186	31,174	31,143	90,867	104,075	103,599	103,100	102,737
1963	102,514	102,452	102,458	102,488	102,496	102,458	102,359	125,394	127,729	127,178	126,615	126,195
1964	125,935	125,866	125,871	125,907	125,916	125,871	125,828	134,787	143,817	143,159	142,503	142,025
1965	141,730	141,650	143,458	-20	0	0	0	1,190	3,797	3,781	9	0
1966	0	0	0	0	-1	0	535	533	532	529	526	524
1967	523	523	523	522	523	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	17,271	17,214	17,136	17,056	16,999
1969	16,964	16,955	16,955	-2	0	0	0	0	0	0	0	0
1970	0	0	0	-1	0	0	0	7,191	7,168	7,137	7,105	7,081
1971	7,066	7,062	7,062	7,064	7,066	0	0	19,395	19,332	19,248	19,165	19,102
1972	19,062	19,051	19,053	19,058	19,060	19,052	19,035	50,301	50,130	49,902	49,670	49,504
1973	49,401	49,373	49,375	49,390	49,393	43,041	42,381	58,917	0	0	0	0
1974	0	0	0	-2	0	0	0	3,135	0	0	0	0
1975	0	0	0	0	0	0	0	19,081	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	-8,218	-3,004	3	3	4	4	4	4	4	4
1978	4	4	4	4	4	4	4	65,910	0	0	0	884
1979	10,531	10,525	10,525	-1	0	0	0	0	0	0	0	0
1980	0	0	0	-4	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	2,681	17,324	17,247	17,168	17,109
1982	17,073	17,063	17,063	-4	0	0	0	0	0	1	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0
1984	7,849	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	10,459	10,423	10,377	10,327	10,293
1986	10,272	10,266	10,266	10,270	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	8,688	18,070	17,987	17,905	17,844
1988	17,806	17,797	17,797	17,802	4,143	4,142	9,715	12,036	40,505	45,304	45,086	44,924
1989	44,826	44,799	44,801	44,815	44,818	44,802	45,122	76,928	78,779	78,422	78,055	77,780
1990	77,611	77,566	77,570	77,592	77,599	77,570	77,492	104,389	104,026	103,544	103,046	102,678
1991	102,454	102,393	101,166	97,285	95,826	95,789	95,690	129,032	133,664	127,992	127,099	126,649
1992	126,371	126,296	126,303	126,340	126,351	126,303	126,446	153,135	152,605	151,894	151,162	150,630
1993	150,300	150,207	150,213	147,344	147,341	161,620	164,204	166,640	88,210	26,856	4,904	8
1994	7	8	8	7	7	8	8	16,901	16,843	16,766	16,688	16,632
1995	16,598	16,588	16,590	16,594	35,231	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	-2	0	0	2,852	2,845	2,837	2,824	2,812	2,803
1998	2,797	2,795	2,795	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	15,449	21,209	21,119	21,026	20,960
2000	20,917	20,906	20,906	20,912	-1	0	0	17,737	0	0	0	0
2001	0	0	0	0	0	0	0	28,824	28,730	28,603	28,472	28,375
2002	28,314	28,298	28,300	28,308	28,310	28,300	28,273	55,523	55,336	55,089	54,836	54,647
Avg (21-02)	33,844	33,431	31,356	28,781	25,777	24,889	26,199	36,801	36,165	35,257	34,696	34,369

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Table 2.5-4

Difference in Don Pedro Reservoir Storage (Acre-feet) 2018 WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	0	0	0	0	0	0	0	-1,607	-648	-2,828	-2,815	-2,807
1922	-2,800	-2,800	-2,799	-2,800	0	0	0	15,826	0	-5	0	0
1923	0	0	0	0	0	0	0	434	-486	-2,668	-2,656	-2,647
1924	-2,642	-2,641	-2,640	-2,642	-2,642	-2,641	4,447	6,884	6,791	6,676	6,577	6,513
1925	6,495	6,490	6,489	6,484	6,483	6,472	5,090	8,195	6,054	3,844	3,827	3,815
1926	3,807	3,805	3,844	3,845	3,843	3,841	-764	-5,857	-18,492	-18,408	-18,322	-18,261
1927	-18,223	-18,213	-3,466	-3,467	-3,467	-3,466	-3,462	-5,260	0	-2,184	-5	0
1928	0	0	0	0	0	0	0	-950	-1,866	-1,858	-1,850	-1,844
1929	-1,841	-1,839	-1,839	-1,840	-1,840	-1,839	-1,837	-4,177	-6,277	-6,249	-6,220	-6,199
1930	-6,186	-6,183	-6,183	-6,185	-6,186	-6,183	-6,177	2,407	286	285	284	282
1931	282	281	281	282	282	282	281	281	279	278	276	275
1932	275	275	-1,617	-5,732	-9,971	-21,567	-25,781	-28,366	-30,365	-32,412	-32,263	-32,152
1933	-32,085	-32,067	-32,068	-32,079	-32,081	-32,068	-34,052	-36,027	-37,380	-39,394	-39,207	-39,066
1934	-38,982	-38,959	-34,222	-37,043	-34,080	-33,605	-35,480	-41,192	-41,045	-40,846	-40,651	-40,508
1935	-40,421	-40,397	-40,399	-53,757	-64,082	-57,213	-60,115	-62,533	-66,173	-68,068	-67,773	-67,550
1936	-67,412	-67,374	-67,488	-67,410	2	0	0	8,922	7,973	5,756	5,730	5,712
1937	5,701	5,698	5,698	5,699	0	0	0	5,622	3,306	1,108	1,104	1,100
1938	1,098	1,098	0	0	0	0	0	0	0	-2,183	-5	0
1939	0	0	0	0	0	0	5,984	3,783	1,657	1,649	1,641	1,635
1940	1,632	1,631	-368	2,411	4,704	0	0	12,026	9,689	9,647	9,605	9,574
1941	9,554	9,548	5,059	-1	0	0	0	3,897	0	-4	0	0
1942	0	0	0	-1	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	475	0	-2,183	-4	0
1944	0	0	0	0	0	0	0	-11,972	-14,047	-16,170	-16,098	-16,044
1945	-16,010	-16,002	-16,002	-16,007	0	0	0	1,721	30,195	27,882	27,759	27,672
1946	27,617	106	0	0	0	0	0	5,859	3,726	3,710	3,693	3,680
1947	3,673	3,671	3,671	3,672	3,672	3,671	3,668	8,891	6,747	6,717	6,686	6,663
1948	6,648	6,645	6,645	6,917	6,919	6,916	5,118	3,209	2,456	343	409	448
1949	464	468	470	447	449	5,347	5,526	6,492	11,777	11,724	11,670	11,631
1950	11,607	11,599	4,140	11,949	-1,973	-3,538	-1,650	-796	12,760	11,317	11,266	11,228
1951	11,205	12,508	0	0	0	0	-2,116	-1,801	-3,973	-6,138	-6,109	-6,089
1952	-6,076	-6,073	-6,073	-186	0	0	0	0	0	-2,184	-5	0
1953	0	0	0	0	0	0	-2,576	-4,755	-6,854	-9,008	-8,970	-8,940
1954	-8,921	-8,916	-8,917	-8,919	-8,920	-8,917	-8,908	-7,801	-9,889	-9,847	-9,803	-9,770
1955	-9,750	-9,744	-9,745	-9,748	-9,748	-9,744	-10,970	-11,689	-2,467	-2,456	-2,444	-2,437
1956	-2,431	-2,430	0	0	0	0	0	-4,425	0	0	0	0
1957	0	0	0	0	0	0	0	-7,471	-9,561	-11,703	-11,651	-11,612
1958	-11,589	-11,582	-11,582	-11,586	-11,587	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	-2,851	-5,587	-5,568	-5,543	-5,517	-5,499
1960	-5,487	-5,484	-5,485	-5,485	-1,747	-962	-590	3,800	2,402	2,391	2,380	2,371
1961	2,365	2,364	577	578	577	577	577	575	573	571	568	566
1962	565	564	565	564	565	564	564	-38,191	-44,742	-46,722	-46,503	-46,336
1963	-46,236	-46,209	-38,284	-24,977	-46,239	-46,222	-46,178	-39,770	-38,718	-40,734	-40,557	-40,424
1964	-40,342	-40,320	-40,322	-40,333	-28,562	-28,551	-30,641	-33,668	-46,421	-46,212	-45,996	-45,842
1965	-45,748	-45,722	-36,519	5	0	0	0	2,733	19,292	17,025	33	0
1966	0	0	0	0	0	0	-8,459	-10,623	-12,703	-12,646	-12,588	-12,545
1967	-12,519	-12,512	-12,513	-12,517	-12,517	0	0	0	0	0	-5	0
1968	0	0	0	0	0	0	0	-6,315	-8,407	-8,369	-8,330	-8,303
1969	-8,285	-8,280	-8,281	1	0	0	0	0	0	-2,184	-5	0
1970	0	0	0	-5	0	0	0	-4,300	-6,400	-8,556	-8,518	-8,489
1971	-8,471	-8,467	-8,467	-8,470	-8,469	0	0	-1,204	-3,314	-5,482	-5,459	-5,440
1972	-5,430	-5,427	-5,427	-5,429	-5,429	-5,427	-5,422	1,237	-882	-877	-873	-870
1973	-869	-868	-868	-868	-868	0	0	549	0	0	0	0
1974	0	0	0	-1	0	0	0	-1,901	0	-2,184	-5	0
1975	0	0	0	0	0	0	0	26,562	0	-4	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	-18,098	0	-2,183	-2,174	-1,593
1979	6,965	6,961	6,960	-1	0	0	0	0	-2,114	-2,105	-2,096	-2,088
1980	-2,085	-2,083	-2,083	-5	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	-2,116	-8,211	-10,299	-10,253	-10,206	-10,170
1982	-10,149	-10,143	-10,144	0	0	0	0	0	0	-2,183	-9	0
1983	0	0	0	0	0	0	0	0	0	0	-2,183	0
1984	4,784	0	0	0	0	0	-196	-14,019	-16,087	-18,202	-18,121	-18,061
1985	-18,022	-18,013	-18,013	-18,018	-18,020	-18,013	-17,996	-4,852	-6,951	-6,919	-6,887	-6,864
1986	-6,850	-6,846	-15,243	-18,908	0	0	0	0	0	-2,184	-2,174	-4
1987	-3	-3	-3	-4	-3	-3	-3	8,685	8,627	8,587	8,548	8,518
1988	8,501	8,497	8,496	8,499	8,499	8,496	8,488	1,102	-6,380	-6,351	-6,321	-6,298
1989	-6,284	-6,281	-6,281	-6,283	-6,284	-6,281	-17,360	-22,351	-25,032	-24,919	-24,805	-24,718
1990	-24,666	-24,652	-24,653	-24,661	-24,662	-24,653	-24,629	-14,718	-8,948	-8,908	-8,865	-8,834
1991	-14,011	-14,003	-15,236	-22,968	-24,438	-24,428	-24,420	-11,105	-23,342	-26,274	-28,497	-28,408
1992	-28,351	-28,336	-28,336	-28,346	-28,348	-28,338	-11,124	-13,430	-13,423	-13,406	-13,380	-13,354
1993	-13,339	-13,332	-21,270	-33,454	-33,472	-25,229	-27,190	-27,124	0	-5	0	0
1994	0	0	0	0	0	0	0	-3,987	-6,088	-6,060	-6,032	-6,012
1995	-6,000	-5,996	-5,996	-5,998	12,637	0	0	0	0	0	-2,184	-3
1996	-3	-3	-3	-3	0	0	0	0	0	-2,183	-2,174	-4
1997	-3	0	0	-1	0	0	-9,724	-11,886	-13,961	-16,084	-16,014	-15,961
1998	-15,929	-15,920	-15,921	3	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	3,128	4,038	1,838	1,828	1,824
2000	1,819	1,819	1,818	1,819	0	0	0	7,361	0	0	0	0
2001	0	0	0	1	0	0	0	-12,907	-14,766	-14,700	-14,634	-14,584
2002	-14,553	-14,545	-14,545	-14,549	-14,550	-14,545	-14,531	-20,414	-22,460	-22,361	-22,257	-22,181
Avg (21-02)	-5,902	-6,276	-6,397	-5,823	-4,775	-4,479	-4,848	-5,008	-5,462	-6,344	-6,419	-6,284

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Figure 2.5-1 and Table 2.5-4 illustrate that during drought sequences, a reduction to inflow to Don Pedro Reservoir can accumulate from year to year. Compared to the base setting, the variant would result in lower Don Pedro Reservoir storage during drought periods. Figure 2.5-2 illustrates the difference in reservoir storage averaged by year type for the variant and WSIP settings. Also shown is the average difference in storage for the two settings during the 82-year simulation. Figure 2.5-3 shows the same information for the variant and the base settings.

Figure 2.5-2

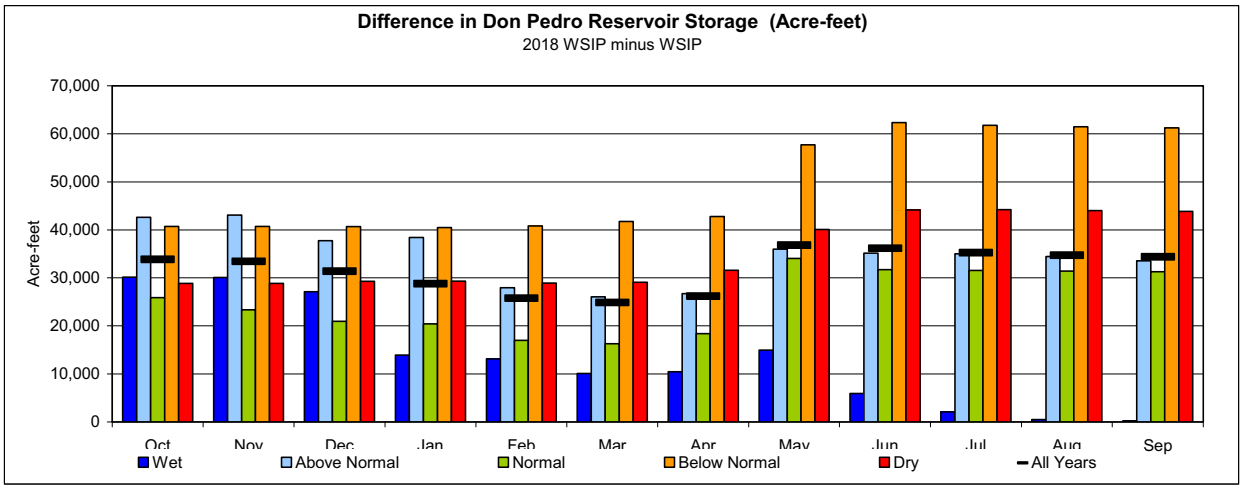

Figure 2.5-3

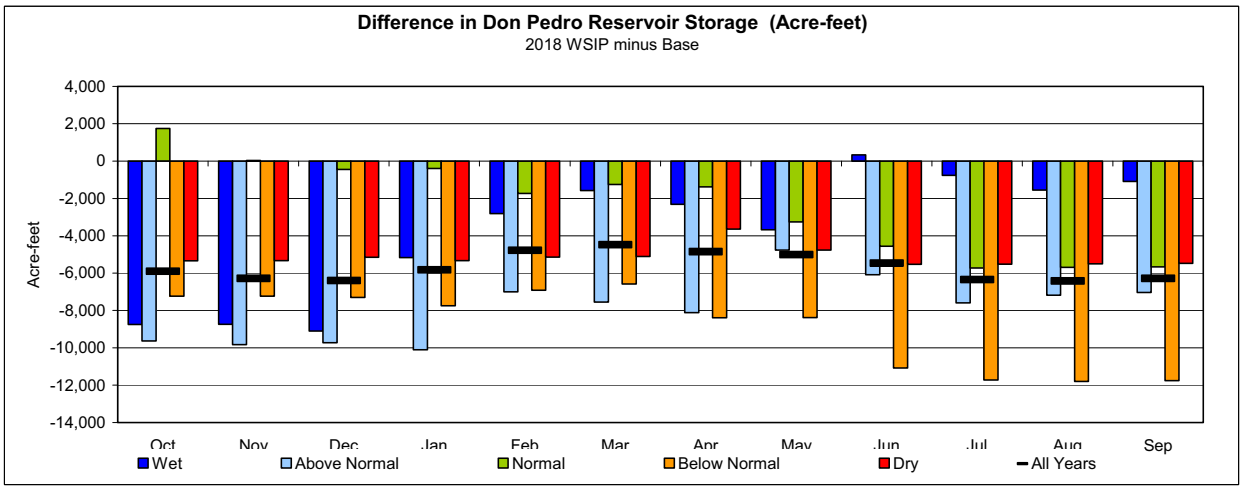

Figure 2.5-4 illustrates the average monthly storage in Don Pedro Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings.

The difference in storage in Don Pedro Reservoir attributed to the upstream effects of the variant would manifest in differences in releases from La Grange Dam to the stream. A different amount of available reservoir space in the winter and spring due to the variant would lead to a different ability to regulate inflow, thus potentially changing the amount of water released to the stream that is in excess of minimum release requirements. During periods when inflow differs and Don Pedro Reservoir is at maximum storage capacity within the flood control storage limitation, a change in inflow directly manifests as a change in releases from La Grange Dam (a change of either more or less flow). Figure 2.5-1 illustrates the stream releases from La Grange Dam for the WSIP, variant, and base settings.

Figure 2.5-4

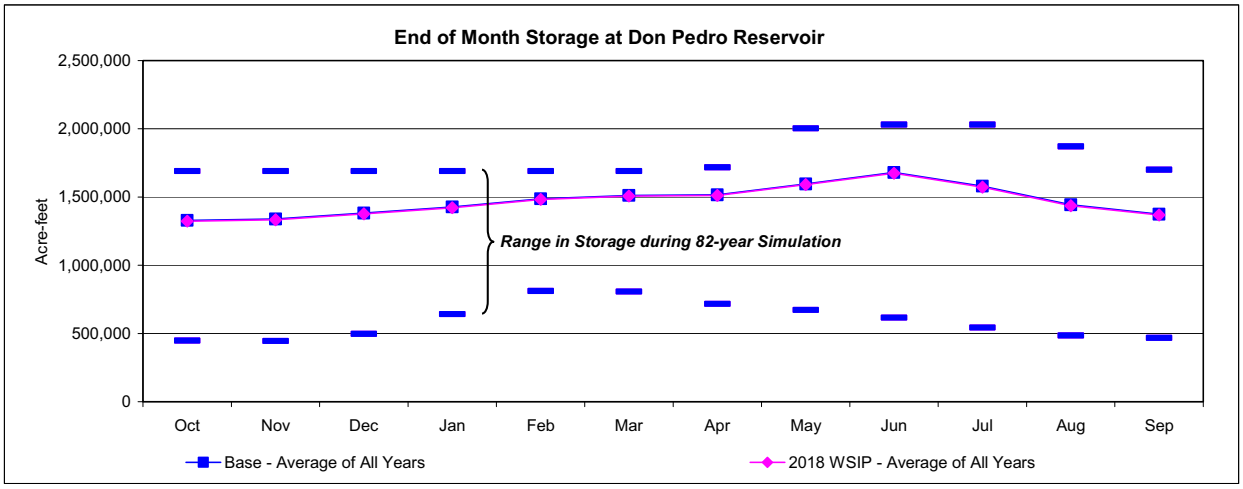

Table 2.5-5 illustrates the difference in stream releases between the variant and WSIP settings. Compared to the WSIP setting, the variant exhibits an incrementally larger stream release, predominately during some months of the early winter through June period, which is reflective of the months when releases to the stream are made in excess of minimum release requirements due to flood control or in anticipation of filling the reservoir. Table 2.5-6 shows the same information for the variant and WSIP settings, arranged by ranking the years in descending order of the San Joaquin River Index (an index of the wetness of the Tuolumne and San Joaquin River Basins). The table illustrates the finding that differences in releases to the Tuolumne River from La Grange Dam occur only when there are releases in excess of minimum FERC flow requirements. This circumstance typically occurs only in above-normal and wet years, and predominately during early winter through June. During other year types and during the summer and fall, releases would be maintained at minimum FERC flow requirements regardless of the setting. Compared to the WSIP setting, the large reduction in flow following an extended drought period is reduced with the variant, since the amount of water delivered by the SFPUC during these periods is less than that delivered in the WSIP setting, but is still more than delivered in the base setting.

As described above concerning Don Pedro inflow and storage, compared to the base setting the variant setting would lead to an additional draw of storage due to SFPUC diversions that are greater than in the base setting in drought periods. Although the reduction in storage would not greatly accumulate, greater replenishment of Don Pedro Reservoir storage would be needed in about 25 percent of the years in the 82-year simulation. There are occasions when an increase in releases would occur. This circumstance would result from the shift in timing of SJPL diversions due to the increased conveyance capacity. The effect would be an occasional additional release of water from Hetch Hetchy Reservoir in the winter that then manifests as an additional release from Don Pedro Reservoir. Table 2.5-7 illustrates the difference in stream releases between the variant and base settings, depicting the predominance of mostly slight reductions in flow. Table 2.5-8 illustrates the same information ranked in descending order of the San Joaquin River Index.

Table 2.5-5 and Table 2.5-7 illustrate the difference in stream releases among the variant, WSIP, and base settings, expressed in terms of a monthly volume (acre-feet) of flow. Table 2.5-9 presents the same information and the average monthly stream releases for the variant and WSIP settings, expressed in average monthly flow (cfs), and Table 2.5-10 shows the same information for the variant and base settings. For the comparison of the variant to the WSIP setting, the difference in monthly flow below La Grange Dam could range from an increase of approximately 179,000 acre-feet to a decrease of approximately 7,000 acre-feet. Considering the manner in which releases are determined and made to the stream, it is not always meaningful to quantify the effect of these changes in terms of average monthly flow (cfs). Similar to the operation of releases below O'Shaughnessy Dam, a change in the volume of release from La Grange Dam to the stream would likely delay or accelerate the initiation of the release by a matter of days. Using the assumption that a change in release volume equates to a delay or acceleration of releasing 6,000 acre-feet per day means that the difference in stream release from La Grange Dam between the variant and WSIP would be an additional day of delay in releases

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Table 2.5-5

Difference in Total La Grange Release to River (Acre-feet) 2018 WSIP minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	5,463	1,820	0	0	0	0	0	7,283
1922	0	0	0	0	2,334	7,312	2,762	0	29,074	0	0	0	41,482
1923	0	0	0	0	0	0	1,197	0	0	0	0	0	1,197
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	7,952	0	6,771	13,152	27,875
1928	0	20,270	34,469	3,128	14,851	6,265	7,344	0	0	0	0	0	86,327
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	179,625	9,045	3,334	0	0	0	0	0	192,004
1937	0	0	0	0	22,628	4,850	7,262	0	0	0	0	0	34,740
1938	0	0	20,688	0	0	39	5,721	24,854	3,038	0	0	0	54,340
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	40,502	2,839	0	0	0	0	0	43,341
1941	0	0	0	1,749	2,234	2,454	3,011	0	15,359	0	0	0	24,807
1942	0	0	0	14,686	-2	2,664	920	2,854	2,762	0	0	0	23,884
1943	0	0	0	0	8,123	9,596	1,197	0	5,234	0	0	0	24,150
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	21,448	-1	2,862	0	0	0	0	0	24,309
1946	0	20,195	0	0	0	5,945	2,986	0	0	0	0	0	29,126
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	129,063	-3	0	0	0	0	0	0	0	0	129,060
1952	0	0	0	0	21,172	0	0	16,285	3,038	0	0	0	40,495
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	30,130	38,536	-5	1,979	293	0	3,995	0	0	0	74,928
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	26,874	0	27,147	2,854	0	0	0	56,875
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	149,207	5,136	0	8,544	0	0	0	3,764	8	166,659
1966	0	0	8,118	0	17,169	0	0	0	0	0	0	0	25,287
1967	0	0	0	0	0	19,122	0	11,600	2,762	0	0	0	33,484
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	16,960	13,682	10,836	2,117	2,188	2,117	0	0	0	47,900
1970	0	0	4,959	10,325	-2	43	0	0	0	0	0	0	15,325
1971	0	0	0	0	0	7,064	0	0	0	0	0	0	7,064
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	6,336	620	0	60,018	0	0	0	66,974
1974	0	0	3,594	13,504	-2	6,659	1,841	0	6,169	0	0	0	31,765
1975	0	0	0	0	0	0	920	0	22,088	0	0	0	23,008
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	66,812	0	0	0	66,812
1979	0	0	0	10,528	-1	10,422	0	0	0	0	0	0	20,949
1980	0	0	0	25,343	-7,495	10,214	0	1,236	1,197	0	0	0	30,495
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	29,613	17,142	-1	0	2,854	2,762	0	1	3,038	55,409
1983	5,803	2,762	952	1	0	0	0	5,646	3,683	0	0	0	18,847
1984	0	10,608	0	0	0	0	0	0	0	0	0	0	10,608
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	11,085	21,884	9,459	2,188	2,118	0	0	0	46,734
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	77,912	61,107	21,881	4,889	165,789
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	38,866	7,636	1,903	1,842	0	0	0	50,247
1996	0	0	0	0	17,438	-7,490	1,311	4,811	2,118	0	0	0	18,188
1997	0	0	0	16,088	-2	0	0	0	0	0	0	0	16,086
1998	0	0	0	2,797	-1	18,936	6,445	2,949	2,854	0	0	0	33,980
1999	0	0	0	0	0	3,805	4,838	0	0	0	0	0	8,643
2000	0	0	0	0	20,913	-1	0	0	17,708	0	0	0	38,620
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	71	657	2,829	4,054	4,481	3,289	1,064	1,299	4,213	745	395	257	23,355

APPENDIX O3

Table 2.5-6

Difference in Total La Grange Release to River (Acre-feet)

Matrix Data for Water Year 1921-2002 Rank Ordered by Descending Unimpaired Runoff at LaGrange

2018 WSIP minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1983	5,803	2,762	952	1	0	0	0	5,646	3,683	0	0	0	18,847
1995	0	0	0	0	0	38,866	7,636	1,903	1,842	0	0	0	50,247
1969	0	0	0	16,960	13,682	10,836	2,117	2,188	2,117	0	0	0	47,900
1982	0	0	0	29,613	17,142	-1	0	2,854	2,762	0	1	3,038	55,409
1938	0	0	20,688	0	0	39	5,721	24,854	3,038	0	0	0	54,340
1998	0	0	0	2,797	-1	18,936	6,445	2,949	2,854	0	0	0	33,980
1997	0	0	0	16,088	-2	0	0	0	0	0	0	0	16,086
1956	0	0	30,130	38,536	-5	1,979	293	0	3,995	0	0	0	74,928
1967	0	0	0	0	0	19,122	0	11,600	2,762	0	0	0	33,484
1980	0	0	0	25,343	-7,495	10,214	0	1,236	1,197	0	0	0	30,495
1986	0	0	0	0	11,085	21,884	9,459	2,188	2,118	0	0	0	46,734
1952	0	0	0	0	21,172	0	0	16,285	3,038	0	0	0	40,495
1978	0	0	0	0	0	0	0	0	66,812	0	0	0	66,812
1965	0	0	0	149,207	5,136	0	8,544	0	0	0	3,764	8	166,659
1958	0	0	0	0	0	26,874	0	27,147	2,854	0	0	0	56,875
1993	0	0	0	0	0	0	0	0	77,912	61,107	21,881	4,889	165,789
1941	0	0	0	1,749	2,234	2,454	3,011	0	15,359	0	0	0	24,807
1951	0	0	129,063	-3	0	0	0	0	0	0	0	0	129,060
1922	0	0	0	0	2,334	7,312	2,762	0	29,074	0	0	0	41,482
1984	0	10,608	0	0	0	0	0	0	0	0	0	0	10,608
1943	0	0	0	0	8,123	9,596	1,197	0	5,234	0	0	0	24,150
1942	0	0	0	14,686	-2	2,664	920	2,854	2,762	0	0	0	23,884
1996	0	0	0	0	17,438	-7,490	1,311	4,811	2,118	0	0	0	18,188
1974	0	0	3,594	13,504	-2	6,659	1,841	0	6,169	0	0	0	31,765
1940	0	0	0	0	0	40,502	2,839	0	0	0	0	0	43,341
1936	0	0	0	0	179,625	9,045	3,334	0	0	0	0	0	192,004
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	3,805	4,838	0	0	0	0	0	8,643
1945	0	0	0	0	21,448	-1	2,862	0	0	0	0	0	24,309
1927	0	0	0	0	0	0	0	0	7,952	0	6,771	13,152	27,875
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	920	0	22,088	0	0	0	23,008
1973	0	0	0	0	0	6,336	620	0	60,018	0	0	0	66,974
1921	0	0	0	0	0	5,463	1,820	0	0	0	0	0	7,283
1937	0	0	0	0	22,628	4,850	7,262	0	0	0	0	0	34,740
1970	0	0	4,959	10,325	-2	43	0	0	0	0	0	0	15,325
2000	0	0	0	0	20,913	-1	0	0	17,708	0	0	0	38,620
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	10,528	-1	10,422	0	0	0	0	0	0	20,949
1946	0	20,195	0	0	0	5,945	2,986	0	0	0	0	0	29,126
1923	0	0	0	0	0	0	1,197	0	0	0	0	0	1,197
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	7,064	0	0	0	0	0	0	7,064
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	20,270	34,469	3,128	14,851	6,265	7,344	0	0	0	0	0	86,327
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	8,118	0	17,169	0	0	0	0	0	0	0	25,287
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0

APPENDIX O3

Table 2.5-7

Difference in Total La Grange Release to River (Acre-feet) 2018 WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	-7,939	-1,434	0	0	0	0	0	-9,373
1922	0	0	0	0	-2,800	0	-4,603	0	13,038	-2,183	-5	0	3,447
1923	0	0	0	0	0	0	-921	0	0	0	0	0	-921
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	-18,955	0	-2,174	-4	-21,133
1928	0	0	0	0	0	6,266	-1,561	0	0	0	0	0	4,705
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	-67,414	-7,845	-301	0	0	0	0	0	-75,560
1937	0	0	0	0	6,428	1,655	-1,251	0	0	0	0	0	6,832
1938	0	0	1,098	0	0	0	-1,422	7,840	-1,842	0	-2,173	-5	3,496
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	2,307	-2,839	0	0	0	0	0	-532
1941	0	0	0	5,060	1,788	2,032	2,492	0	11,823	-2,184	-5	0	21,006
1942	0	0	0	9,144	-1	0	-4,604	0	0	-2,188	0	0	2,351
1943	0	0	0	0	8,123	7,595	-5,524	0	935	0	-2,174	-5	8,950
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	-16,008	-15,316	2,660	0	0	0	0	0	-28,664
1946	0	27,503	106	0	0	-6,263	-626	0	0	0	0	0	20,720
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	12,509	0	0	0	0	0	0	0	0	0	12,509
1952	0	0	0	0	-185	0	0	406	921	0	-2,174	-4	-1,036
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	-6,938	0	0	-1,576	-2,775	0	-5,339	-2,188	0	0	-18,816
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	-11,584	0	15,657	1,841	-2,188	0	0	3,726
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	-11,774	0	0	0	0	0	0	0	-11,774
1965	0	0	0	-36,529	4	-10,710	-1,225	0	0	0	14,767	32	-33,661
1966	0	1	6,966	0	0	0	0	0	0	0	0	0	6,967
1967	0	0	0	0	0	624	0	-827	2,762	-2,188	-2,184	-5	-1,818
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	-8,284	11,234	-1	-5,524	0	0	0	-2,174	-4	-4,753
1970	0	0	4,959	36,921	-5,959	-21,031	0	0	0	0	0	0	14,890
1971	0	0	0	0	0	-8,468	0	0	0	0	0	0	-8,468
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	-868	0	0	-372	0	0	0	-1,240
1974	0	0	3,594	5,112	-1	-3,806	-2,762	0	-3,738	0	-2,174	-5	-3,780
1975	0	0	0	0	0	0	-7,366	0	28,609	-2,183	-4	0	19,056
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	-22,671	0	0	0	-22,671
1979	0	0	0	6,963	-1	-5,797	-2,118	-2,188	0	0	0	0	-3,141
1980	0	0	0	32,984	-7,496	2,603	-4,879	-952	-921	-2,188	0	0	19,151
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	2,398	5,591	-1	0	951	921	0	-4,357	911	6,414
1983	4,757	5,524	0	0	0	0	0	-3,896	-920	-2,188	0	-2,180	1,097
1984	0	12,147	0	0	0	3,936	0	0	0	0	0	0	16,083
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	-6,028	1,757	-1,841	-2,854	-2,762	0	0	-2,167	-13,895
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	-52,475	-2,184	-5	0	-54,664
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	29,603	-1,570	0	0	-2,188	0	-2,177	23,668
1996	0	0	0	0	15,744	-7,490	-3,569	-231	-2,762	0	0	-2,167	-475
1997	0	-3	0	9,880	-1	0	0	0	0	0	0	0	9,876
1998	0	0	0	-15,925	2	15,817	-4,603	-951	-920	-2,188	0	0	-8,768
1999	0	0	0	0	0	-4,757	-6,144	0	0	0	0	0	-10,901
2000	0	0	0	0	1,819	-1	0	0	5,232	0	0	0	7,050
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	58	551	272	582	-816	-479	-784	158	-580	-320	-59	-95	-1,513

APPENDIX O3

Table 2.5-8

Difference in Total La Grange Release to River (Acre-feet)

Matrix Data for Water Year 1921-2002 Rank Ordered by Descending Unimpaired Runoff at LaGrange

2018 WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1983	4,757	5,524	0	0	0	0	0	-3,896	-920	-2,188	0	-2,180	1,097
1995	0	0	0	0	0	29,603	-1,570	0	0	-2,188	0	-2,177	23,668
1969	0	0	0	-8,284	11,234	-1	-5,524	0	0	0	-2,174	-4	-4,753
1982	0	0	0	2,398	5,591	-1	0	951	921	0	-4,357	911	6,414
1938	0	0	1,098	0	0	0	-1,422	7,840	-1,842	0	-2,173	-5	3,496
1998	0	0	0	-15,925	2	15,817	-4,603	-951	-920	-2,188	0	0	-8,768
1997	0	-3	0	9,880	-1	0	0	0	0	0	0	0	9,876
1956	0	0	-6,938	0	0	-1,576	-2,775	0	-5,339	-2,188	0	0	-18,816
1967	0	0	0	0	0	624	0	-827	2,762	-2,188	-2,184	-5	-1,818
1980	0	0	0	32,984	-7,496	2,603	-4,879	-952	-921	-2,188	0	0	19,151
1986	0	0	0	0	-6,028	1,757	-1,841	-2,854	-2,762	0	0	-2,167	-13,895
1952	0	0	0	0	-185	0	0	406	921	0	-2,174	-4	-1,036
1978	0	0	0	0	0	0	0	0	-22,671	0	0	0	-22,671
1965	0	0	0	-36,529	4	-10,710	-1,225	0	0	0	14,767	32	-33,661
1958	0	0	0	0	0	-11,584	0	15,657	1,841	-2,188	0	0	3,726
1993	0	0	0	0	0	0	0	0	-52,475	-2,184	-5	0	-54,664
1941	0	0	0	5,060	1,788	2,032	2,492	0	11,823	-2,184	-5	0	21,006
1951	0	0	12,509	0	0	0	0	0	0	0	0	0	12,509
1922	0	0	0	0	-2,800	0	-4,603	0	13,038	-2,183	-5	0	3,447
1984	0	12,147	0	0	0	3,936	0	0	0	0	0	0	16,083
1943	0	0	0	0	8,123	7,595	-5,524	0	935	0	-2,174	-5	8,950
1942	0	0	0	9,144	-1	0	-4,604	0	0	-2,188	0	0	2,351
1996	0	0	0	0	15,744	-7,490	-3,569	-231	-2,762	0	0	-2,167	-475
1974	0	0	3,594	5,112	-1	-3,806	-2,762	0	-3,738	0	-2,174	-5	-3,780
1940	0	0	0	0	0	2,307	-2,839	0	0	0	0	0	-532
1936	0	0	0	0	-67,414	-7,845	-301	0	0	0	0	0	-75,560
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	-4,757	-6,144	0	0	0	0	0	-10,901
1945	0	0	0	0	-16,008	-15,316	2,660	0	0	0	0	0	-28,664
1927	0	0	0	0	0	0	0	0	-18,955	0	-2,174	-4	-21,133
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	-7,366	0	28,609	-2,183	-4	0	19,056
1973	0	0	0	0	0	-868	0	0	-372	0	0	0	-1,240
1921	0	0	0	0	0	-7,939	-1,434	0	0	0	0	0	-9,373
1937	0	0	0	0	6,428	1,655	-1,251	0	0	0	0	0	6,832
1970	0	0	4,959	36,921	-5,959	-21,031	0	0	0	0	0	0	14,890
2000	0	0	0	0	1,819	-1	0	0	5,232	0	0	0	7,050
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	6,963	-1	-5,797	-2,118	-2,188	0	0	0	0	-3,141
1946	0	27,503	106	0	0	-6,263	-626	0	0	0	0	0	20,720
1923	0	0	0	0	0	0	-921	0	0	0	0	0	-921
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	-8,468	0	0	0	0	0	0	-8,468
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	0	0	0	6,266	-1,561	0	0	0	0	0	4,705
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	1	6,966	0	0	0	0	0	0	0	0	0	6,967
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	-11,774	0	0	0	0	0	0	0	-11,774
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.5-9

Total La Grange Release to River (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP Sep	WY Total
Wet	23,264	21,635	56,327	150,325	184,968	276,250	214,153	243,710	227,036	142,651	66,645	45,515	1,652,480
Above Normal	18,683	30,882	67,212	75,648	127,296	167,481	128,473	78,842	84,574	27,869	19,798	18,215	844,972
Normal	18,264	17,249	35,981	51,832	74,090	104,453	84,424	77,929	20,660	9,992	9,992	9,670	514,534
Below Normal	17,105	13,768	20,372	15,874	17,613	21,364	34,828	33,554	4,025	4,160	4,160	4,025	190,847
Dry	17,240	13,842	14,866	13,950	15,511	20,672	21,732	21,240	3,347	3,459	3,459	3,347	152,665
All Years	18,886	19,545	39,070	61,141	83,616	117,468	96,354	90,205	67,352	37,099	20,595	16,032	667,363

Total La Grange Release to River (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	22,901	21,463	53,092	132,916	181,173	266,954	211,640	237,532	215,975	138,831	65,042	45,019	1,592,538
Above Normal	18,683	30,258	59,409	73,887	113,696	163,096	126,954	78,391	79,235	27,869	19,400	17,441	808,318
Normal	18,264	14,720	33,517	50,334	70,441	101,554	83,097	77,929	15,802	9,992	9,992	9,670	495,309
Below Normal	17,105	13,768	19,894	15,874	16,603	21,364	34,828	33,554	4,025	4,160	4,160	4,025	189,359
Dry	17,240	13,842	14,866	13,950	15,511	20,672	21,732	21,240	3,347	3,459	3,459	3,347	152,665
All Years	18,815	18,888	36,241	57,087	79,135	114,179	95,290	88,906	63,139	36,354	20,200	15,774	644,009

Difference in Total La Grange Release to River (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	2018 WSIP minus WSIP Aug	Sep	WY Total
Wet	363	173	3,236	17,409	3,795	9,297	2,513	6,178	11,062	3,819	1,603	496	59,943
Above Normal	0	624	7,803	1,761	13,600	4,385	1,520	451	5,339	0	398	774	36,654
Normal	0	2,529	2,464	1,499	3,649	2,899	1,327	0	4,858	0	0	0	19,225
Below Normal	0	0	478	0	1,010	0	0	0	0	0	0	0	1,487
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	71	657	2,829	4,054	4,481	3,289	1,064	1,299	4,213	745	395	257	23,355

Table 2.5-10

Total La Grange Release to River (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP Sep	WY Total
Wet	23,264	21,635	56,327	150,325	184,968	276,250	214,153	243,710	227,036	142,651	66,645	45,515	1,652,480
Above Normal	18,683	30,882	67,212	75,648	127,296	167,481	128,473	78,842	84,574	27,869	19,798	18,215	844,972
Normal	18,264	17,249	35,981	51,832	74,090	104,453	84,424	77,929	20,660	9,992	9,992	9,670	514,534
Below Normal	17,105	13,768	20,372	15,874	17,613	21,364	34,828	33,554	4,025	4,160	4,160	4,025	190,847
Dry	17,240	13,842	14,866	13,950	15,511	20,672	21,732	21,240	3,347	3,459	3,459	3,347	152,665
All Years	18,886	19,545	39,070	61,141	83,616	117,468	96,354	90,205	67,352	37,099	20,595	16,032	667,363

Total La Grange Release to River (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base Sep	WY Total
Wet	22,967	21,290	56,692	151,293	184,772	274,592	215,643	242,749	232,124	143,744	66,539	45,865	1,658,271
Above Normal	18,683	30,167	66,265	74,511	130,859	168,855	130,389	78,856	82,871	28,383	20,182	18,343	848,363
Normal	18,264	15,530	35,664	49,090	73,947	107,106	84,918	78,066	20,356	9,992	9,992	9,670	512,593
Below Normal	17,105	13,768	19,962	15,874	18,305	21,364	34,828	33,554	4,025	4,160	4,160	4,025	191,130
Dry	17,240	13,842	14,866	13,950	15,511	20,672	21,732	21,240	3,347	3,459	3,459	3,347	152,665
All Years	18,828	18,994	38,798	60,559	84,433	117,947	97,139	90,047	67,933	37,419	20,654	16,126	668,876

Difference in Total La Grange Release to River (Acre-feet)
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	2018 WSIP minus Base Aug	Sep	WY Total
Wet	297	345	-365	-967	195	1,658	-1,490	961	-5,088	-1,094	106	-350	-5,791
Above Normal	0	715	947	1,136	-3,563	-1,373	-1,915	-14	1,703	-514	-384	-128	-3,391
Normal	0	1,719	317	2,743	143	-2,653	-494	-137	304	0	0	0	1,941
Below Normal	0	0	410	0	-693	0	0	0	0	0	0	0	-283
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	58	551	272	582	-816	-479	-784	158	-580	-320	-59	-95	-1,513

or up to almost an added month of release. Normally, a change in release would not affect the peak stream release rate during a year. However, infrequently (a rare event following a prolonged drought), the variant's effect on stream releases could manifest as an elimination of all flow during a year or as the only provision of flow that occurs in excess of minimum FERC flow requirements. Compared to the base setting, the variant's effect on stream flow ranges from a reduction in releases (a potential delay in release of 11 days) to an increase in releases (a potential additional 5 days of release).

2.6 Calaveras and San Antonio Reservoirs, Alameda Creek, and Downstream

Compared to the WSIP setting, the operation of Calaveras Reservoir in the variant setting is almost identical. Figure 2.6-1 illustrates a chronological trace of the simulation of Calaveras Reservoir storage and stream releases from Calaveras Dam. Shown in Figure 2.6-1 are the results for the WSIP, variant, and base settings. In recognition of the different levels of systemwide deliveries served in each setting, the near identical operation of Calaveras Reservoir resulting from the two settings is an indication that Calaveras Reservoir operations are mostly influenced by the principles that manage local watershed production. The differences in reservoir operation during droughts are the result of modeling assumptions that balance reservoir storage among SFPUC reservoirs and the selection of the monthly SJPL conveyance rate. It is anticipated that the difference in Calaveras Reservoir operation during actual operations would be minimal, if any difference occurred at all.

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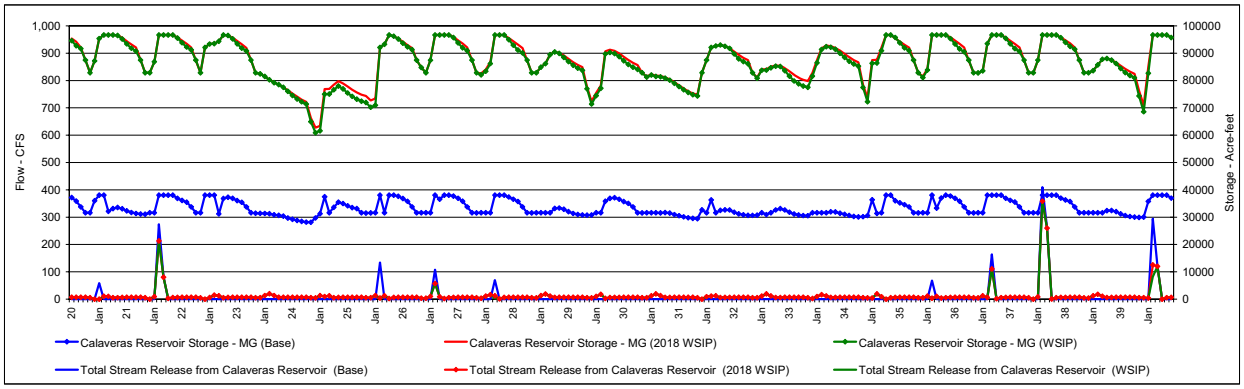
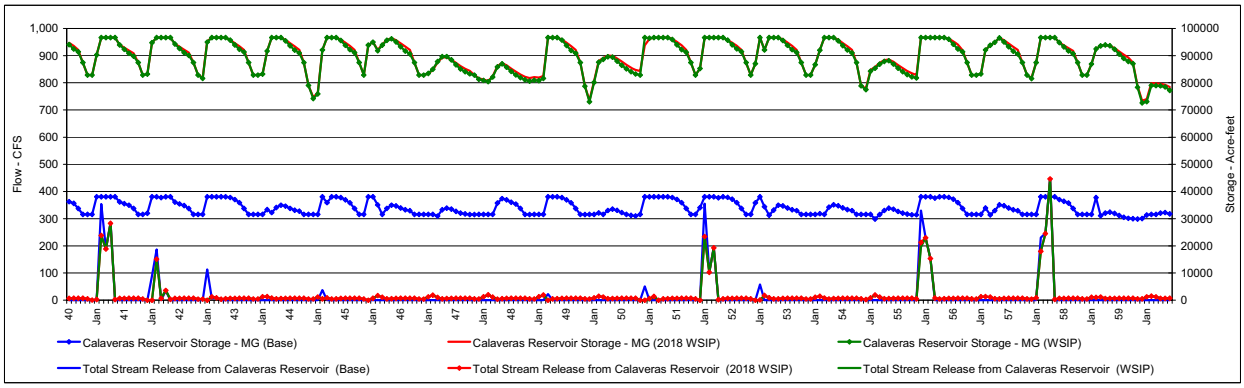
Figure 2.6-1
Calaveras Reservoir Storage and Stream Release

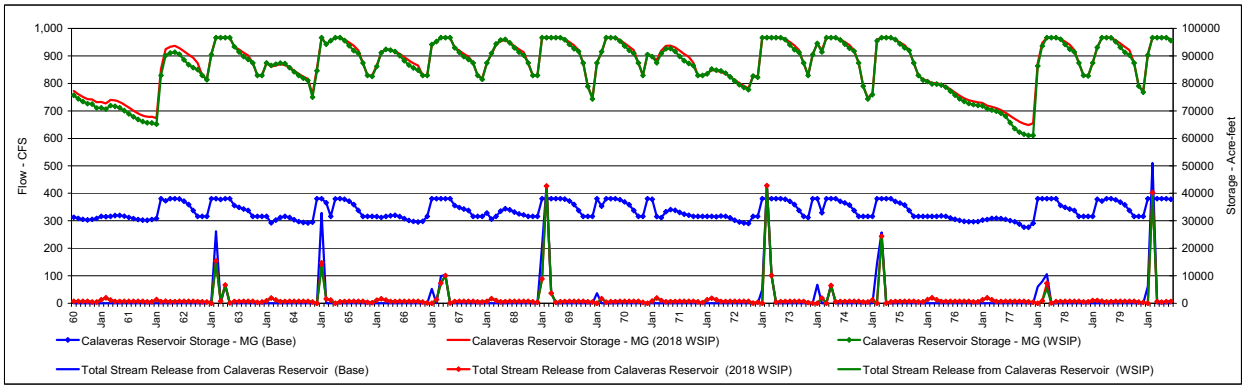
1920 - 1939



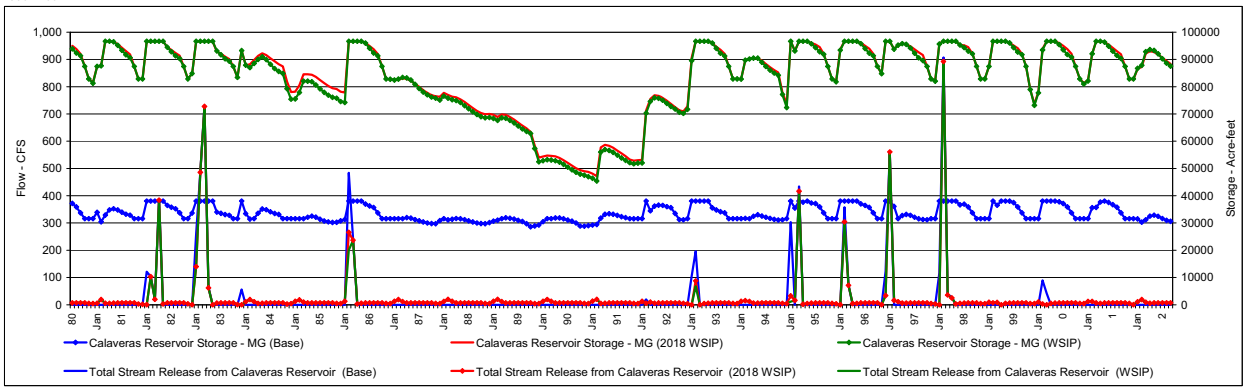
1940 - 1959



1960 - 1979



1980 - 2002



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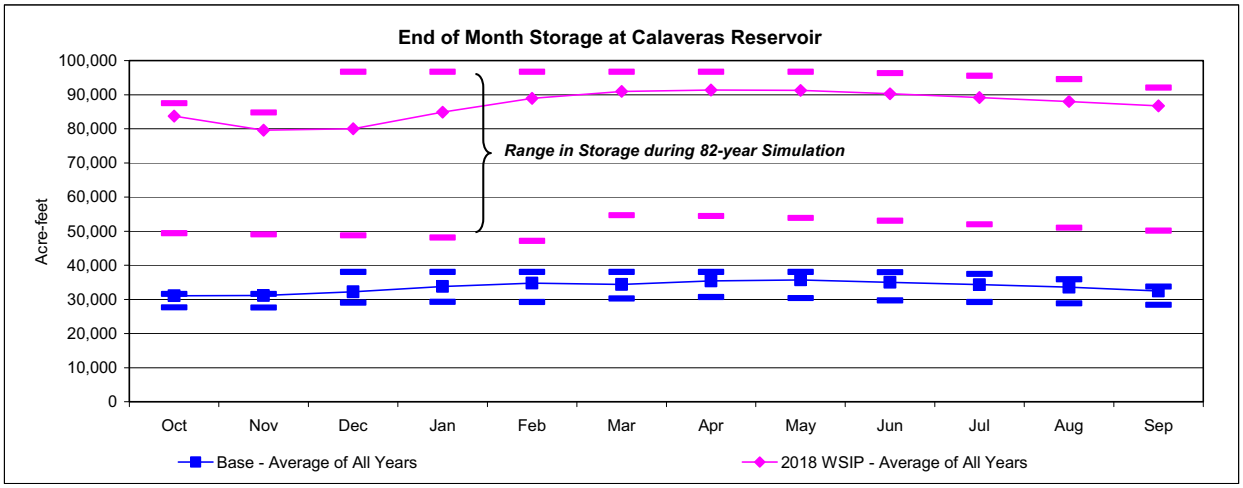
The difference in storage between the variant and WSIP settings and the base setting is due to the restoration of the operational capacity of Calaveras Reservoir. Under both the variant and WSIP settings the full capacity of Calaveras Reservoir would be available, and a greater range in storage operation would occur. Figure 2.6-2 illustrates the average monthly storage in Calaveras Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings.

Figure 2.6-2



Compared to the WSIP setting, there would be the potential for either less or more release to Calaveras Creek below Calaveras Dam in the variant setting. Both settings require fishery releases below Calaveras Reservoir that are not included in the base setting. Calaveras Reservoir storage in the variant setting is sometimes more or sometimes less than in the WSIP setting; however, in either direction the difference is minor. Table 2.6-1 illustrates the difference in releases to Calaveras Creek between the variant and WSIP settings (considered insubstantial). Supplementing the Figure 2.6-1 representation of Calaveras Dam stream releases and Table 2.6-1 is Table 2.6-2, which illustrates the releases for the variant and WSIP settings, and the difference in releases between the two. Table 2.6-3 provides the same form of information for the variant and base settings. The notable difference in releases between the variant and base settings is the addition of the required flows to satisfy the 1997 CDFG MOU and the reduction of stream releases during wetter-year, wetter-season flows due to the restoration of Calaveras Reservoir operational capacity.

There would be very little, if any, difference in Alameda Creek diversions to Calaveras Reservoir in the variant setting compared to the WSIP setting. With essentially the same storage conditions between the two settings, there would be no difference in diversions from the Alameda Creek watershed. With no difference in diversions at Alameda Creek Diversion Dam (ACDD), flow spilling past the diversion dam would be the same in the variant setting. Table 2.6-4 illustrates the difference in flow below the ACDD between the variant and WSIP settings (considered insubstantial).

Table 2.6-5 illustrates the difference in flow below the ACDD between the variant and base settings. In this comparison, the reduction in flow below the diversion dam is due to the additional diversions to Calaveras Reservoir resulting from the restoration of reservoir operating capacity. Table 2.6-6 and Table 2.6-7 illustrate the flow past the ACDD, comparing the variant, WSIP, and base settings by year type and the average of all years.

APPENDIX O3

Table 2.6-1

Difference in Total Stream Release from Calaveras Reservoir (Acre-feet) 2018 WSIP minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	11	0	0	0	0	0	0	0	11
1928	0	0	0	0	0	583	0	0	0	0	0	0	583
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	0	0	0	0	0	0	0	0	0
1937	0	0	0	0	0	0	0	0	0	0	0	0	0
1938	0	0	0	0	-1	0	0	0	0	0	0	0	-1
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	2,379	0	0	0	0	0	0	0	2,379
1941	0	0	0	0	18	0	0	0	0	0	0	0	18
1942	0	0	0	0	0	0	-52	0	0	0	0	0	-52
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	384	0	0	0	0	0	0	0	0	384
1952	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	1,044	0	0	0	0	0	0	0	0	0	1,044
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	291	0	0	0	0	0	0	0	291
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	954	0	0	0	0	0	0	0	0	954
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	-6	0	0	0	0	0	0	-6
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	26	0	0	0	0	0	0	0	26
1974	0	0	0	0	0	-132	0	0	0	0	0	0	-132
1975	0	0	0	0	0	447	0	0	0	0	0	0	447
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	1,136	0	0	0	0	0	0	1,136
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	447	0	0	0	0	0	0	0	447
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	3,629	0	0	0	0	0	0	0	3,629
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	1,110	0	0	0	0	0	0	0	1,110
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	1,311	0	0	0	0	0	0	0	0	1,311
1996	0	0	0	0	354	0	0	0	0	0	0	0	354
1997	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	291	0	0	0	0	0	0	0	291
1999	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	0	0	13	32	104	25	-1	0	0	0	0	0	173

APPENDIX O3

Table 2.6-2

Total Stream Release from Calaveras Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP Sep	WY Total
Wet	429	246	1,063	5,067	14,701	9,862	5,082	255	386	417	425	415	38,348
Above Normal	425	258	172	825	3,440	2,773	606	327	396	424	428	417	10,490
Normal	429	275	194	548	725	543	265	370	408	428	430	417	5,031
Below Normal	428	275	246	672	876	596	345	389	411	430	430	417	5,515
Dry	429	292	281	778	1,044	747	375	407	416	430	430	417	6,044
All Years	428	269	387	1,558	4,108	2,874	1,314	350	403	426	428	417	12,962

Total Stream Release from Calaveras Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	429	246	998	4,985	14,425	9,862	5,085	255	386	417	425	415	37,928
Above Normal	425	258	172	746	3,196	2,688	606	327	396	424	428	417	10,082
Normal	429	275	194	548	725	506	265	370	408	428	430	417	4,995
Below Normal	428	275	246	672	876	596	345	389	411	430	430	417	5,515
Dry	429	292	281	778	1,044	747	375	407	416	430	430	417	6,044
All Years	428	269	374	1,526	4,004	2,850	1,314	350	403	426	428	417	12,788

Difference in Total Stream Release from Calaveras Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP minus WSIP Sep	WY Total
Wet	0	0	65	82	276	0	-3	0	0	0	0	0	419
Above Normal	0	0	0	79	244	85	0	0	0	0	0	0	408
Normal	0	0	0	0	0	36	0	0	0	0	0	0	36
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	13	32	104	25	-1	0	0	0	0	0	173

Table 2.6-3

Total Stream Release from Calaveras Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP Sep	WY Total
Wet	429	246	1,063	5,067	14,701	9,862	5,082	255	386	417	425	415	38,348
Above Normal	425	258	172	825	3,440	2,773	606	327	396	424	428	417	10,490
Normal	429	275	194	548	725	543	265	370	408	428	430	417	5,031
Below Normal	428	275	246	672	876	596	345	389	411	430	430	417	5,515
Dry	429	292	281	778	1,044	747	375	407	416	430	430	417	6,044
All Years	428	269	387	1,558	4,108	2,874	1,314	350	403	426	428	417	12,962

Total Stream Release from Calaveras Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base Sep	WY Total
Wet	0	0	1,741	9,267	16,622	9,968	5,024	0	0	0	0	0	42,623
Above Normal	0	0	184	2,685	5,918	3,096	459	0	0	0	0	0	12,342
Normal	0	0	216	364	898	353	0	0	0	0	0	0	1,831
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	420	2,436	4,645	2,656	1,076	0	0	0	0	0	11,233

Difference in Total Stream Release from Calaveras Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP minus Base Sep	WY Total
Wet	429	246	-678	-4,200	-1,921	-106	57	255	386	417	425	415	-4,275
Above Normal	425	258	-12	-1,860	-2,477	-323	147	327	396	424	428	417	-1,852
Normal	429	275	-22	184	-173	190	265	370	408	428	430	417	3,200
Below Normal	428	275	246	672	876	596	345	389	411	430	430	417	5,515
Dry	429	292	281	778	1,044	747	375	407	416	430	430	417	6,044
All Years	428	269	-33	-878	-537	219	238	350	403	426	428	417	1,729

APPENDIX O3

Table 2.6-4

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet) 2018 WSIP minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	447	0	0	0	0	0	0	0	447
1937	0	0	0	0	0	0	0	0	0	0	0	0	0
1938	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	0	0	0	0	0	0	0	0
1941	0	0	0	0	0	0	0	0	0	0	0	0	0
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	291	0	0	0	0	0	0	0	291
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	4,282	-3,001	-212	0	0	0	0	0	0	0	1,068
1952	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	204	0	0	0	0	0	0	0	0	204
1974	0	0	0	0	0	1,842	0	0	0	0	0	0	1,842
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	0	0	52	-34	6	22	0	0	0	0	0	0	47

APPENDIX O3

Table 2.6-5

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet) 2018 WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	-2,559	-1,946	0	0	0	0	0	0	0	-4,505
1922	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	-2,856	-1,688	-1,004	0	0	0	0	0	0	0	-5,547
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	-3,210	0	0	0	0	0	0	0	-3,210
1927	0	0	0	0	0	0	235	0	0	0	0	0	235
1928	0	0	0	0	0	0	-214	0	0	0	0	0	-214
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	-2,422	0	0	0	0	0	0	0	-2,422
1937	0	0	0	0	-3,964	0	0	0	0	0	0	0	-3,964
1938	0	0	0	0	0	0	-187	0	0	0	0	0	-187
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	0	-156	0	0	0	0	0	-156
1941	0	0	0	-1,197	0	0	0	0	0	0	0	0	-1,197
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	-1,822	0	0	0	0	0	0	0	-1,822
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	-4,471	0	0	0	0	0	0	0	-4,471
1946	0	0	-4,651	-1,522	0	0	0	0	0	0	0	0	-6,173
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	-5,524	0	0	0	0	0	0	-5,524
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	-2,793	-1,287	301	0	0	0	0	0	0	-3,779
1952	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	-3,956	0	0	0	0	0	0	0	0	-3,956
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	-3,275	0	0	0	0	0	0	0	-3,275
1963	0	0	0	-2,219	0	0	0	0	0	0	0	0	-2,219
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	-1,163	0	0	0	3,250	0	0	0	0	0	2,087
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	-1,676	-1,872	0	0	0	0	0	0	0	-3,548
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	-4,247	0	-1,623	0	0	0	0	0	0	-5,870
1971	0	0	-1,260	0	0	0	0	0	0	0	0	0	-1,260
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	-4,722	0	0	0	0	0	0	0	0	-4,722
1974	0	0	-791	0	0	1,444	0	0	0	0	0	0	653
1975	0	0	0	0	-5,196	0	-180	0	0	0	0	0	-5,376
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	-4,152	-3,403	0	0	0	0	0	0	0	-7,556
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	-3,360	0	-482	0	0	0	0	0	0	-3,842
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	687	0	0	0	0	687
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	-3,354	0	0	0	0	0	0	0	-3,354
1993	0	0	0	-4,999	0	651	0	0	0	0	0	0	-4,349
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	-5,239	0	0	0	0	0	0	0	0	-5,239
1997	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	-3,223	0	1,392	0	0	0	0	0	-1,831
2000	0	0	0	0	-4,567	0	0	0	0	0	0	0	-4,567
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	0	0	-131	-541	-549	-64	50	8	0	0	0	0	-1,225

APPENDIX O3

Table 2.6-6

Flow Passing Alameda Creek Diversion Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP Sep	WY Total
Wet	0	28	1,379	6,282	7,982	5,727	2,960	173	0	0	0	0	24,531
Above Normal	7	23	843	2,281	3,740	3,237	959	0	0	0	0	0	11,091
Normal	0	6	585	260	824	459	113	0	0	0	0	0	2,247
Below Normal	0	0	18	45	102	229	0	0	0	0	0	0	394
Dry	0	0	0	0	57	0	0	0	0	0	0	0	58
All Years	1	12	562	1,759	2,526	1,926	798	34	0	0	0	0	7,617

Flow Passing Alameda Creek Diversion Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	0	28	1,379	6,269	7,982	5,727	2,960	173	0	0	0	0	24,518
Above Normal	7	23	591	2,457	3,735	3,129	959	0	0	0	0	0	10,903
Normal	0	6	585	260	796	459	113	0	0	0	0	0	2,219
Below Normal	0	0	18	45	102	229	0	0	0	0	0	0	394
Dry	0	0	0	0	57	0	0	0	0	0	0	0	58
All Years	1	12	509	1,793	2,520	1,903	798	34	0	0	0	0	7,570

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP minus WSIP Sep	WY Total
Wet	0	0	0	13	0	0	0	0	0	0	0	0	13
Above Normal	0	0	252	-177	5	108	0	0	0	0	0	0	188
Normal	0	0	0	0	28	0	0	0	0	0	0	0	28
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	52	-34	6	22	0	0	0	0	0	0	47

Table 2.6-7

Flow Passing Alameda Creek Diversion Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP Sep	WY Total
Wet	0	28	1,379	6,282	7,982	5,727	2,960	173	0	0	0	0	24,531
Above Normal	7	23	843	2,281	3,740	3,237	959	0	0	0	0	0	11,091
Normal	0	6	585	260	824	459	113	0	0	0	0	0	2,247
Below Normal	0	0	18	45	102	229	0	0	0	0	0	0	394
Dry	0	0	0	0	57	0	0	0	0	0	0	0	58
All Years	1	12	562	1,759	2,526	1,926	798	34	0	0	0	0	7,617

Flow Passing Alameda Creek Diversion Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base Sep	WY Total
Wet	0	28	1,379	6,967	8,099	5,757	2,972	130	0	0	0	0	25,331
Above Normal	7	23	1,126	3,672	5,294	3,096	692	0	0	0	0	0	13,911
Normal	0	6	954	868	1,870	906	126	0	0	0	0	0	4,731
Below Normal	0	0	18	45	102	229	0	0	0	0	0	0	394
Dry	0	0	0	0	57	0	0	0	0	0	0	0	58
All Years	1	12	692	2,299	3,075	1,989	748	26	0	0	0	0	8,843

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP minus Base Sep	WY Total
Wet	0	0	0	-685	-117	-30	-12	43	0	0	0	0	-801
Above Normal	0	0	-283	-1,391	-1,554	141	267	0	0	0	0	0	-2,820
Normal	0	0	-369	-608	-1,046	-447	-13	0	0	0	0	0	-2,483
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-131	-541	-549	-64	50	8	0	0	0	0	-1,225

Comparing the variant and WSIP settings, differences in releases from Calaveras Dam to the stream and differences to spills at the ACDD result in differences in flow below the Alameda Creek and Calaveras Creek confluence between the settings. Table 2.6-8 illustrates the flow below the confluence for the variant and WSIP settings. The modeled differences in these parameters were described above as insubstantial, and thus the combined effect of the differences at the confluence would also be insubstantial. Fishery releases for the 1997 MOU are assumed in both of the settings. Table 2.6-9 provides the same form of information for the variant and base settings. The notable differences between the variant and base settings (comparable to the differences between the WSIP and base settings) are the addition of required stream flows for the 1997 MOU and the reduction of wetter-year, wet-season flows due to the restoration of Calaveras Reservoir storage.

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Table 2.6-8

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP Sep	WY Total
Wet	430	326	2,786	12,358	23,871	16,574	8,643	605	417	429	429	417	67,286
Above Normal	437	326	1,259	3,703	7,956	6,572	1,876	430	418	430	429	417	24,255
Normal	429	304	1,006	1,077	1,935	1,329	536	430	417	429	430	417	8,739
Below Normal	429	297	324	859	1,214	1,046	417	430	417	430	430	417	6,709
Dry	429	298	307	813	1,168	816	418	430	417	430	430	417	6,373
All Years	431	310	1,128	3,726	7,164	5,232	2,348	464	417	430	429	417	22,497

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	430	326	2,721	12,263	23,595	16,575	8,647	605	417	429	429	417	66,854
Above Normal	437	326	1,007	3,801	7,708	6,379	1,876	430	418	430	429	417	23,658
Normal	429	304	1,006	1,077	1,907	1,293	536	430	417	429	430	417	8,675
Below Normal	429	297	324	859	1,214	1,046	417	430	417	430	430	417	6,709
Dry	429	298	307	813	1,168	816	418	430	417	430	430	417	6,373
All Years	431	310	1,063	3,728	7,053	5,185	2,349	464	417	430	429	417	22,276

Difference in Flow below Alameda/Calaveras Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP minus WSIP Sep	WY Total
Wet	0	0	65	95	276	0	-3	0	0	0	0	0	432
Above Normal	0	0	252	-98	248	194	0	0	0	0	0	0	596
Normal	0	0	0	0	28	36	0	0	0	0	0	0	64
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	65	-2	111	47	-1	0	0	0	0	0	220

Table 2.6-9

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP Sep	WY Total
Wet	430	326	2,786	12,358	23,871	16,574	8,643	605	417	429	429	417	67,286
Above Normal	437	326	1,259	3,703	7,956	6,572	1,876	430	418	430	429	417	24,255
Normal	429	304	1,006	1,077	1,935	1,329	536	430	417	429	430	417	8,739
Below Normal	429	297	324	859	1,214	1,046	417	430	417	430	430	417	6,709
Dry	429	298	307	813	1,168	816	418	430	417	430	430	417	6,373
All Years	431	310	1,128	3,726	7,164	5,232	2,348	464	417	430	429	417	22,497

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base Sep	WY Total
Wet	1	80	3,465	17,243	25,909	16,711	8,598	307	30	12	4	2	72,361
Above Normal	12	68	1,554	6,954	11,987	6,754	1,462	103	22	6	2	1	28,926
Normal	1	29	1,397	1,501	3,154	1,586	284	60	9	2	0	0	8,022
Below Normal	1	22	78	186	338	450	72	41	7	0	0	0	1,195
Dry	1	6	26	35	124	69	43	23	1	0	0	0	328
All Years	3	41	1,292	5,145	8,250	5,077	2,060	106	14	4	1	1	21,993

Difference in Flow below Alameda/Calaveras Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP minus Base Sep	WY Total
Wet	429	246	-678	-4,885	-2,038	-136	46	298	386	417	425	415	-5,075
Above Normal	425	258	-295	-3,251	-4,031	-182	414	327	396	424	428	417	-4,671
Normal	429	275	-391	-424	-1,219	-257	251	370	408	428	430	417	717
Below Normal	428	275	246	672	876	596	345	389	411	430	430	417	5,515
Dry	429	292	281	778	1,044	747	375	407	416	430	430	417	6,044
All Years	428	269	-164	-1,419	-1,086	155	288	358	403	426	428	417	504

A flow recapture facility in Alameda Creek below Calaveras Reservoir is incorporated in the variant and WSIP settings. This facility is assumed to recapture flows explicitly released from Calaveras Dam for the 1997 MOU. The effect of the recapture would be a reduction in the flow below the confluence of Alameda and Calaveras Creeks, but only to the extent that releases were explicitly made from Calaveras Reservoir for the 1997 MOU. Flows below this diversion have been estimated and noted as the flow above the Alameda Creek and San Antonio Creek confluence. Table 2.6-10 illustrates the flow at this location for the variant and WSIP settings. The flow changes at this location are consistent with the changes noted for below the confluence of Alameda and Calaveras Creeks. These flow changes are considered insubstantial. Table 2.6-11 provides the same form of information for the variant and base settings. The flows identified at this location are indicative of flow occurring below the confluence of Alameda and Calaveras Creeks (described above) with the addition of estimated stream accretions between the Alameda and Calaveras Creek confluence and the Alameda and San Antonio Creek confluence, less the water assumed to be recaptured (diverted) by the SFPUC from the creek.

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Table 2.6-10

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP Sep	WY Total
Wet	6	154	3,178	13,705	25,474	17,719	9,294	556	76	33	15	9	70,220
Above Normal	19	150	1,455	4,230	8,670	7,073	2,127	217	54	20	9	6	24,031
Normal	7	64	1,131	909	1,768	1,255	466	128	28	9	4	3	5,770
Below Normal	7	56	183	404	678	717	154	91	20	5	3	2	2,321
Dry	6	19	70	98	231	145	91	48	9	3	2	2	724
All Years	9	89	1,194	3,831	7,299	5,346	2,395	207	38	14	7	4	20,432

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	6	154	3,113	13,610	25,199	17,720	9,297	556	76	33	15	9	69,788
Above Normal	19	150	1,203	4,350	8,422	6,871	2,127	217	54	20	9	6	23,450
Normal	7	64	1,131	909	1,740	1,219	466	128	28	9	4	3	5,706
Below Normal	7	56	183	404	678	717	154	91	20	5	3	2	2,321
Dry	6	19	70	98	231	145	91	48	9	3	2	2	724
All Years	9	89	1,129	3,838	7,188	5,297	2,396	207	38	14	7	4	20,215

Difference in Alameda Creek Flow abv San Antonio Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP minus WSIP Sep	WY Total
Wet	0	0	65	95	276	0	-3	0	0	0	0	0	432
Above Normal	0	0	252	-120	248	201	0	0	0	0	0	0	581
Normal	0	0	0	0	28	36	0	0	0	0	0	0	64
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	65	-7	111	49	-1	0	0	0	0	0	217

Table 2.6-11

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP Sep	WY Total
Wet	6	154	3,178	13,705	25,474	17,719	9,294	556	76	33	15	9	70,220
Above Normal	19	150	1,455	4,230	8,670	7,073	2,127	217	54	20	9	6	24,031
Normal	7	64	1,131	909	1,768	1,255	466	128	28	9	4	3	5,770
Below Normal	7	56	183	404	678	717	154	91	20	5	3	2	2,321
Dry	6	19	70	98	231	145	91	48	9	3	2	2	724
All Years	9	89	1,194	3,831	7,299	5,346	2,395	207	38	14	7	4	20,432

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base Sep	WY Total
Wet	6	154	3,973	18,714	27,673	17,977	9,358	513	76	33	15	9	78,502
Above Normal	19	150	1,922	7,772	13,068	7,467	1,861	217	54	20	9	6	32,566
Normal	7	64	1,716	1,881	3,712	2,007	479	128	28	9	4	3	10,037
Below Normal	7	56	183	404	678	717	154	91	20	5	3	2	2,321
Dry	6	19	70	98	231	145	91	48	9	3	2	2	724
All Years	9	89	1,560	5,733	9,019	5,624	2,355	198	38	14	7	4	24,650

Difference in Alameda Creek Flow abv San Antonio Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP minus Base Sep	WY Total
Wet	0	0	-795	-5,009	-2,198	-258	-64	43	0	0	0	0	-8,282
Above Normal	0	0	-467	-3,542	-4,397	-394	266	0	0	0	0	0	-8,535
Normal	0	0	-585	-972	-1,944	-752	-13	0	0	0	0	0	-4,267
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-366	-1,901	-1,720	-279	40	8	0	0	0	0	-4,218

Compared to the WSIP setting, the variant's San Antonio Reservoir operation would typically draw less from storage on an annual basis, particularly during cyclic maintenance. Figure 2.6-3 illustrates a chronological trace of the simulation of San Antonio Reservoir storage and stream releases from San Antonio Dam. Shown in Figure 2.6-3 are the results for the WSIP, variant, and base settings. The difference in San Antonio Reservoir storage between the variant and WSIP settings is mostly caused by the lesser demand of the variant. Considering that Calaveras Reservoir storage is essentially the same between the settings, the difference in San Antonio Reservoir storage is indicative of the operational strategy to affect storage in San Antonio Reservoir more than storage in the other SFPUC Bay Area reservoirs. San Antonio Reservoir would retain more storage in the variant setting compared to the WSIP setting.

The difference in storage between the variant and WSIP settings and the base setting is due to the restoration of the operational capacity of Calaveras Reservoir. In the base setting, the limited operating storage capacity at Calaveras Reservoir leads to a different operation at San Antonio Reservoir, one that retains relatively more stored water for system demands when the draw from Calaveras Reservoir is constrained due to limited storage. There is also a notable difference in storage operation between the variant and WSIP settings and the base setting due to assumed maintenance. Assumed systematic maintenance of Hetch Hetchy conveyance facilities constrains diversions to the Bay Area from Hetch Hetchy every year, and particularly during every fifth year in the WSIP and variant settings.

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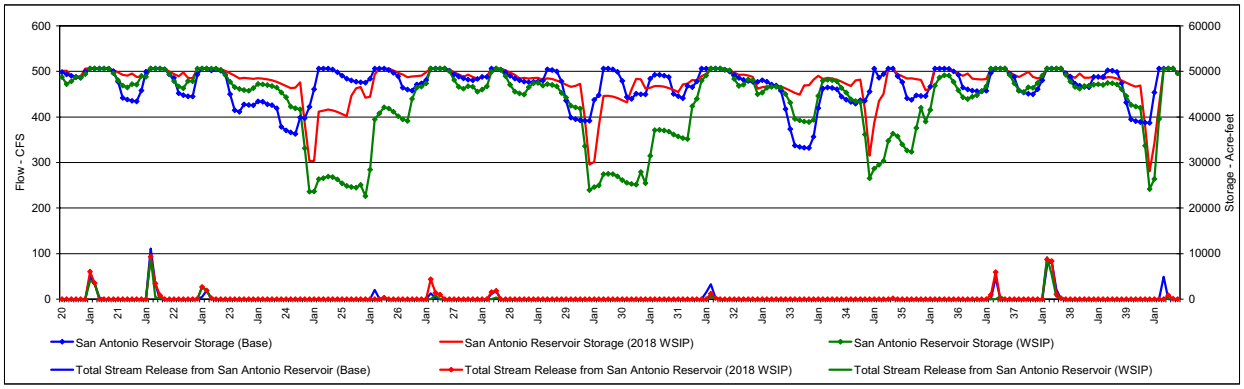
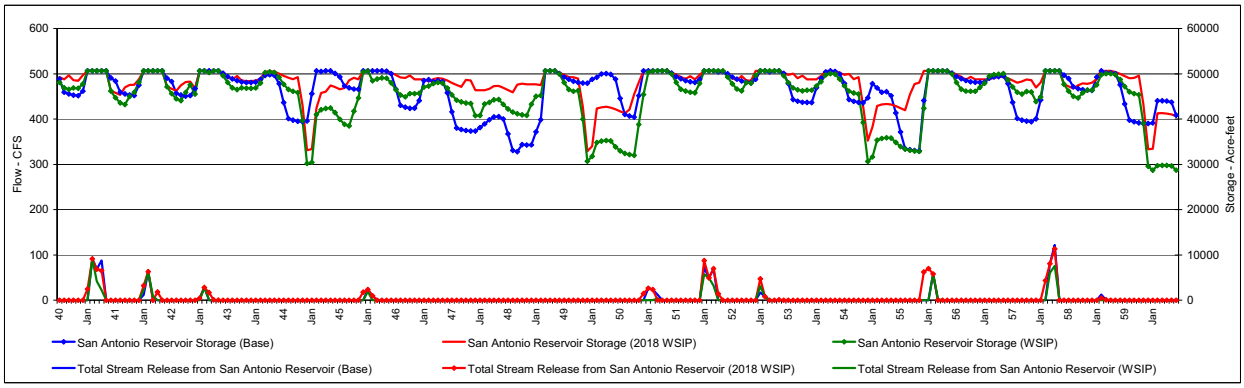
Figure 2.6-3
San Antonio Reservoir Storage and Stream Release

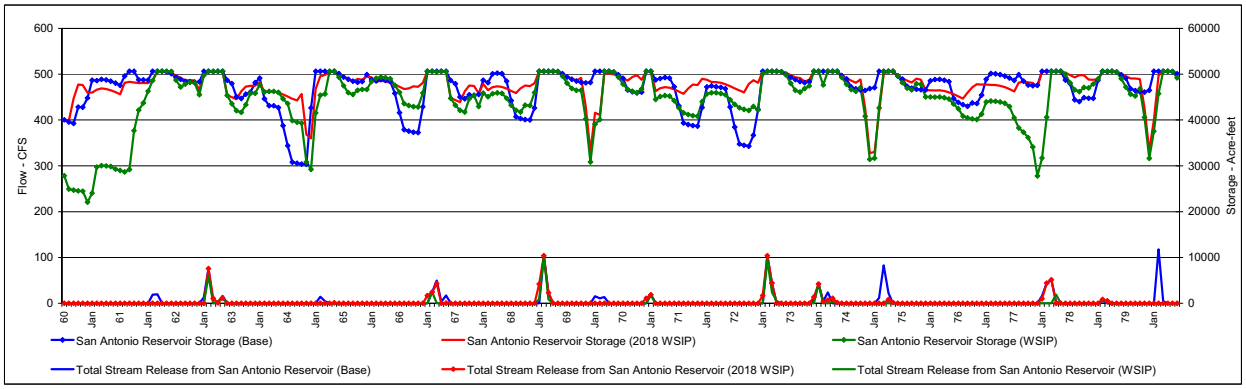
1920 - 1939



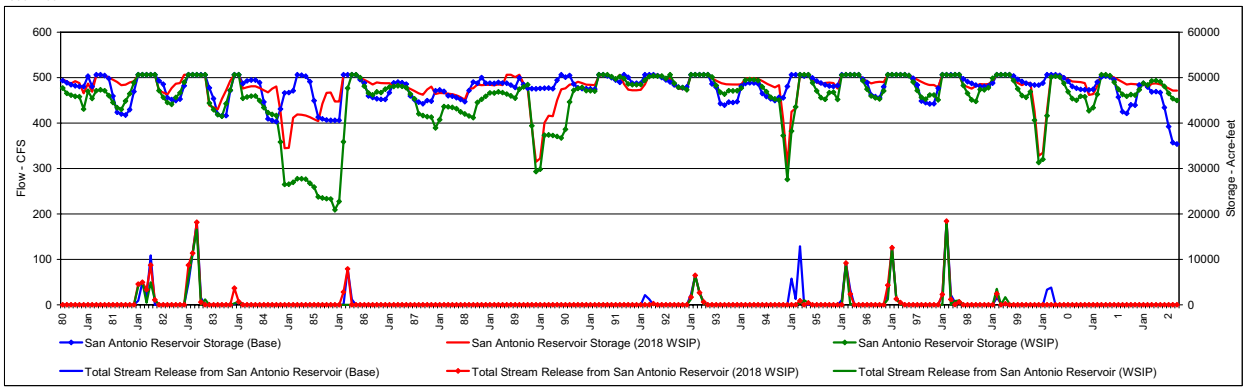
1940 - 1959



1960 - 1979

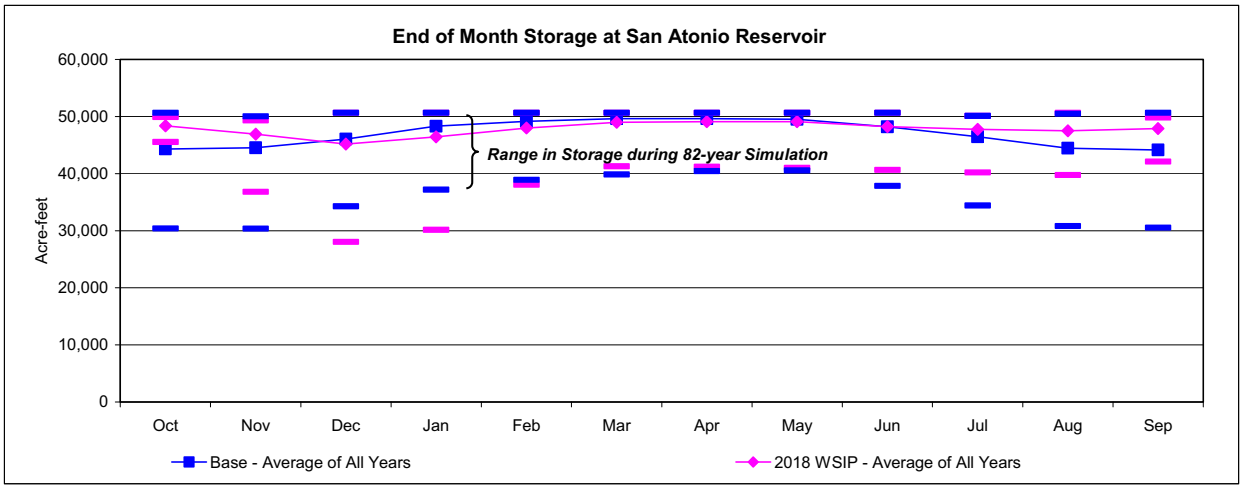


1980 - 2002



The reduction in diversion from Hetch Hetchy during these periods is accommodated in the system by drawing additional water from the Bay Area reservoirs. The proportionate share of this operation that is directed toward San Antonio Reservoir is evident in the tracing of San Antonio Reservoir storage for the variant and WSIP settings. Figure 2.6-4 illustrates the average monthly storage in San Antonio Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings. Compared to the base setting, the variant would draw less storage from San Antonio Reservoir, typically retaining a fuller reservoir except during the cyclic maintenance period November through January.

Figure 2.6-4



There is very little anticipated change in stream releases below San Antonio Reservoir between the variant and WSIP settings. Table 2.6-12 illustrates the modeled releases to San Antonio Creek from San Antonio Reservoir for the two settings and the differences for the average release during a year type. With a different reservoir operation at times during the winter, as seen in Figure 2.6-4, it is expected that there would be a difference in the ability to regulate reservoir inflow and avoid stream releases. Given the sometimes rigid constraints within the modeling assumptions, the model will overestimate the frequency and magnitude of stream releases from San Antonio Reservoir under any of the investigated settings. The flexibility that occurs in actual operations would likely avoid most of the releases represented by the model. The modeled stream releases from San Antonio Reservoir and the difference between releases for the variant and base setting are shown in Table 2.6-13. The differences between the two settings reflect a slight decrease in modeled releases. This modeled circumstance reflects the different resulting storage operation between the two settings, as seen in Figure 2.6-3. In most instances, the variant setting storage at San Antonio Reservoir during a period would be lower than that projected for the base setting during the same period. This circumstance could lead to an occasionally lesser modeled release for the variant setting, which is reflected in the results. As described above, the model will overestimate the frequency and magnitude of releases from San Antonio Reservoir, and the actual releases from the reservoir in any setting and the difference between settings are expected to be minor.

Flow below the confluence of Alameda and San Antonio Creeks is influenced by releases from San Antonio Creek and flow arriving at the location from Alameda Creek, which includes upstream impairment by SFPUC operations and facilities. Table 2.6-14 illustrates the flow below the confluence for the variant and WSIP settings, and the differences in flow between the two. The differences in flow between the variant and WSIP settings at this location are the net sum of the differences identified for flow reaching the location from Alameda Creek and from San Antonio Creek. The difference in flow from upstream in Alameda Creek was previously identified as insubstantial. Along with the conclusion that flow differences in San Antonio Creek would not be substantial, modeled differences below the confluence are also considered insubstantial.

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Table 2.6-12

Total Stream Release from San Antonio Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP Sep	WY Total
Wet	0	0	404	2,195	3,512	2,817	1,171	88	0	0	0	0	10,187
Above Normal	0	0	107	673	1,818	888	197	62	0	0	0	0	3,745
Normal	0	0	251	368	133	90	90	11	0	0	0	0	943
Below Normal	0	0	0	0	16	4	0	0	0	0	0	0	19
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	150	640	1,091	752	287	32	0	0	0	0	2,952

Total Stream Release from San Antonio Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	0	0	44	1,208	3,251	1,558	658	151	0	0	0	0	6,870
Above Normal	0	0	0	442	1,381	158	192	62	0	0	0	0	2,235
Normal	0	0	11	287	78	6	13	0	0	0	0	0	395
Below Normal	0	0	0	0	0	0	4	0	0	0	0	0	4
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	11	383	936	338	172	42	0	0	0	0	1,882

Difference in Total Stream Release from San Antonio Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP minus WSIP Sep	WY Total
Wet	0	0	360	987	261	1,259	513	-63	0	0	0	0	3,317
Above Normal	0	0	107	231	437	731	4	0	0	0	0	0	1,510
Normal	0	0	240	81	55	84	78	11	0	0	0	0	548
Below Normal	0	0	0	0	16	4	-4	0	0	0	0	0	15
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	139	256	155	414	115	-10	0	0	0	0	1,070

Table 2.6-13

Total Stream Release from San Antonio Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP Sep	WY Total
Wet	0	0	404	2,195	3,512	2,817	1,171	88	0	0	0	0	10,187
Above Normal	0	0	107	673	1,818	888	197	62	0	0	0	0	3,745
Normal	0	0	251	368	133	90	90	11	0	0	0	0	943
Below Normal	0	0	0	0	16	4	0	0	0	0	0	0	19
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	150	640	1,091	752	287	32	0	0	0	0	2,952

Total Stream Release from San Antonio Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base Sep	WY Total
Wet	0	0	101	1,322	3,669	3,288	1,398	94	0	0	0	0	9,872
Above Normal	0	0	26	687	1,909	1,487	116	58	0	0	0	0	4,283
Normal	0	0	7	370	441	237	65	0	0	0	0	0	1,120
Below Normal	0	0	0	0	41	0	0	0	0	0	0	0	41
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	26	472	1,206	996	309	30	0	0	0	0	3,041

Difference in Total Stream Release from San Antonio Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP minus Base Sep	WY Total
Wet	0	0	303	873	-157	-471	-227	-6	0	0	0	0	315
Above Normal	0	0	81	-14	-91	-599	81	4	0	0	0	0	-538
Normal	0	0	244	-1	-309	-147	26	11	0	0	0	0	-177
Below Normal	0	0	0	0	-26	4	0	0	0	0	0	0	-22
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	124	167	-115	-244	-23	2	0	0	0	0	-89

Table 2.6-14

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP Sep	WY Total
Wet	6	154	3,582	15,900	28,986	20,536	10,465	644	76	33	15	9	80,407
Above Normal	19	150	1,562	4,903	10,488	7,961	2,324	280	54	20	9	6	27,776
Normal	7	64	1,382	1,278	1,901	1,345	556	139	28	9	4	3	6,713
Below Normal	7	56	183	404	694	720	154	91	20	5	3	2	2,340
Dry	6	19	70	98	231	145	91	48	9	3	2	2	724
All Years	9	89	1,344	4,471	8,390	6,098	2,682	239	38	14	7	4	23,384

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	6	154	3,157	14,818	28,449	19,278	9,955	707	76	33	15	9	76,658
Above Normal	19	150	1,203	4,792	9,803	7,029	2,320	279	54	20	9	6	25,685
Normal	7	64	1,142	1,197	1,818	1,224	478	128	28	9	4	3	6,101
Below Normal	7	56	183	404	678	717	159	91	20	5	3	2	2,326
Dry	6	19	70	98	231	145	91	48	9	3	2	2	724
All Years	9	89	1,140	4,221	8,124	5,635	2,567	249	38	14	7	4	22,097

Difference in Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP minus WSIP Sep	WY Total
Wet	0	0	425	1,081	537	1,259	510	-63	0	0	0	0	3,749
Above Normal	0	0	359	111	685	932	4	0	0	0	0	0	2,091
Normal	0	0	240	81	83	121	78	11	0	0	0	0	612
Below Normal	0	0	0	0	16	4	-4	0	0	0	0	0	15
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	204	250	266	463	115	-10	0	0	0	0	1,288

Table 2.6-15 illustrates the same information for the variant and base settings. Table 2.6-15 shows the larger differences in flow that would occur between the variant and base settings. Those differences are particularly due to the effects of the restoration of Calaveras Reservoir operating capacity and the difference in San Antonio Reservoir storage operations.

Table 2.6-15

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP Sep	WY Total
Wet	6	154	3,582	15,900	28,986	20,536	10,465	644	76	33	15	9	80,407
Above Normal	19	150	1,562	4,903	10,488	7,961	2,324	280	54	20	9	6	27,776
Normal	7	64	1,382	1,278	1,901	1,345	556	139	28	9	4	3	6,713
Below Normal	7	56	183	404	694	720	154	91	20	5	3	2	2,340
Dry	6	19	70	98	231	145	91	48	9	3	2	2	724
All Years	9	89	1,344	4,471	8,390	6,098	2,682	239	38	14	7	4	23,384

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base Sep	WY Total
Wet	6	154	4,075	20,036	31,342	21,266	10,756	607	76	33	15	9	88,374
Above Normal	19	150	1,948	8,459	14,977	8,954	1,977	276	54	20	9	6	36,849
Normal	7	64	1,723	2,251	4,153	2,244	544	128	28	9	4	3	11,157
Below Normal	7	56	183	404	720	717	154	91	20	5	3	2	2,363
Dry	6	19	70	98	231	145	91	48	9	3	2	2	724
All Years	9	89	1,587	6,205	10,225	6,620	2,664	229	38	14	7	4	27,691

Difference in Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP minus Base Sep	WY Total
Wet	0	0	-492	-4,136	-2,355	-730	-291	37	0	0	0	0	-7,967
Above Normal	0	0	-386	-3,557	-4,489	-993	347	4	0	0	0	0	-9,073
Normal	0	0	-341	-973	-2,252	-899	12	11	0	0	0	0	-4,443
Below Normal	0	0	0	0	-26	4	0	0	0	0	0	0	-22
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-243	-1,734	-1,835	-523	17	10	0	0	0	0	-4,307

2.7 Crystal Springs and San Andreas Reservoirs

There are differences in Crystal Springs Reservoir operations among the WSIP, variant, and base settings. Figure 2.7-1 illustrates a chronological trace of the simulation of Crystal Springs Reservoir storage and stream releases from Crystal Springs Dam. Shown in Figure 2.7-1 are the results for the WSIP, variant, and base settings. Fundamental to the difference in storage operations between the WSIP and variant settings and the base setting is the restoration of reservoir operation capacity in the WSIP and variant setting that does not occur in the base setting. The result is the operation of Crystal Springs Reservoir at a lower maximum storage in the base setting. The difference in Crystal Springs Reservoir storage between the variant and WSIP settings is caused by the interaction of the increased demand served by the system's resources (a net 265 mgd for the variant and a net 290 mgd for the WSIP), which tends to lessen the operational range of the reservoir in the variant setting. Less drawdown and an accelerated replenishment of Crystal Springs Reservoir storage (as well as other Bay Area reservoirs) would occur with less systemwide demand to serve. The magnitude of the draw of storage from Crystal Springs Reservoir is partially dependent on the discretionary assumptions of the model that proportion the use of storage among the Bay Area system reservoirs. In actual operations, some of these differences may not occur, as system operators and prevailing hydraulic and hydrologic conditions may result in a different apportionment of effect among the reservoirs. However, the operational strategy prefers the retention of storage in the Peninsula reservoirs, similar to the strategy used by the model. Figure 2.7-2 illustrates the average monthly storage in Crystal Springs Reservoir for the 82-year simulation, and the range in storage for each month for the variant and WSIP settings.

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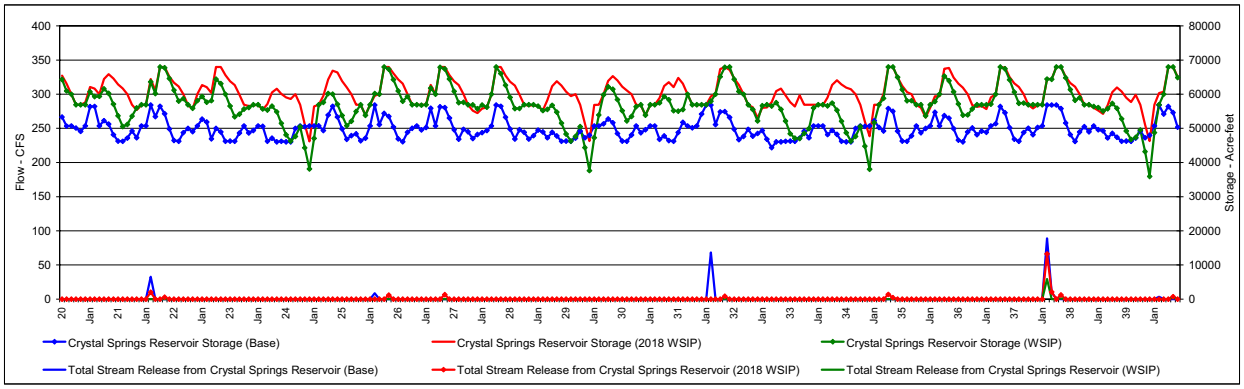
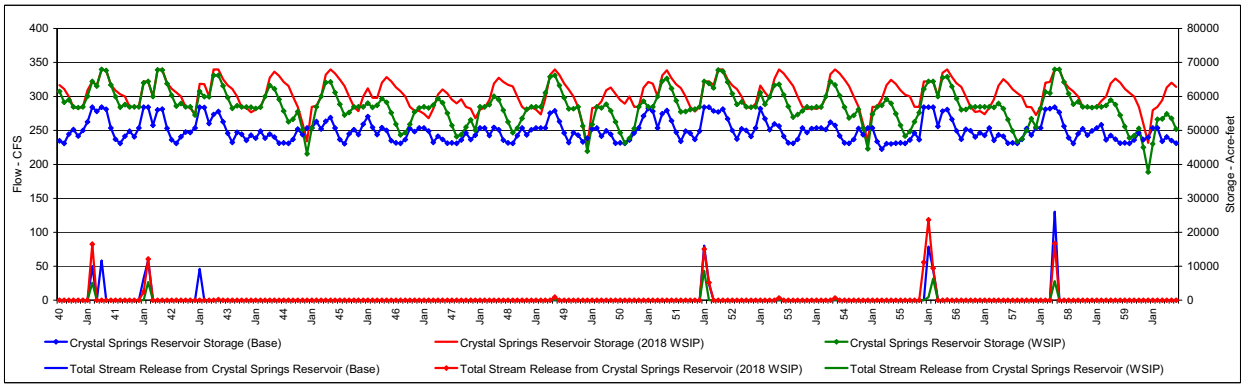
Figure 2.7-1
Crystal Springs Reservoir Storage and Release

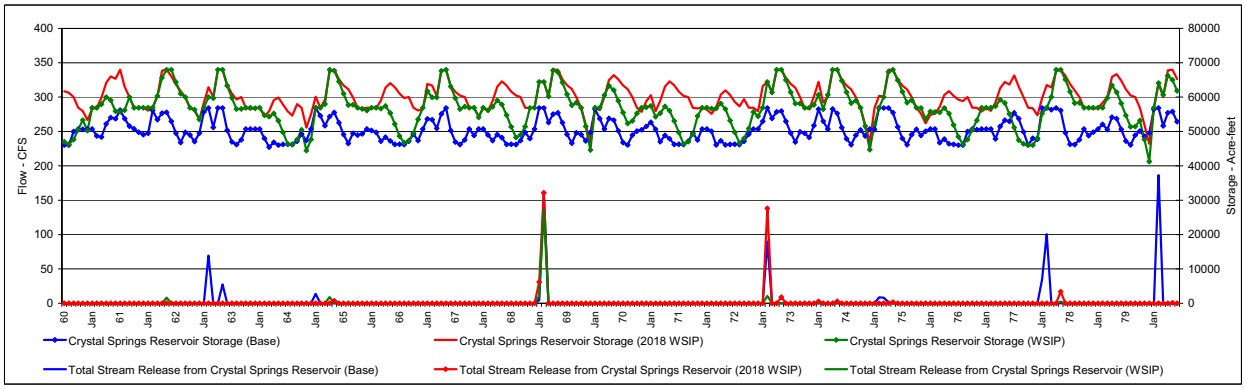
1920 - 1939



1940 - 1959



1960 - 1979



1980 - 2002

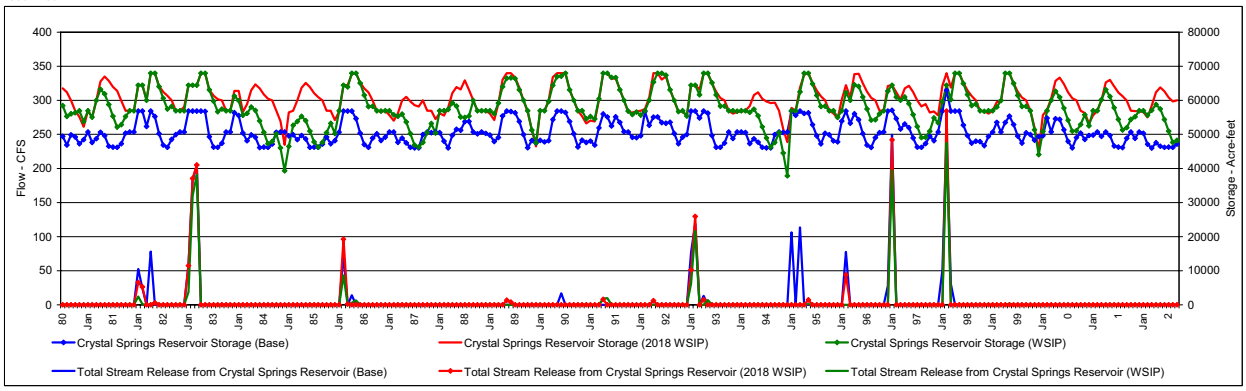


Figure 2.7-2

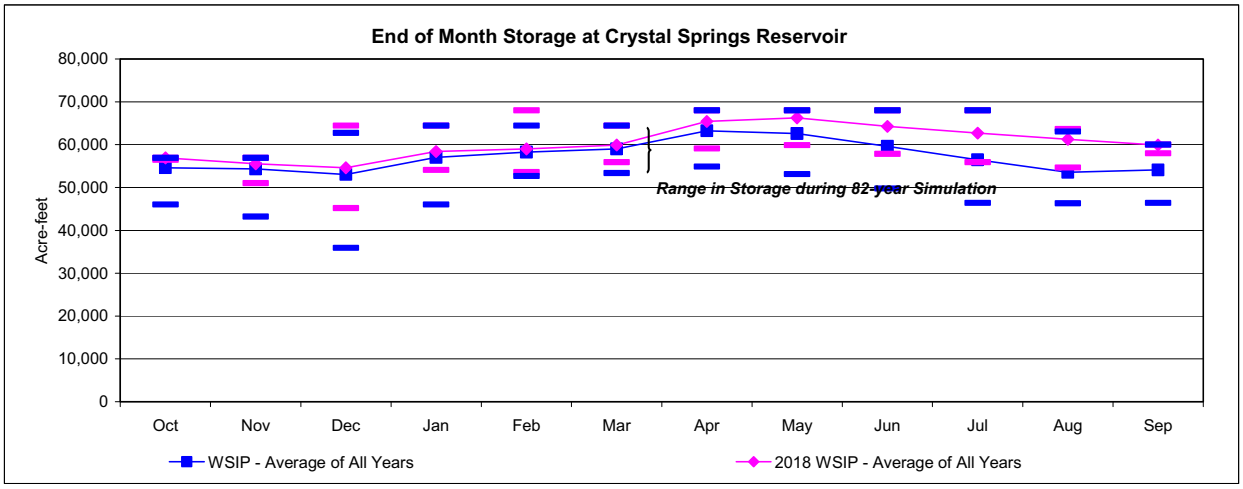


Figure 2.7-3 illustrates the average monthly storage in Crystal Springs Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings. The variant setting would result in reservoir storage operating at a higher average level during all months, and the range of operating storage would be larger in some months.

Figure 2.7-3

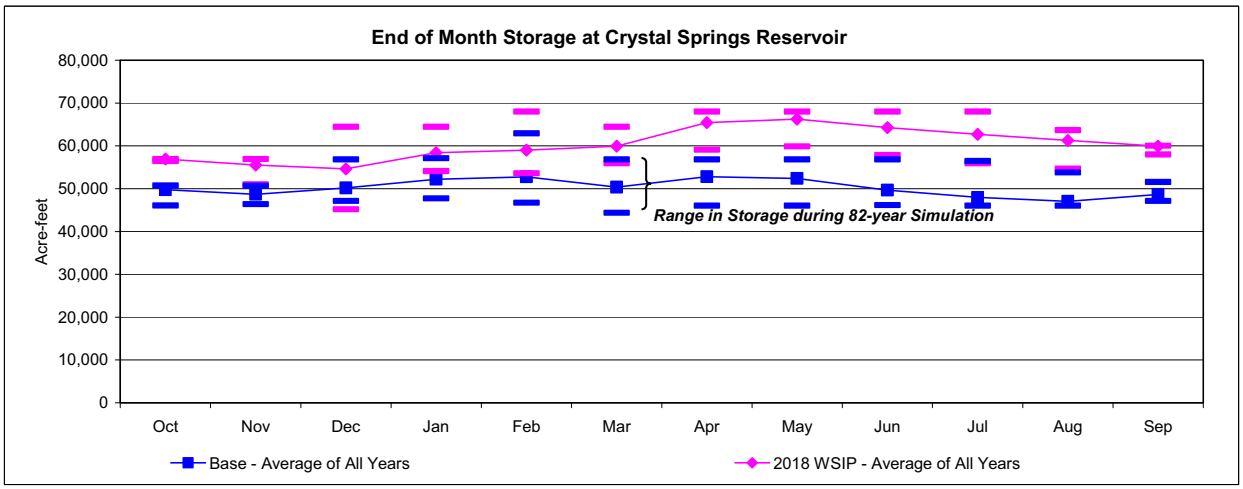


Table 2.7-1 illustrates the modeled variant and WSIP stream releases from Crystal Springs Reservoir and the differences between the two settings. Modeling results indicate that an increase or decrease in the occasional release could occur. The potential difference is attributed to a difference in the operating range of reservoir storage in the variant setting. In actual operations, it is anticipated that system operators would manage the reservoir system whereby stream releases would be minimal under any setting, and the effect would be essentially no difference between the variant and WSIP settings. Similarly, Table 2.7-2 illustrates the stream releases for the variant and base settings, and the difference in modeled flows between the two settings. A difference in Crystal Springs Reservoir storage between the two settings would lead to a different potential to regulate reservoir inflow, which could lead to different stream releases. However, as described above, actual system operations attempt to minimize releases under any setting, and thus the difference in releases between the variant and base setting is minimal, if any.

APPENDIX O3

Table 2.7-1

Total Stream Release from Crystal Springs Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP Sep	WY Total
Wet	0	0	215	2,186	4,073	833	310	101	0	0	0	0	7,718
Above Normal	0	0	0	195	600	0	26	140	0	0	0	0	960
Normal	0	0	0	0	0	0	48	77	0	0	0	0	125
Below Normal	0	0	0	0	0	0	28	12	0	0	0	0	39
Dry	0	0	0	0	0	0	0	26	15	0	0	0	41
All Years	0	0	42	467	919	163	81	71	3	0	0	0	1,745

Total Stream Release from Crystal Springs Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	0	0	0	1,098	2,435	732	115	48	0	0	0	0	4,428
Above Normal	0	0	0	111	353	0	32	47	0	0	0	0	544
Normal	0	0	0	0	0	0	0	31	0	0	0	0	31
Below Normal	0	0	0	0	0	0	31	35	0	0	0	0	67
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	237	548	143	36	33	0	0	0	0	997

Difference in Total Stream Release from Crystal Springs Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP minus WSIP Sep	WY Total
Wet	0	0	215	1,088	1,638	101	195	53	0	0	0	0	3,290
Above Normal	0	0	0	83	247	0	-6	92	0	0	0	0	416
Normal	0	0	0	0	0	0	48	46	0	0	0	0	94
Below Normal	0	0	0	0	0	0	-4	-24	0	0	0	0	-28
Dry	0	0	0	0	0	0	0	26	15	0	0	0	41
All Years	0	0	42	230	371	20	45	38	3	0	0	0	749

Table 2.7-2

Total Stream Release from Crystal Springs Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP Sep	WY Total
Wet	0	0	215	2,186	4,073	833	310	101	0	0	0	0	7,718
Above Normal	0	0	0	195	600	0	26	140	0	0	0	0	960
Normal	0	0	0	0	0	0	48	77	0	0	0	0	125
Below Normal	0	0	0	0	0	0	28	12	0	0	0	0	39
Dry	0	0	0	0	0	0	0	26	15	0	0	0	41
All Years	0	0	42	467	919	163	81	71	3	0	0	0	1,745

Total Stream Release from Crystal Springs Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base Sep	WY Total
Wet	0	0	107	2,744	4,279	1,376	1,047	2	0	0	0	0	9,556
Above Normal	0	0	0	618	1,343	29	52	100	0	0	0	0	2,142
Normal	0	0	0	0	268	0	0	0	0	0	0	0	268
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	62	0	0	0	62
All Years	0	0	21	664	1,166	274	215	21	12	0	0	0	2,373

Difference in Total Stream Release from Crystal Springs Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	2018 WSIP minus Base Sep	WY Total
Wet	0	0	107	-558	-207	-542	-737	98	0	0	0	0	-1,838
Above Normal	0	0	0	-424	-743	-29	-26	40	0	0	0	0	-1,182
Normal	0	0	0	0	-268	0	48	77	0	0	0	0	-143
Below Normal	0	0	0	0	0	0	28	12	0	0	0	0	39
Dry	0	0	0	0	0	0	0	26	-48	0	0	0	-22
All Years	0	0	21	-197	-247	-112	-134	50	-9	0	0	0	-628

Reservoir storage at San Andreas Reservoir would follow a systematic filling and lowering each year; however, there would be slight differences in drawdown between the variant and WSIP settings, primarily due to the coincidence of the effects of different systemwide maintenance and water demands within each setting. Figure 2.7-4 illustrates a chronological trace of the simulation of San Andreas Reservoir storage and stream releases from San Andreas Dam. Shown in Figure 2.7-4 are the results for the WSIP, variant, and base settings. There are no projected stream releases from San Andreas Reservoir in any setting. Compared to the base setting, as Figure 2.7-4 illustrates, there would be a difference in storage operation every fifth year for the WSIP and variant settings. These differences would be the result of Hetch Hetchy conveyance maintenance, which is assumed to occur systematically in the variant and WSIP settings. The maintenance constrains the amount of Hetch Hetchy water supplied to serve water demands in the Bay Area. As previously discussed, during these winter periods the Bay Area reservoir system would accommodate the reduction in imported supply by serving the Bay Area water deliveries with the local watersheds' runoff and storage. At San Andreas Reservoir, serving this water demand would affect the reservoir when additional required water production at Harry Tracy WTP associated with WSIP or the variant exceeded the ability to maintain San Andreas Reservoir storage with pumping from Crystal Springs Reservoir. In the modeling, the conveyance capacity from Crystal Springs Reservoir is assumed to be the same among all of the settings. The additional water demand of the WSIP and variant require additional production from Harry Tracy WTP to be drawn from San Andreas Reservoir.

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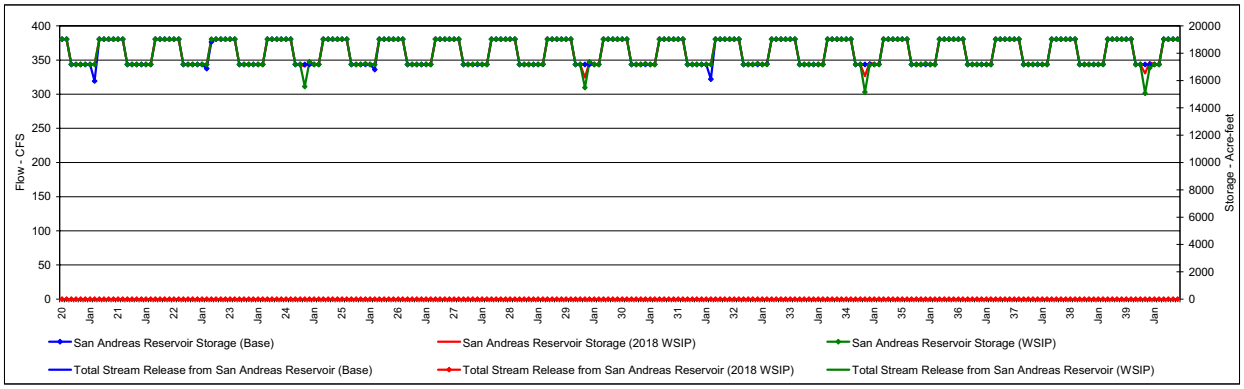
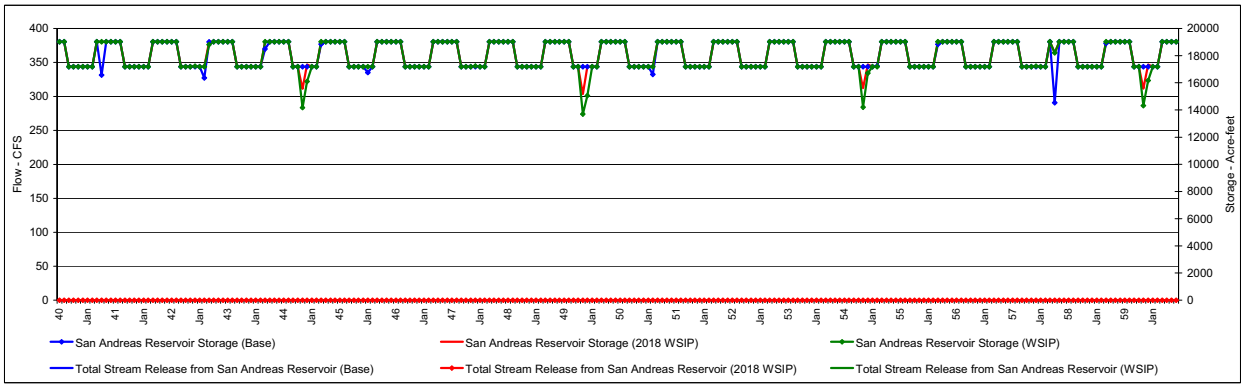
Figure 2.7-4
San Andreas Reservoir Storage and Stream Release

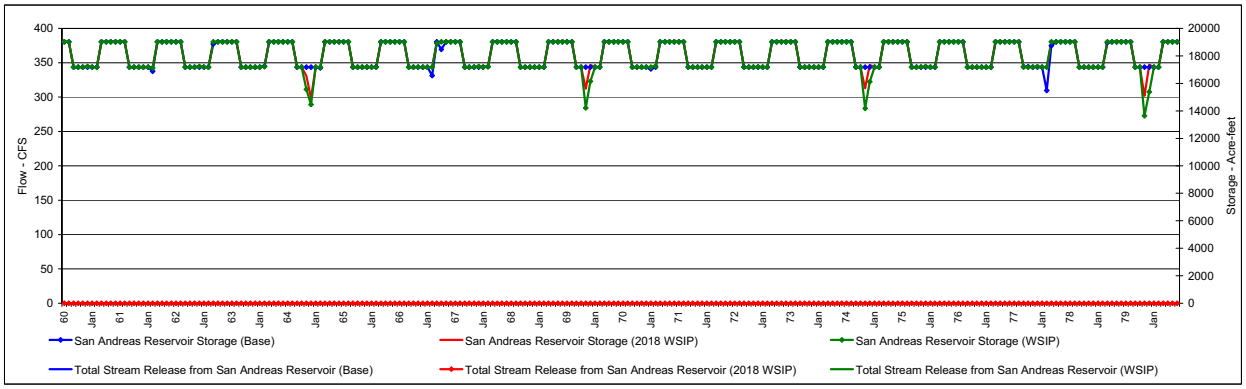
1920 - 1939



1940 - 1959



1960 - 1979



1980 - 2002

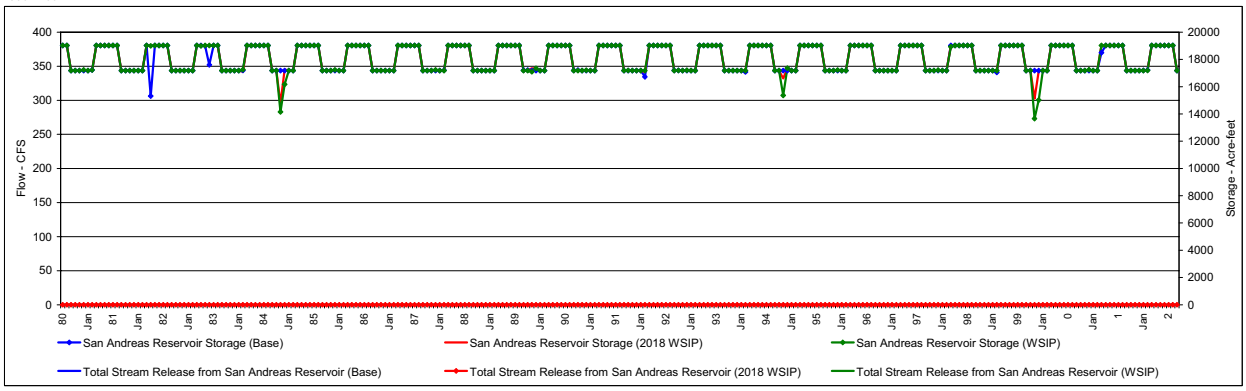
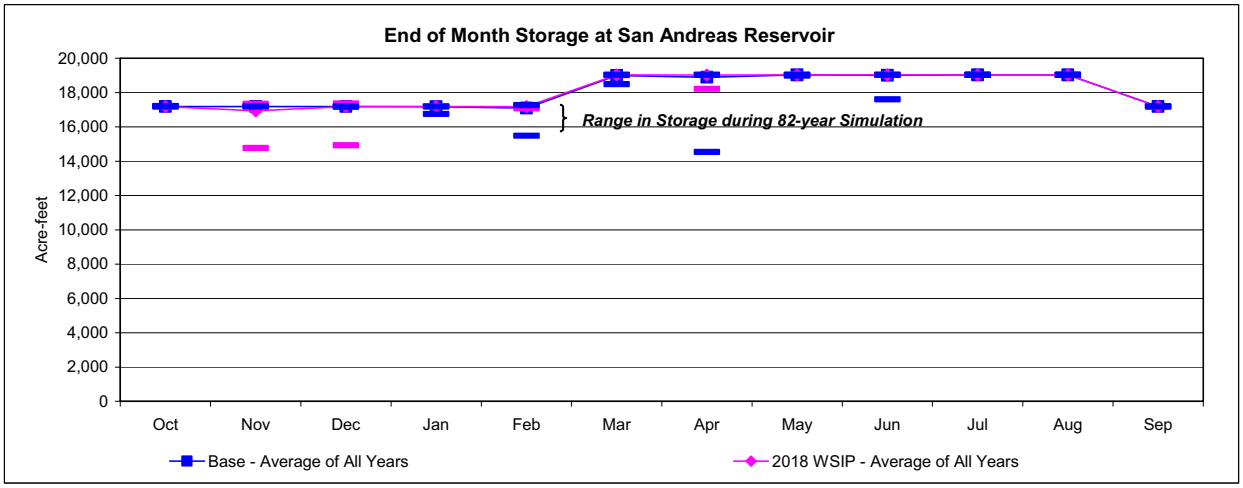


Figure 2.7-5 illustrates the average monthly storage in San Andreas Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings.

Figure 2.7-5



2.8 Pilarcitos Reservoir

Coastside County Water District's (Coastside CWD) water demand and its SFPUC purchase request are projected to increase within the WSIP planning horizon of year 2030. Within the context of the 2030 purchase request of 300 mgd, Coastside CWD's portion is estimated to amount to about 3 mgd. This projected purchase request is approximately 1 mgd greater that its current purchase request. Considering the current physical constraints on deliveries from the SFPUC to Coastside CWD and the ongoing planning activities in the watershed, the precise means of serving Coastside CWD's additional purchase request, and the resultant potential changes in the operation of SFPUC facilities and their affected environs, are uncertain.[2] For the variant, Coastside CWD's delivery would remain at its current level of approximately 1.8 mgd.

Assuming a range of potential means to serve the additional purchase request from Coastside CWD, the following are potential hydrologic effects on SFPUC facilities and their affected environs:

- Due to limited yield from Pilarcitos Reservoir, additional diversions would be required from Crystal Springs Reservoir.
- If deliveries to Coastside CWD from Pilarcitos Reservoir increase during the winter season, these deliveries could potentially reduce storage in Pilarcitos Reservoir, thereby potentially reducing diversions to the San Mateo Creek watershed. Although the increased delivery would increase releases to Pilarcitos Creek from Pilarcitos Dam for a period of time, the increase would subsequently lead to a reduction in spills past Stone Dam.
- Additional wintertime deliveries could also potentially impair the ability to provide carryover storage into the summer season from Pilarcitos Reservoir, and subsequently lead to an acceleration of the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.
- An increase in summertime deliveries from Pilarcitos Creek could also accelerate the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.

Figure 2.8-1 illustrates a chronological trace of the simulation of Pilarcitos Reservoir storage and stream releases from Pilarcitos Dam. Shown in Figure 2.8-1 are the results for the WSIP, variant, and base

[2] See *Analysis of SFPUC Pilarcitos/Coastside County Water District Operations*, Memorandum by Daniel B. Steiner, March 8, 2007.

settings. For the WSIP setting, the operation assumes an increase in purchase request by Coastside CWD, distributed on a proportionate monthly pattern during the year consistent with historical SFPUC deliveries. Also assumed is a conveyance constraint of 2 mgd to Coastside CWD from the Pilarcitos Creek source of water. When the assumed monthly purchase request of Coastside CWD exceeds this conveyance constraint, Coastside CWD's request is met with deliveries from Crystal Springs Reservoir. For the variant setting, Coastside CWD's demand is the same as depicted for the base setting.

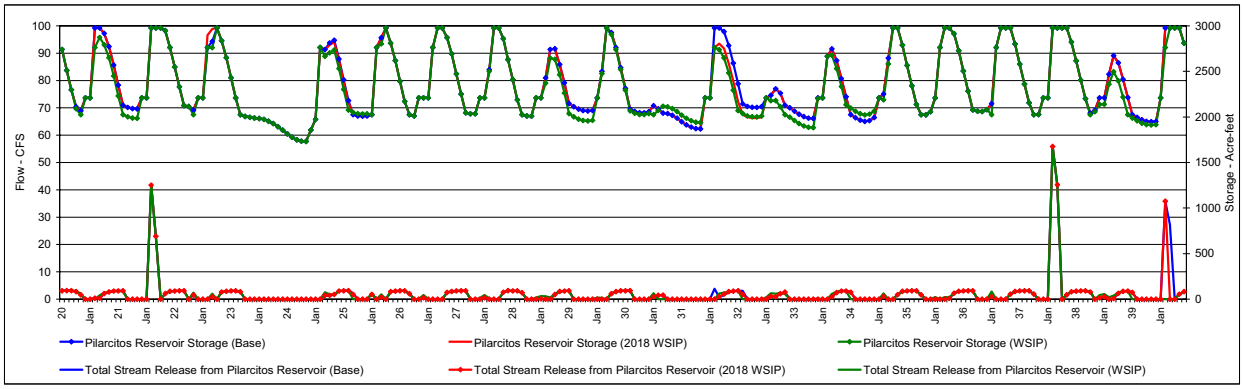
Compared to the WSIP setting, the variant would draw less water from Pilarcitos Reservoir, thus avoiding the effects on Pilarcitos Reservoir and its operations associated with the WSIP. A potential increased draw of storage from Pilarcitos Reservoir earlier in the year would not occur under the variant, and thus the earlier summertime reduction in Pilarcitos Reservoir releases to the Pilarcitos Creek would not occur. The variant's operation would be much the same as, if not identical to, that depicted for the base setting. Figure 2.8-2 illustrates the average monthly storage in Pilarcitos Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings.

There are occasional differences in the operation of Pilarcitos Reservoir due to slight changes in the overall operation of the SFPUC system. These changes could affect the timing and frequency of the transfer of water from the Pilarcitos Creek watershed to the San Mateo Creek watershed.

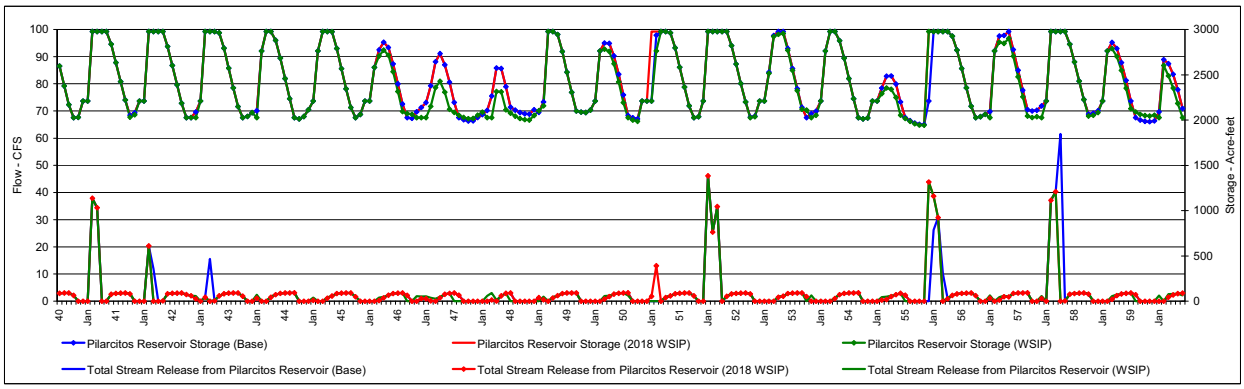
APPENDIX O3

Figure 2.8-1
Pilarcitos Reservoir Storage and Stream Release

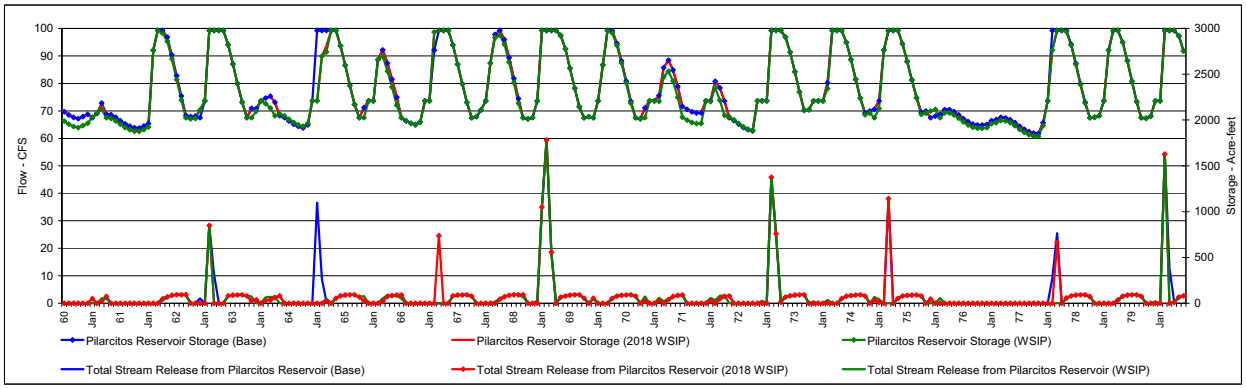
1920 - 1939



1940 - 1959



1960 - 1979



1980 - 2002

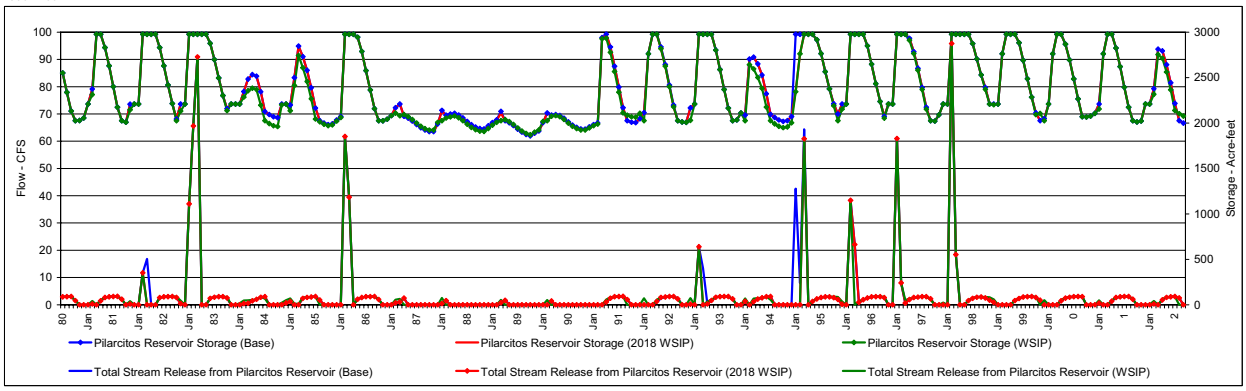
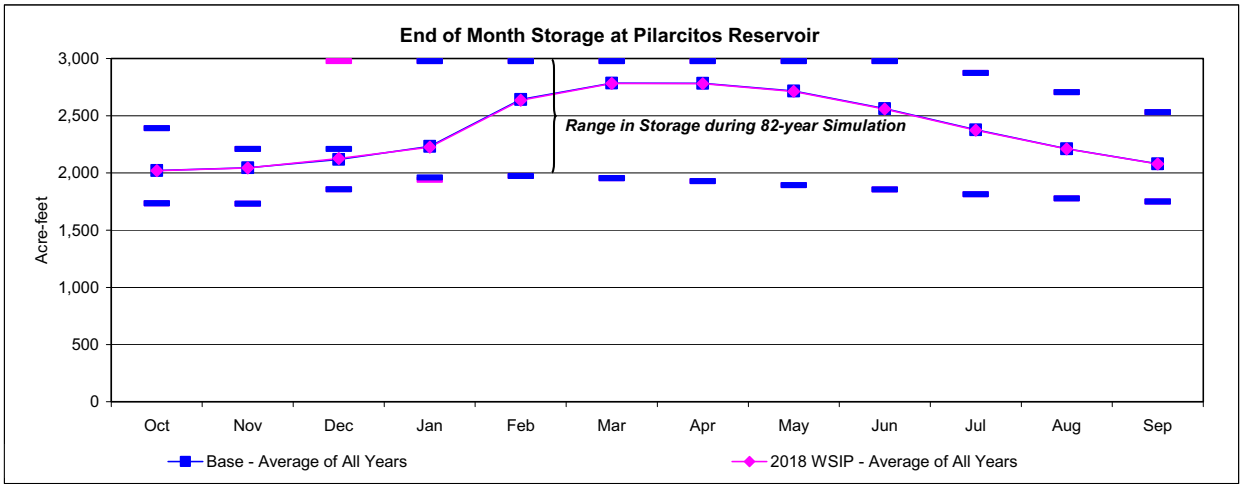


Figure 2.8-2



Stream releases from Pilarcitos Dam are also shown in Figure 2.8-1. Releases can occur for diversions at Stone Dam for Coastside CWD deliveries, conveyance to the San Mateo Creek watershed (e.g., Crystal Springs Reservoir), and reservoir spills. Pilarcitos Creek typically gains flow from unregulated tributary streams and runoff below Pilarcitos Dam. The differences in flow between the variant setting and base setting are shown chronologically in Table 2.8-1 and summarized by monthly averages within year types in Table 2.8-2. The reductions in flows during the winter and spring are indicative of the averaging of the few instances when additional water is transferred to the San Mateo watershed from Pilarcitos Reservoir.

The effect of the variant on Pilarcitos Creek flows below Stone Dam is different than the effect on flows below Pilarcitos Dam. Figure 2.8-3 illustrates the chronological trace of inflow to Stone Dam, which includes releases from Pilarcitos Dam to Pilarcitos Creek and unregulated flow to the stream below Pilarcitos Dam, and releases (spills) from Stone Dam to Pilarcitos Creek. Shown in the figure are the results for the WSIP, variant, and base settings. The flow past Stone Dam in all settings is typically minor (zero in modeling results, but may be measurable in terms of leakage and seepage past the dam), as inflow to the dam is diverted to Coastside CWD or to the San Mateo watershed. Releases past Stone Dam typically occur when unregulated flow below Pilarcitos Dam exceeds the delivery needs of Coastside CWD at a time when the storage level at Crystal Springs Reservoir rejects the water from the Pilarcitos watershed. There are a few instances when flow past Stone Dam in the variant setting would be diminished by the change in releases from Pilarcitos Reservoir. Table 2.8-3 summarizes the results for the variant and base settings in terms of average monthly flows by year type, and the average differences in flow between the two settings.

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Table 2.8-1

Difference in Total Stream Release from Pilarcitos Reservoir (Acre-feet) 2018 WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	7	15	0	0	0	0	-21	1
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	-211	12	16	17	0	0	-76	0	-241
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	3	0	0	0	0	0	0	0	3
1936	0	0	0	0	0	0	0	0	0	0	0	0	0
1937	0	0	0	0	0	0	0	0	0	0	0	0	0
1938	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	-1,677	0	0	0	0	0	0	-1,677
1941	0	0	0	0	0	0	0	0	0	0	0	0	0
1942	0	0	0	0	0	-734	0	0	0	0	0	0	-734
1943	0	0	0	0	0	-958	0	0	0	0	0	0	-958
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	109	725	0	0	0	0	0	0	0	834
1952	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	2,697	766	0	-624	0	0	0	0	0	0	2,838
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	-3,661	0	0	0	0	0	-3,661
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	7	15	0	0	0	0	0	22
1962	0	0	0	0	0	0	16	17	0	0	0	0	34
1963	0	0	-107	0	0	-639	0	0	0	0	0	0	-747
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	-2,248	-485	0	0	0	0	0	0	0	-2,733
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	1,511	0	0	0	0	0	0	1,511
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	-503	-213	0	17	0	0	0	0	-698
1979	-10	0	0	0	0	0	0	0	0	0	0	0	-10
1980	0	0	0	0	0	-783	0	0	0	0	0	0	-783
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	-1,032	0	0	0	0	0	0	-1,032
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	4	3	0	0	0	0	0	0	0	8
1989	0	0	0	0	0	12	-20	0	0	0	0	0	-7
1990	0	0	0	0	0	12	0	0	0	0	0	0	12
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	16	17	0	0	0	-17	17
1993	0	0	0	0	0	-820	0	0	0	0	0	0	-820
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	-2,620	-442	-213	0	0	0	0	0	0	-3,275
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	0	0	32	-49	-11	-75	-44	1	0	0	-1	0	-148

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Table 2.8-2

Total Stream Release from Pilarcitos Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

2018 WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	54	3	172	837	2,116	1,653	13	70	152	175	183	177	5,606
Above Normal	56	37	14	11	589	388	22	116	161	181	186	169	1,928
Normal	54	3	7	15	11	9	63	143	171	185	159	127	947
Below Normal	57	6	7	15	6	24	103	154	164	171	124	63	894
Dry	36	0	11	27	17	43	70	69	55	44	8	0	381
All Years	51	10	41	177	542	418	54	111	141	152	133	107	1,938

Total Stream Release from Pilarcitos Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	54	3	4	953	2,144	1,770	242	70	152	175	183	177	5,927
Above Normal	56	37	20	137	605	641	22	115	161	181	186	169	2,328
Normal	55	3	7	15	24	9	60	139	171	185	164	128	960
Below Normal	57	6	7	15	6	23	103	154	164	171	124	65	894
Dry	36	0	11	26	17	41	70	69	55	44	8	0	378
All Years	52	10	10	225	553	493	98	110	141	152	134	108	2,085

Difference in Total Stream Release from Pilarcitos Reservoir (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)

2018 WSIP minus Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	169	-116	-28	-117	-229	0	0	0	0	0	-321
Above Normal	0	0	-6	-126	-15	-253	0	1	0	0	0	0	-400
Normal	-1	0	0	0	-13	1	3	3	0	0	-5	-1	-12
Below Normal	0	0	0	0	0	0	1	0	0	0	0	-1	0
Dry	0	0	0	0	0	2	0	0	0	0	0	0	2
All Years	0	0	32	-49	-11	-75	-44	1	0	0	-1	0	-148

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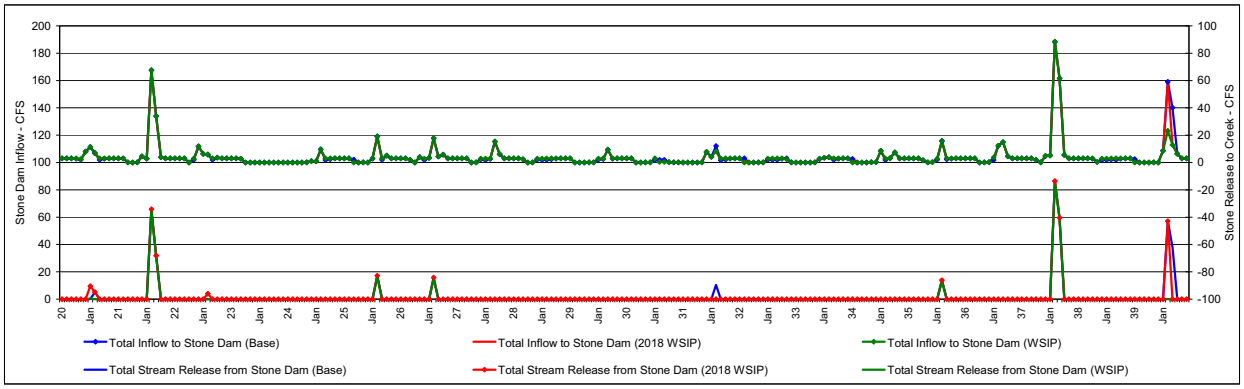
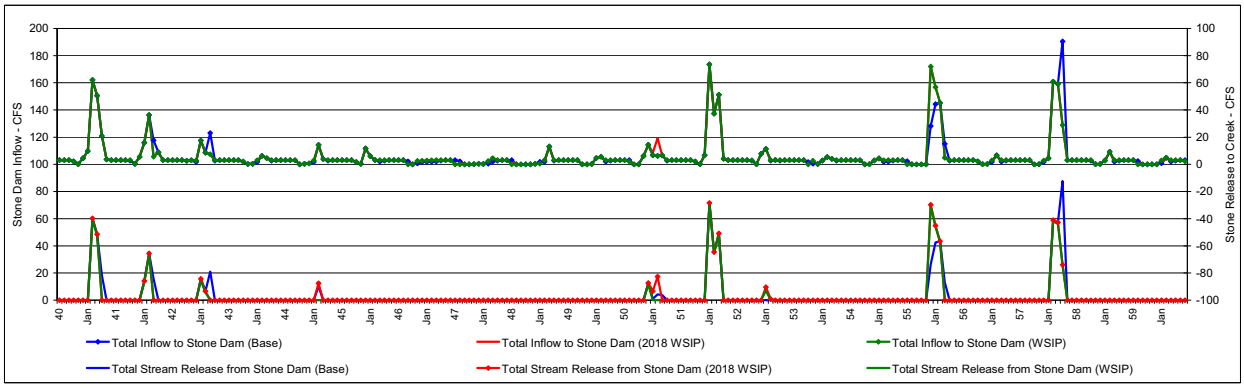
Figure 2.8-3
Stone Dam Stream Release and Inflow

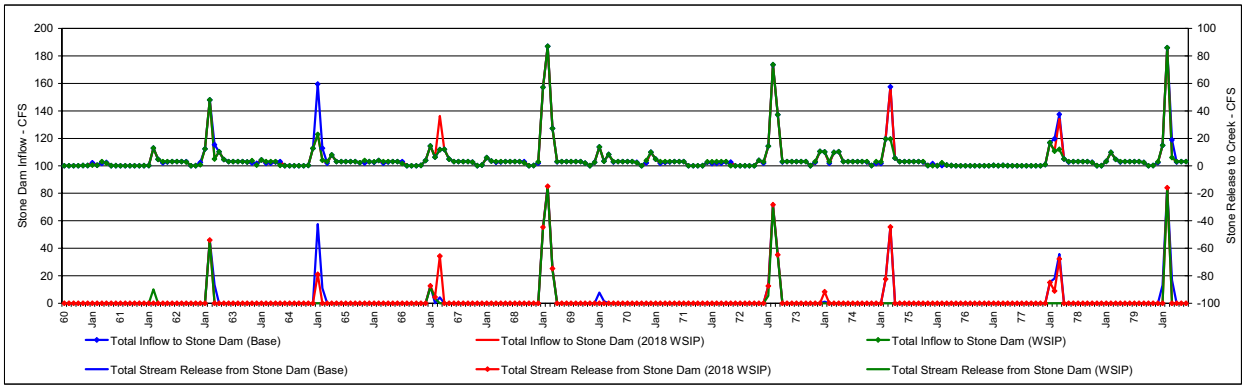
1920 - 1939



1940 - 1959



1960 - 1979



1980 - 2002

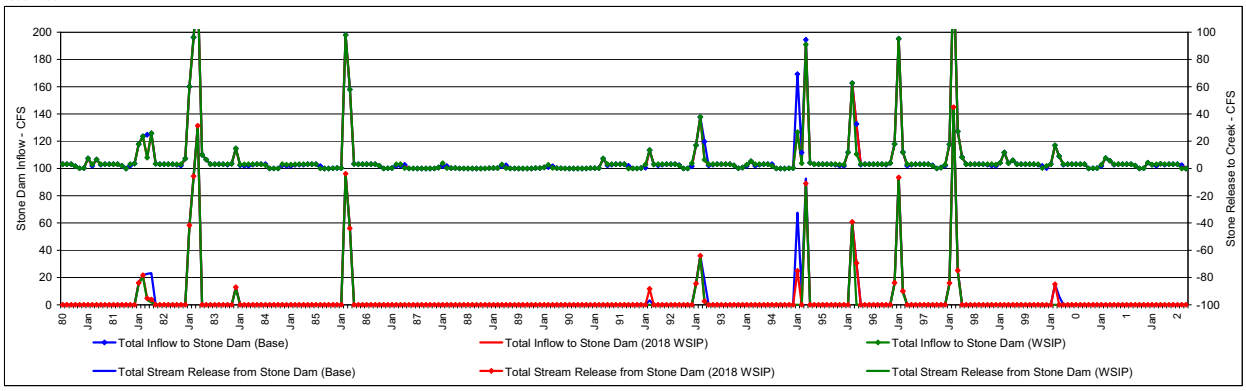


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Table 2.8-3

Total Stream Release from Stone Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
2018 WSIP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	332	1,652	3,233	2,366	112	0	0	0	0	0	7,695
Above Normal	0	0	46	332	1,164	553	0	0	0	0	0	0	2,095
Normal	0	0	49	37	195	0	0	0	0	0	0	0	281
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	84	398	910	576	22	0	0	0	0	0	1,991

Total Stream Release from Stone Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	164	1,819	3,252	2,509	479	0	0	0	0	0	8,223
Above Normal	0	0	46	384	1,174	921	0	0	0	0	0	0	2,525
Normal	0	0	49	30	197	0	0	0	0	0	0	0	276
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	51	440	917	680	94	0	0	0	0	0	2,182

Difference in Total Stream Release from Stone Dam (Acre-feet)
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)
2018 WSIP minus Base

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	169	-167	-19	-143	-368	0	0	0	0	0	-528
Above Normal	0	0	0	-52	-11	-368	0	0	0	0	0	0	-430
Normal	0	0	0	7	-2	0	0	0	0	0	0	0	4
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	33	-42	-6	-104	-72	0	0	0	0	0	-191

APPENDIX O4

Memorandum

Subject: **Analysis of WSIP upon the San Joaquin River and the Sacramento-San Joaquin Delta**
From: **Daniel B. Steiner**
Date: **May 22, 2008**

1. Introduction

This memorandum summarizes an evaluation of the potential effects of the WSIP on the hydrology and operations of the San Joaquin River and the Sacramento-San Joaquin Delta (Delta). The evaluation is based on a contrast of HH/LSM results for the simulation of the WSIP against the simulation of San Joaquin River and Delta hydrology and operations. The projected hydrology due to the WSIP is primarily discussed in terms of a comparison to the existing condition.

2. Setting

The Tuolumne River is one of the principal tributaries of the San Joaquin River. Combined with the operations of the Stanislaus River, the Merced River, and intermittent releases from the upper San Joaquin River, Kings River, and other lesser tributary and uncontrolled flow, the contemporary average annual flow in the Tuolumne River at Vernalis is estimated to be approximately 3,050,000 acre-feet per year (afy), with a very large variance between drought and flood conditions. Figure 2-1 illustrates the setting of the Tuolumne River within the San Joaquin River system.

The Tuolumne River experiences an average annual unimpaired runoff of approximately 1,850,000 afy, of which an average of approximately 669,000 afy are released at La Grange Dam to the lower Tuolumne River. Releases below La Grange Dam are guided by FERC flows requirements and range between 94,000 and 301,000 afy. Additional releases occur in excess of FERC requirements during wetter years. The general magnitude and distribution of current releases at La Grange Dam by year type are illustrated in Figure 2-2. The effect of the WSIP on the Don Pedro Project would be to reduce inflow to Don Pedro Reservoir, which, if not affecting TID/MID canal diversions, would lead to a depletion in Don Pedro Reservoir storage. The depletion in reservoir storage would be replenished during wetter years when, absent the WSIP, releases below La Grange Dam would be in excess of required FERC flows. The average annual reduction in flow below La Grange Dam due to the WSIP amounts to approximately 25,000 afy, primarily during wetter years and during the winter or spring period depending on the coincidence of the WSIP's effect on inflow and the sequence of month-to-month and year-to-year hydrology.

The hydrology of the San Joaquin River at Vernalis is illustrated in Figure 2-4. The hydrology at Vernalis is dependent on several factors, including incidental and prescribed operations within the basin for the San Joaquin River. Generally, the flow in the San Joaquin River is a result of the independent operation of the tributaries for purposes specific to their respective watershed basins. An amount of flow interaction with the river also occurs through groundwater accretions, diversions, and return flows from adjacent lands.

The U.S. Bureau of Reclamation's (USBR) Central Valley Project (CVP) New Melones Project regulates the Stanislaus River, which is operated for purposes of water supply, flood control, power generation, fishery enhancement, and water quality improvement in the lower San Joaquin River. The operations of the New Melones Project are partially guided by State Water Resources Control Board (SWRCB) decisions, including Decision 1422 pertaining to releases for existing water rights, fish and wildlife enhancement, and the maintenance of water quality in the Stanislaus River and San Joaquin River. Decision 1641 assigns additional responsibility to the USBR concerning flow requirements at Vernalis.

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Figure 2-1
San Joaquin River System

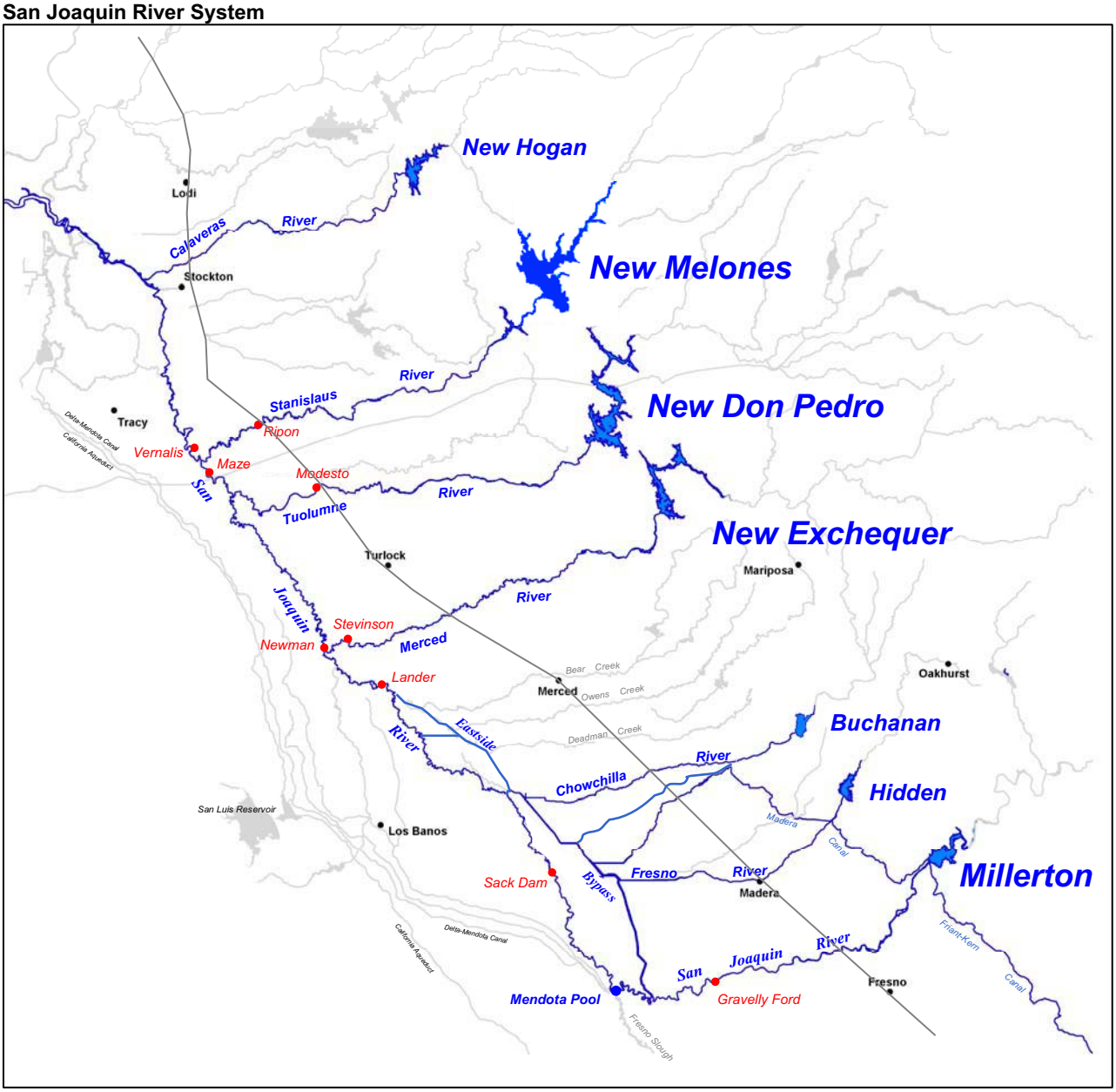

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Figure 2-2
Tuolumne River Flow below La Grange Dam

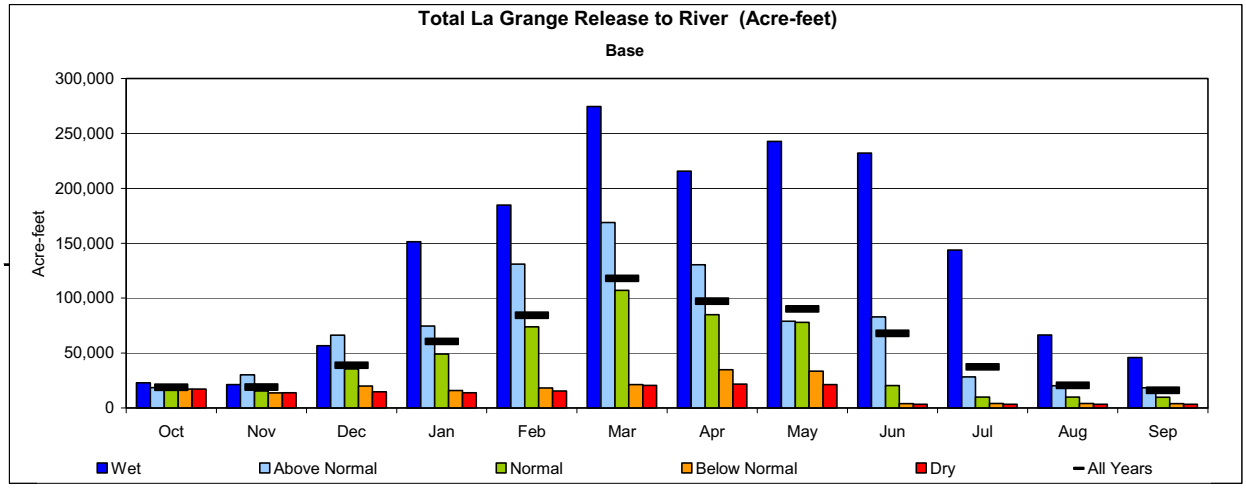


Figure 2-3
Tuolumne River Flow below La Grange Dam – WSIP Effect

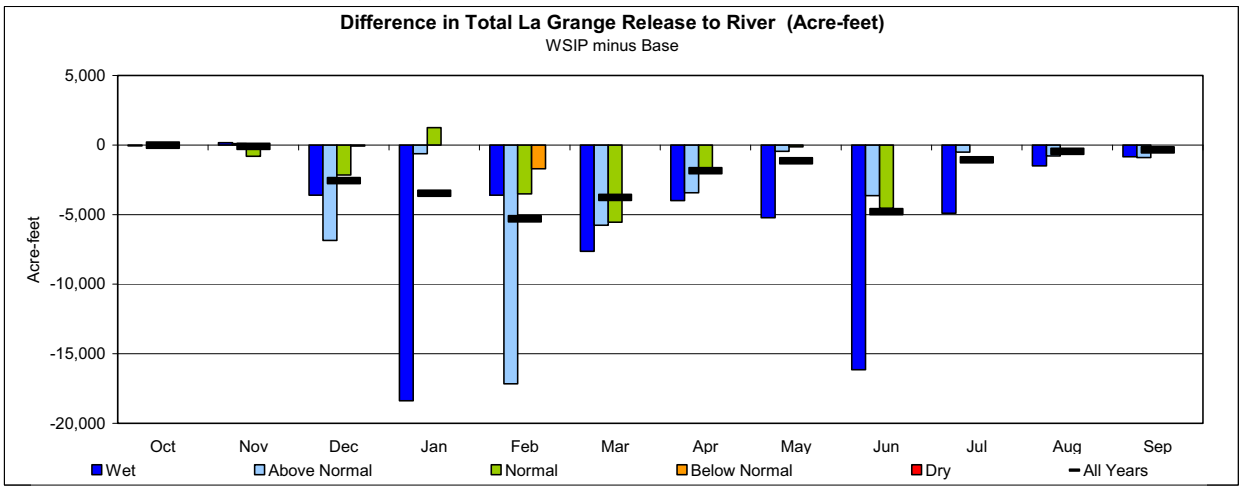
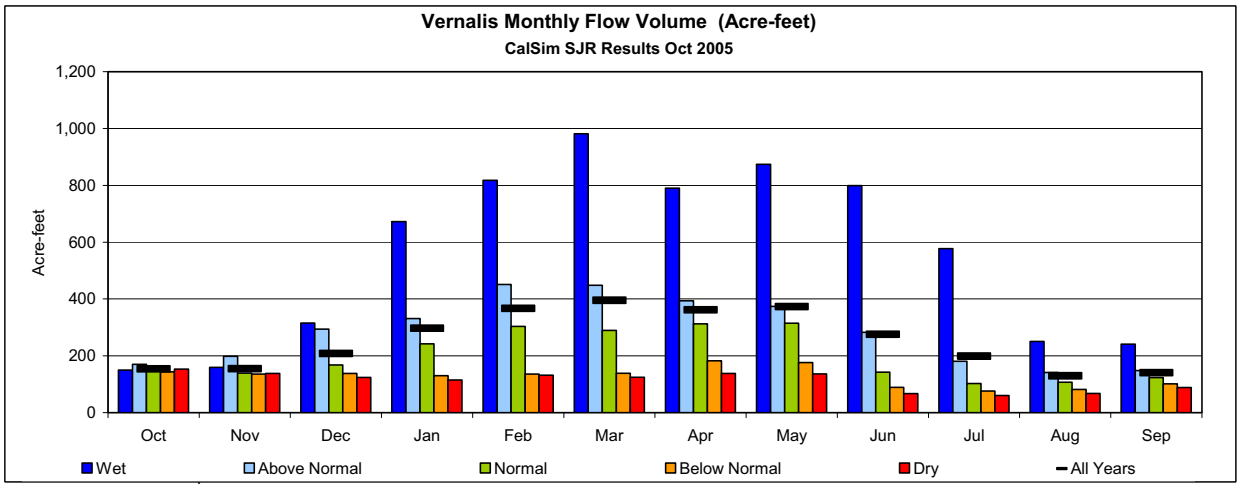


Figure 2-4
San Joaquin River Flow at Vernalis



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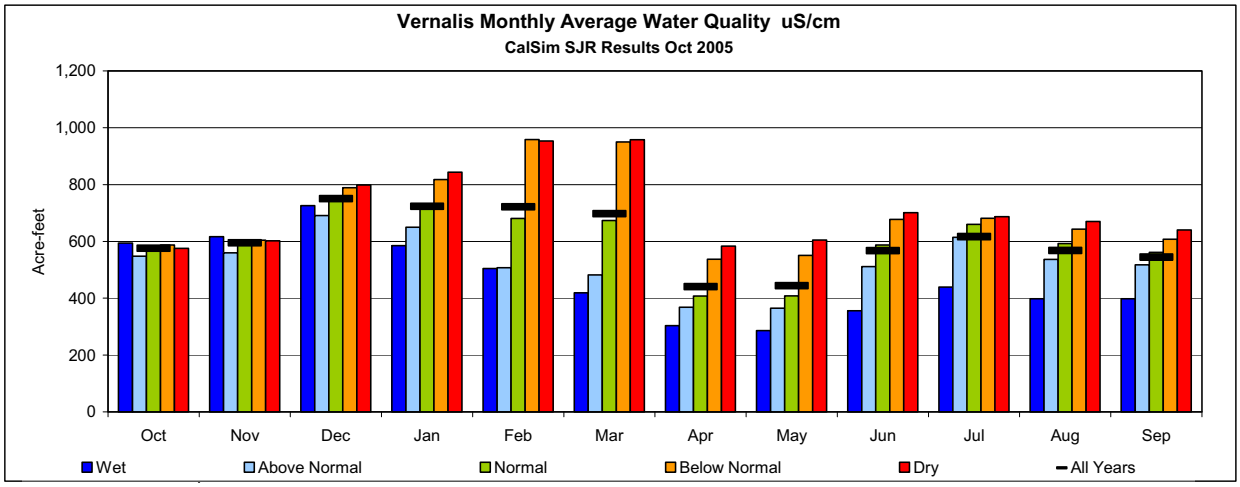
Water quality objectives at Vernalis are established as follows: for the irrigation season (April through August), a running 30-day average conductivity of 0.7 milliSiemens per centimeter (mS/cm); and during the rest of the year, 1.0 mS/cm. Flow requirements at Vernalis are established for the February through June period. Based on the wetness of the San Joaquin River Basin and the required location of a water quality parameter prescribed by Decision 1641 (called "X2"), the "base" required flow at Vernalis ranges between 710 cubic feet per second (cfs) and 3,420 cfs. During a 30-day period in April and May, the Vernalis Adaptive Management Plan (VAMP) flow objective ranges between 3,200 cfs and 7,000 cfs. The SWRCB has assigned the USBR the responsibility for compliance with the Vernalis flow standards, with other entities within the basin contributing towards compliance during the VAMP period through agreement. Water quality (electrical conductivity) at Vernalis is illustrated in Figure 2-5.

Figure 2-5
San Joaquin River Water Quality at Vernalis



The Delta forms the confluence of the Sacramento and San Joaquin Rivers, and is the eastern portion of the San Francisco Bay estuary. The CVP and the State Water Project (SWP) use the Delta channels to convey water to their respective export facilities in the southern Delta. Jones Pumping Plant (CVP) has a pumping capacity of 4,600 cfs; Banks Pumping Plant (SWP) has a pumping capacity of 10,300 cfs, although it is typically constrained to an average pumping capacity of 6,680 cfs. Figure 2-6 illustrates the geographical setting of the Delta.

Through coordinated operation, the CVP and SWP control releases from reservoirs and exports from the Delta to serve water supply contracts totaling several million acre-feet. The Coordinated Operating Agreement (COA) sets guidelines for sharing the supply as well as the responsibility for meeting water quality standards in the Delta. Currently, Delta water quality objectives are prescribed by the 1995 *Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary* through SWRCB Decision 1641.

In addition to SWRCB requirements, the operations of the CVP and SWP are also affected by the objectives of their various authorizations, requirements under the Endangered Species Act, and legal directives. Most recently, in December 2007 a federal court constrained the export operations of the CVP and SWP while a new federal biological opinion is developed for delta smelt. Additional CVP and SWP operational constraints may be developed for the protection of salmon.

To provide a context for comparing changes in Tuolumne River flow, Table 2-1 illustrates several parameters of historical measured flow within the Delta. For the recent period 1995 through 2006, the average annual total exports from the Delta have amounted to approximately 5,585,000 acre-feet, as computed outflow has been 24,189,000 acre-feet. Measured San Joaquin River flow at Vernalis for the same period, which includes flow from the Tuolumne River, has been an average annual of 4,075,000 acre-feet.

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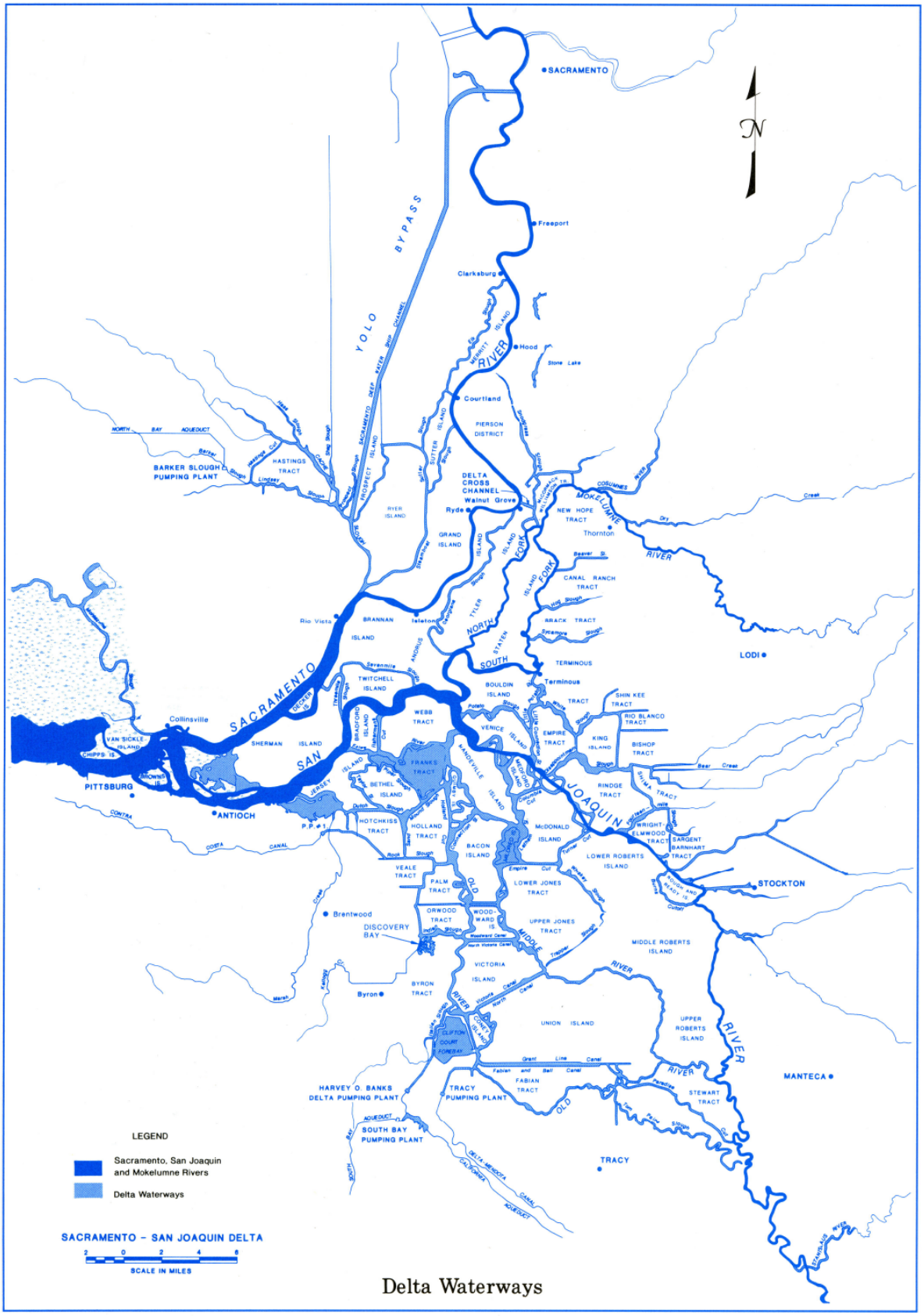
Figure 2-6
Sacramento-San Joaquin Delta



Sacramento–San Joaquin Delta Atlas *Department of Water Resources*

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Table 2-1
Measured Historical Delta Flows

Water Year	Total Exports	Sacramento River Inflow	San Joaquin R Inflow	Delta Ouflow
1971	2,874,333	24,192,000	1,775,014	23,251,928
1972	3,495,757	12,548,000	1,108,825	9,226,357
1973	3,440,149	24,482,000	2,373,013	24,414,917
1974	4,408,835	38,233,000	2,769,796	37,459,002
1975	3,939,862	20,811,000	2,814,656	19,930,841
1976	4,942,896	11,035,000	1,527,879	6,596,232
1977	2,181,995	5,509,000	416,534	2,522,619
1978	4,402,769	20,480,000	4,478,832	21,349,263
1979	4,559,091	13,144,000	2,614,526	11,441,671
1980	4,607,462	25,629,000	5,954,154	28,155,761
1981	4,789,735	11,609,000	1,765,402	7,912,080
1982	4,677,208	37,221,000	5,474,326	40,945,458
1983	4,470,267	48,798,000	15,406,434	64,289,934
1984	3,938,610	27,327,000	6,284,455	30,635,544
1985	5,583,587	12,379,000	2,107,505	8,434,052
1986	5,411,704	28,061,000	5,227,289	29,671,290
1987	5,175,981	10,080,000	1,813,670	6,078,525
1988	5,736,575	9,829,000	1,165,644	4,417,524
1989	6,100,259	12,347,000	1,058,878	6,592,739
1990	5,929,312	9,903,000	915,614	3,933,160
1991	3,294,025	7,652,000	657,097	4,347,499
1992	3,021,048	8,142,000	696,216	5,178,236
1993	4,758,603	21,538,000	1,702,844	19,075,046
1994	4,113,456	11,409,741	1,219,740	6,010,543
1995	5,149,575	27,780,391	6,300,636	41,824,482
1996	5,338,588	25,991,516	3,922,419	25,511,023
1997	5,084,754	30,816,584	6,772,377	34,333,623
1998	4,749,955	38,011,421	8,490,664	43,506,339
1999	4,806,790	23,405,992	3,567,963	22,570,354
2000	6,285,299	21,321,316	2,845,985	18,175,727
2001	5,039,586	10,883,722	1,732,250	6,975,620
2002	5,499,327	13,812,201	1,395,751	9,190,646
2003	6,280,616	19,426,635	1,364,926	14,049,962
2004	6,093,213	20,250,761	1,373,096	14,922,390
2005	6,422,061	17,453,822	3,789,397	15,403,712
2006	6,271,595	41,073,358	7,339,862	43,806,137
2007	5,742,300	11,372,200	1,591,588	
Average	4,827,491	20,377,261	3,292,304	19,781,673

Source: Dayflow record, Interagency Ecological Progarm (http://www.iep.ca.gov/dayflow/)

Total Exports: Banks PP, Jones PP, Contra Costa Pumping

Sacramento River Inflow: Sacramento River and Yolo Byapss

San Joaquin R Inflow: San Joaquin River at Vernalis

Delta Outflow: Net computed outflow at Chipps Island

3. San Joaquin River

The effect of the WSIP on San Joaquin River hydrology is evaluated by a post-process analysis of operation simulations of the Tuolumne River system and the San Joaquin River Basin system. The Tuolumne River system, including the SFPUC regional water system and the Don Pedro Project, is modeled using the HH/LSM, as described in the PEIR. Results are provided from that model for the flow release to the lower Tuolumne River below La Grange Dam. Changes in those projected releases between the PEIR “base” study (current conditions without the WSIP) and a projected future condition (with the WSIP) provide the hydrologic data needed to track the WSIP’s effects downstream of La Grange Dam. These projected changes in La Grange Dam releases to the Tuolumne River are combined with a separate San Joaquin River operation simulation to estimate the impacts of the WSIP on San Joaquin River hydrology and operations.

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CalSim II, a computer model developed jointly by the Department of Water Resources (DWR) and the USBR, is used to model the San Joaquin River Basin system and much of the Central Valley and Delta region water resources infrastructure system. Focused primarily on the operations of the CVP and SWP, CalSim II necessarily incorporates the simulated operations of non-CVP/SWP projects that exist on tributaries to the San Joaquin and Sacramento Rivers. Explicitly, the operation of the Don Pedro Project is modeled in CalSim II. Although the HH/LSM and CalSim II are different models, the underlying logic of Don Pedro Project operations for each of the models was developed coincidentally and produces very similar results.

A subset of the CalSim II model and its results are used for this analysis of San Joaquin River hydrology. Development of the CalSim II model during 2005 included a refinement of the depiction of San Joaquin River Basin operations and hydrology. For the development process, a stand-alone version of CalSim II focusing on San Joaquin River Basin operations was constructed. This version of the model uses a constant boundary condition for the geographical range of the system outside of the San Joaquin River Basin to speed up the processing of simulations. This approach to CalSim II modeling of the San Joaquin River Basin system is adequate for studies that focus on San Joaquin River operations, which are not greatly dependent on a broader CVP-SWP operation. The model's depiction of the San Joaquin River Basin's current operations and hydrology received a peer review (2005) and was described in a public workshop sponsored by the SWRCB during 2006. The CalSim II results used for that workshop are used for this analysis.[1]

3.1 Releases to the Tuolumne River at La Grange Dam

As described above, the effect of the WSIP on the Don Pedro Project would be to reduce inflow to Don Pedro Reservoir, which would lead to depletions in Don Pedro Reservoir storage. The depletion in reservoir storage would be replenished during wetter years when, absent the WSIP, releases below La Grange Dam would be in excess of FERC-required flows. Table 3.1-1 and Table 3.1-2 illustrate the projected monthly releases at La Grange Dam to the Tuolumne River for the WSIP and base settings for the 82-year simulation period (1921-2002). Table 3.1-3 illustrates the projected difference in releases at La Grange Dam due to the WSIP's effect on Don Pedro Project operations.[2] The average annual reduction in flow below La Grange Dam due to the WSIP would amount to approximately 25,000 afy, primarily during wetter years and during the winter or spring period depending on the coincidence of the WSIP's effect on inflow and the sequence of month-to-month and year-to-year hydrology. The projected difference in releases from La Grange Dam (comparing the WSIP and base settings), ranked in descending order of wetness in the San Joaquin River Basin runoff, is illustrated in Table 3.1-4. These changes in La Grange Dam releases to the lower Tuolumne River would change the flow in the Tuolumne River between La Grange Dam and the confluence with the San Joaquin River. The flow projected in the San Joaquin River between the Tuolumne River confluence and the Stanislaus River confluence would be similarly changed.

3.2 Flow Upstream of the Stanislaus River Confluence

The flow of the San Joaquin River upstream of the Stanislaus River confluence (commonly referred to as the "Maze" Boulevard crossing of the San Joaquin River) is a point of interest in the identification of San Joaquin River hydrology. The tributary operations upstream of the Stanislaus River confluence (e.g., the Tuolumne River and Merced River) are generally not required to be responsive to San Joaquin River conditions. Therefore, the changes in the hydrology of the San Joaquin River upstream of the Stanislaus River due to the WSIP can be described by the change in hydrology that occurs at La Grange Dam. Downstream of the Stanislaus River confluence, the San Joaquin River hydrology may also include the reactions of the USBR's New Melones Project (Stanislaus River) to changes in the river at Maze; that is, reactions to both flow and water quality conditions. Projected changes in San Joaquin River flow upstream of the Stanislaus River confluence at Maze are illustrated in Figure 3.2-1 through Figure 3.2-4.[2] The figures illustrate the wetness rank-ordered flow at Maze with the projected coincidental change in

[1] CalSim II studies supporting a presentation of the San Joaquin River Group Authority to the State Water Resources Control Board regarding CalSim II – San Joaquin River Basin Development, Refinements and Results, April 24, 2006. Notice and materials of workshop can be found at http://www.waterrights.ca.gov/baydelta/Notices.htm.

[2] La Grange Dam release results are from the HH/LSM. Maze and San Joaquin River results are from CalSim II.

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Table 3.1-1
Total La Grange Release to River (Acre-feet) – WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	12,744	10,711	11,068	11,068	33,964	231,996	111,640	64,123	14,876	15,372	15,372	14,876	547,810
1922	24,397	17,852	18,447	18,447	16,661	169,885	167,789	61,936	470,876	59,363	27,204	24,862	1,077,719
1923	24,397	17,852	52,816	101,025	90,321	34,926	156,958	61,936	14,876	15,372	15,372	14,876	600,727
1924	24,397	17,852	18,447	18,447	17,256	18,447	14,650	14,589	2,975	3,074	3,074	2,975	156,183
1925	7,736	8,926	9,223	9,223	8,331	9,223	73,158	69,584	4,463	4,612	4,612	4,463	213,554
1926	13,240	10,413	10,760	10,760	9,719	10,760	31,566	30,449	4,463	4,612	4,612	4,463	145,817
1927	9,223	8,926	9,223	9,223	8,331	9,223	64,241	61,936	14,876	15,372	15,372	14,876	240,822
1928	24,397	17,852	18,447	18,447	53,135	208,209	37,200	35,902	4,463	4,612	4,612	4,463	431,739
1929	12,744	10,711	11,068	11,068	9,997	11,068	26,770	25,952	2,975	3,074	3,074	2,975	131,476
1930	9,223	8,926	9,223	9,223	8,331	9,223	27,049	26,214	2,975	3,074	3,074	2,975	119,510
1931	9,223	8,926	9,223	9,223	8,331	9,223	14,650	14,589	2,975	3,074	3,074	2,975	95,486
1932	7,736	8,926	9,223	9,223	8,628	9,223	64,241	61,936	14,876	15,372	15,372	14,876	239,632
1933	24,397	17,852	18,447	18,447	16,661	18,447	35,753	34,374	4,463	4,612	4,612	4,463	202,528
1934	9,223	8,926	9,223	9,223	8,331	9,223	14,650	14,589	2,975	3,074	3,074	2,975	95,486
1935	7,736	8,926	9,223	9,223	8,331	9,223	64,241	61,936	14,876	15,372	15,372	14,876	239,335
1936	24,397	17,852	18,447	18,447	54,167	204,086	168,811	61,936	14,876	15,372	15,372	14,876	628,639
1937	24,397	17,852	18,447	18,447	194,659	260,123	177,081	61,936	14,876	15,372	15,372	14,876	833,438
1938	24,397	17,852	88,717	79,596	381,104	454,579	291,007	288,864	227,401	156,701	48,636	34,811	2,093,665
1939	24,397	17,852	18,447	18,447	45,240	66,009	28,525	27,598	4,463	4,612	4,612	4,463	264,665
1940	9,223	8,926	9,223	9,223	8,628	196,482	163,672	61,936	14,876	15,372	15,372	14,876	527,809
1941	24,397	17,852	18,447	59,195	262,128	284,760	249,836	61,936	49,928	88,796	26,488	21,347	1,165,110
1942	24,397	17,852	41,845	150,525	153,324	148,197	218,453	228,994	91,485	115,177	26,854	17,017	1,234,120
1943	24,397	17,852	32,826	197,464	149,252	336,578	194,801	61,936	72,671	15,372	17,014	17,597	1,137,760
1944	24,397	17,852	18,447	18,447	17,256	55,093	47,894	45,898	4,463	4,612	4,612	4,463	263,434
1945	13,240	10,413	10,760	10,760	86,052	215,383	119,005	61,936	14,876	15,372	15,372	14,876	588,045
1946	24,397	25,160	229,316	136,983	150,231	166,940	68,500	61,936	14,876	15,372	15,372	14,876	923,959
1947	24,397	17,852	18,447	18,447	16,661	18,447	28,054	27,156	4,463	4,612	4,612	4,463	187,611
1948	9,223	8,926	9,223	9,223	8,628	9,223	39,947	38,477	4,463	4,612	4,612	4,463	151,020
1949	12,744	10,711	11,068	11,068	9,997	11,068	33,037	31,999	4,463	4,612	4,612	4,463	149,842
1950	12,744	10,711	11,068	11,068	9,997	11,068	61,680	58,823	4,463	4,612	4,612	4,463	205,309
1951	13,240	10,413	227,649	225,258	195,815	153,328	104,899	99,341	4,463	4,612	4,612	4,463	1,048,093
1952	13,240	10,413	10,760	10,760	56,975	213,745	258,495	264,611	230,309	162,673	38,667	32,093	1,302,741
1953	24,397	17,852	18,447	27,845	60,046	18,447	87,632	83,153	4,463	4,612	4,612	4,463	355,969
1954	13,240	10,413	10,760	10,760	9,719	10,760	41,422	39,831	4,463	4,612	4,612	4,463	165,055
1955	13,240	10,413	10,760	10,760	9,719	10,760	31,555	30,438	4,463	4,612	4,612	4,463	145,795
1956	9,223	8,926	9,223	397,642	218,902	177,380	103,683	61,936	153,608	108,969	29,023	30,608	1,309,123
1957	24,397	17,852	18,447	18,447	16,661	25,078	85,025	80,709	4,463	4,612	4,612	4,463	304,766
1958	13,240	10,413	10,760	10,760	9,719	173,384	311,309	268,728	276,764	96,627	36,329	32,935	1,250,968
1959	24,397	17,852	18,447	18,447	32,284	59,822	28,824	27,878	4,463	4,612	4,612	4,463	246,101
1960	9,223	8,926	9,223	9,223	8,628	9,223	24,895	24,194	2,975	3,074	3,074	2,975	115,633
1961	7,736	8,926	9,223	9,223	8,331	9,223	14,650	14,589	2,975	3,074	3,074	2,975	93,999
1962	7,736	8,926	9,223	9,223	8,331	9,223	94,959	90,022	4,463	4,612	4,612	4,463	255,793
1963	13,240	10,413	10,760	10,760	9,719	10,760	64,241	61,936	14,876	15,372	15,372	14,876	252,325
1964	24,397	17,852	18,447	18,447	17,256	18,447	28,168	27,263	4,463	4,612	4,612	4,463	188,427
1965	9,223	8,926	9,223	94,896	193,710	157,615	159,589	61,936	14,876	15,372	32,886	32,779	791,031
1966	24,397	22,517	119,607	51,266	82,677	61,610	32,240	31,252	4,463	4,612	4,612	4,463	443,716
1967	12,744	10,711	11,068	11,068	9,997	84,982	252,040	220,298	388,802	257,232	131,931	28,007	1,418,880
1968	24,397	17,852	18,447	18,447	17,256	32,584	28,988	28,031	4,463	4,612	4,612	4,463	204,152
1969	9,223	8,926	9,223	32,847	276,920	244,541	322,211	447,942	425,936	156,634	66,306	35,885	2,036,594
1970	24,397	17,852	73,665	370,017	136,129	162,608	64,241	61,936	14,876	15,372	15,372	14,876	971,341
1971	24,397	17,852	18,447	18,447	16,661	70,249	66,522	63,363	4,463	4,612	4,612	4,463	314,088
1972	13,240	10,413	10,760	10,760	10,066	10,760	30,579	29,524	2,975	3,074	3,074	2,975	138,200
1973	9,223	8,926	9,223	9,223	8,331	9,223	64,241	61,936	35,698	15,372	15,372	14,876	261,644
1974	24,397	42,215	100,199	144,039	84,226	200,904	125,080	61,936	182,580	15,372	23,592	26,455	1,030,995
1975	24,397	17,852	18,447	18,447	112,415	201,425	100,944	61,936	174,642	21,358	50,309	29,597	831,769
1976	35,185	23,322	33,098	18,447	17,256	18,447	20,660	20,224	2,975	3,074	3,074	2,975	198,737
1977	7,736	8,926	9,223	9,223	8,331	9,223	14,650	14,589	2,975	3,074	3,074	2,975	93,999
1978	7,736	8,926	9,223	9,223	8,331	9,223	64,241	61,936	71,448	15,372	15,372	14,876	295,907
1979	24,397	17,852	18,447	25,892	150,953	195,605	90,635	338,861	14,876	15,372	15,372	14,876	923,138
1980	24,397	17,852	18,447	183,143	376,597	204,132	110,674	105,463	278,671	152,585	41,442	36,580	1,549,983
1981	24,397	17,852	18,447	18,447	16,661	22,926	29,256	28,454	4,463	4,612	4,612	4,463	194,590
1982	12,744	10,711	11,068	32,535	338,147	314,765	511,142	350,499	260,216	155,711	59,424	132,689	2,189,651
1983	155,278	142,160	252,175	268,145	324,750	929,999	277,685	441,769	223,430	236,135	186,588	171,850	3,609,964
1984	24,397	262,407	413,016	228,905	204,697	159,934	64,241	61,936	14,876	15,372	15,372	14,876	1,480,029
1985	24,397	17,852	18,447	18,447	16,661	18,447	34,634	33,325	4,463	4,612	4,612	4,463	200,360
1986	9,223	8,926	9,223	9,223	156,378	441,405	148,505	177,029	197,577	15,372	15,372	17,744	1,205,977
1987	24,397	17,852	18,447	18,447	16,661	18,447	25,003	24,296	2,975	3,074	3,074	2,975	175,648
1988	7,736	8,926	9,223	9,223	8,628	9,223	19,297	18,947	2,975	3,074	3,074	2,975	103,301
1989	7,736	8,926	9,223	9,223	8,331	9,223	26,519	25,717	2,975	3,074	3,074	2,975	116,996
1990	7,736	8,926	9,223	9,223	8,331	9,223	19,866	19,480	2,975	3,074	3,074	2,975	104,106
1991	7,736	8,926	9,223	9,223	8,331	9,223	26,397	25,603	2,975	3,074	3,074	2,975	116,760
1992	7,736	8,926	9,223	9,223	8,628	9,223	20,501	20,075	2,975	3,074	3,074	2,975	105,633
1993	7,736	8,926	9,223	9,223	8,331	9,223	64,241	61,936	14,876	15,372	15,372	23,914	248,373
1994	24,397	17,852	18,447	18,447	16,661	18,447	26,774	25,956	2,975	3,074	3,074	2,975	179,079
1995	9,223	8,926	9,223	9,223	8,331	444,650	252,480	587,468	266,389	378,373	180,518	51,840	2,206,644
1996	24,397	17,852	18,447	18,447	282,350	273,866	138,689	137,214	166,467	15,372	15,372	21,277	1,129,750
1997	24,397	42,957	363,466	949,830	195,855	141,961	64,241	61,936	14,876	15,372	15,372	14,876	1,905,139
1998	24,397	17,852	18,447	18,548	334,719	269,674	194,691	338,154	410,419	282,802	127,440	28,820	2,065,963
1999	24,397	17,852	43,763	118,488	288,111	189,381	85,028	61,936	14,876	15,372	15,372	14,876	889,452
2000	24,397	17,852	18,447	18,447	187,912	217,038	100,903	61,936	92,171	15,372	15,372	14,876	784,723
2001	24,397	17,852	18,447	18,447	16,661	58,155	28,763	27,821	4,463	4,612	4,612	4,463	228,693
2002	9,223	8,926	9,223	9,223	8,331	9,223	32,775	31,582	4,463	4,612	4,612	4,463	136,656
Avg (21-02)	18,815	18,888	36,241	57,087	79,135	114,179	95,290	88,906	63,139	36,354	20,200	15,774	644,009
Max (21-02)	155,278	262,407	413,016	949,830	381,104	929,999	511,142	587,468	470,876	378,373	186,588	171,850	3,609,964
Min (21-02)	7,736	8,926	9,223	9,223	8,331	9,223	14,650	14,589	2,975	3,074	3,074	2,975	93,999

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Table 3.1-2
Total La Grange Release to River (Acre-feet) – Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	12,744	10,711	11,068	11,068	33,964	245,398	114,894	64,123	14,876	15,372	15,372	14,876	564,466
1922	24,397	17,852	18,447	18,447	21,795	177,197	175,154	61,936	486,912	61,546	27,209	24,862	1,115,754
1923	24,397	17,852	52,816	101,025	90,321	34,926	159,076	61,936	14,876	15,372	15,372	14,876	602,845
1924	24,397	17,852	18,447	18,447	17,256	18,447	14,650	14,589	2,975	3,074	3,074	2,975	156,183
1925	7,736	8,926	9,223	9,223	8,331	9,223	73,158	69,584	4,463	4,612	4,612	4,463	213,554
1926	13,240	10,413	10,760	10,760	9,719	10,760	31,566	30,449	4,463	4,612	4,612	4,463	145,817
1927	9,223	8,926	9,223	9,223	8,331	9,223	64,241	61,936	41,783	15,372	24,317	28,032	289,830
1928	24,397	38,122	52,916	21,575	67,986	208,208	46,105	35,902	4,463	4,612	4,612	4,463	513,361
1929	12,744	10,711	11,068	11,068	9,997	11,068	26,770	25,952	2,975	3,074	3,074	2,975	131,476
1930	9,223	8,926	9,223	9,223	8,331	9,223	27,049	26,214	2,975	3,074	3,074	2,975	119,510
1931	9,223	8,926	9,223	9,223	8,331	9,223	14,650	14,589	2,975	3,074	3,074	2,975	95,486
1932	7,736	8,926	9,223	9,223	8,628	9,223	64,241	61,936	14,876	15,372	15,372	14,876	239,632
1933	24,397	17,852	18,447	18,447	16,661	18,447	35,753	34,374	4,463	4,612	4,612	4,463	202,528
1934	9,223	8,926	9,223	9,223	8,331	9,223	14,650	14,589	2,975	3,074	3,074	2,975	95,486
1935	7,736	8,926	9,223	9,223	8,331	9,223	64,241	61,936	14,876	15,372	15,372	14,876	239,335
1936	24,397	17,852	18,447	18,447	301,206	220,976	172,446	61,936	14,876	15,372	15,372	14,876	896,203
1937	24,397	17,852	18,447	18,447	210,859	263,318	185,594	61,936	14,876	15,372	15,372	14,876	861,346
1938	24,397	17,852	108,307	79,596	381,104	454,618	298,150	305,878	232,281	156,701	50,809	34,816	2,144,509
1939	24,397	17,852	18,447	18,447	45,240	66,009	28,525	27,598	4,463	4,612	4,612	4,463	264,665
1940	9,223	8,926	9,223	9,223	8,628	234,677	169,350	61,936	14,876	15,372	15,372	14,876	571,682
1941	24,397	17,852	18,447	55,884	262,574	285,182	250,355	61,936	53,464	90,980	26,493	21,347	1,168,911
1942	24,397	17,852	41,845	156,067	153,323	150,861	223,977	231,848	94,247	117,365	26,854	17,017	1,255,653
1943	24,397	17,852	32,826	197,464	149,252	338,579	201,522	61,936	76,970	15,372	19,188	17,602	1,152,960
1944	24,397	17,852	18,447	18,447	17,256	55,093	47,894	45,898	4,463	4,612	4,612	4,463	263,434
1945	13,240	10,413	10,760	10,760	123,508	230,698	119,207	61,936	14,876	15,372	15,372	14,876	641,018
1946	24,397	17,852	229,210	136,983	150,231	179,148	72,112	61,936	14,876	15,372	15,372	14,876	932,365
1947	24,397	17,852	18,447	18,447	16,661	18,447	28,054	27,156	4,463	4,612	4,612	4,463	187,611
1948	9,223	8,926	9,223	9,223	8,628	9,223	39,947	38,477	4,463	4,612	4,612	4,463	151,020
1949	12,744	10,711	11,068	11,068	9,997	11,068	33,037	31,999	4,463	4,612	4,612	4,463	149,842
1950	12,744	10,711	11,068	11,068	9,997	11,068	61,680	58,823	4,463	4,612	4,612	4,463	205,309
1951	13,240	10,413	344,203	225,255	195,815	153,328	104,899	99,341	4,463	4,612	4,612	4,463	1,164,644
1952	13,240	10,413	10,760	10,760	78,332	213,745	258,495	280,490	232,426	162,673	40,841	32,097	1,344,272
1953	24,397	17,852	18,447	27,845	60,046	18,447	87,632	83,153	4,463	4,612	4,612	4,463	355,969
1954	13,240	10,413	10,760	10,760	9,719	10,760	41,422	39,831	4,463	4,612	4,612	4,463	165,055
1955	13,240	10,413	10,760	10,760	9,719	10,760	31,555	30,438	4,463	4,612	4,612	4,463	145,795
1956	9,223	8,926	46,291	436,178	218,897	180,935	106,751	61,936	162,942	111,157	29,023	30,608	1,402,867
1957	24,397	17,852	18,447	18,447	16,661	25,078	85,025	80,709	4,463	4,612	4,612	4,463	304,766
1958	13,240	10,413	10,760	10,760	9,719	211,842	311,309	280,218	277,777	98,815	36,329	32,935	1,304,117
1959	24,397	17,852	18,447	18,447	32,284	59,822	28,824	27,878	4,463	4,612	4,612	4,463	246,101
1960	9,223	8,926	9,223	9,223	8,628	9,223	24,895	24,194	2,975	3,074	3,074	2,975	115,633
1961	7,736	8,926	9,223	9,223	8,331	9,223	14,650	14,589	2,975	3,074	3,074	2,975	93,999
1962	7,736	8,926	9,223	9,223	8,331	9,223	94,959	90,022	4,463	4,612	4,612	4,463	255,793
1963	13,240	10,413	10,760	10,760	9,719	10,760	64,241	61,936	14,876	15,372	15,372	14,876	252,325
1964	24,397	17,852	18,447	18,447	29,030	18,447	28,168	27,263	4,463	4,612	4,612	4,463	200,201
1965	9,223	8,926	9,223	280,632	198,842	168,325	169,358	61,936	14,876	15,372	21,883	32,755	991,351
1966	24,397	22,516	120,759	51,266	99,846	61,610	32,240	31,252	4,463	4,612	4,612	4,463	462,036
1967	12,744	10,711	11,068	11,068	9,997	103,480	252,040	232,725	388,802	259,420	134,115	28,012	1,454,182
1968	24,397	17,852	18,447	18,447	17,256	32,584	28,988	28,031	4,463	4,612	4,612	4,463	204,152
1969	9,223	8,926	9,223	58,091	279,368	255,378	329,852	450,130	428,053	156,634	68,480	35,889	2,089,247
1970	24,397	17,852	73,665	343,421	142,086	183,682	64,241	61,936	14,876	15,372	15,372	14,876	971,776
1971	24,397	17,852	18,447	18,447	16,661	85,781	66,522	63,363	4,463	4,612	4,612	4,463	329,620
1972	13,240	10,413	10,760	10,760	10,066	10,760	30,579	29,524	2,975	3,074	3,074	2,975	138,200
1973	9,223	8,926	9,223	9,223	8,331	16,427	64,861	61,936	96,088	15,372	15,372	14,876	329,858
1974	24,397	42,215	100,199	152,431	84,225	211,369	129,683	61,936	192,487	15,372	25,766	26,460	1,066,540
1975	24,397	17,852	18,447	18,447	112,415	201,425	109,230	61,936	168,121	23,541	50,313	29,597	835,721
1976	35,185	23,322	33,098	18,447	17,256	18,447	20,660	20,224	2,975	3,074	3,074	2,975	198,737
1977	7,736	8,926	9,223	9,223	8,331	9,223	14,650	14,589	2,975	3,074	3,074	2,975	93,999
1978	7,736	8,926	9,223	9,223	8,331	9,223	64,241	61,936	160,931	15,372	15,372	14,876	385,390
1979	24,397	17,852	18,447	29,457	150,953	211,824	92,753	341,049	14,876	15,372	15,372	14,876	947,228
1980	24,397	17,852	18,447	175,502	376,598	211,743	115,553	107,651	280,789	154,773	41,442	36,580	1,561,327
1981	24,397	17,852	18,447	18,447	16,661	22,926	29,256	28,454	4,463	4,612	4,612	4,463	194,590
1982	12,744	10,711	11,068	59,750	349,698	314,765	511,142	352,402	262,057	155,711	63,782	134,816	2,238,646
1983	156,324	139,398	253,127	268,146	324,750	929,999	277,685	451,311	228,033	238,323	186,588	174,030	3,627,714
1984	24,397	260,868	413,016	228,905	204,697	155,998	64,241	61,936	14,876	15,372	15,372	14,876	1,474,554
1985	24,397	17,852	18,447	18,447	16,661	18,447	34,634	33,325	4,463	4,612	4,612	4,463	200,360
1986	9,223	8,926	9,223	9,223	173,491	461,532	159,805	182,071	202,457	15,372	15,372	19,911	1,266,606
1987	24,397	17,852	18,447	18,447	16,661	18,447	25,003	24,296	2,975	3,074	3,074	2,975	175,648
1988	7,736	8,926	9,223	9,223	8,628	9,223	19,297	18,947	2,975	3,074	3,074	2,975	103,301
1989	7,736	8,926	9,223	9,223	8,331	9,223	26,519	25,717	2,975	3,074	3,074	2,975	116,996
1990	7,736	8,926	9,223	9,223	8,331	9,223	19,866	19,480	2,975	3,074	3,074	2,975	104,106
1991	7,736	8,926	9,223	9,223	8,331	9,223	26,397	25,603	2,975	3,074	3,074	2,975	116,760
1992	7,736	8,926	9,223	9,223	8,628	9,223	20,501	20,075	2,975	3,074	3,074	2,975	105,633
1993	7,736	8,926	9,223	9,223	8,331	9,223	64,241	61,936	145,263	78,663	37,258	28,803	468,826
1994	24,397	17,852	18,447	18,447	16,661	18,447	26,774	25,956	2,975	3,074	3,074	2,975	179,079
1995	9,223	8,926	9,223	9,223	8,331	453,913	261,686	589,371	268,231	380,561	180,518	54,017	2,233,223
1996	24,397	17,852	18,447	18,447	284,044	273,866	143,569	142,256	171,347	15,372	15,372	23,444	1,148,413
1997	24,397	42,960	363,466	956,038	195,854	141,961	64,241	61,936	14,876	15,372	15,372	14,876	1,911,349
1998	24,397	17,852	18,447	37,270	334,716	272,793	205,739	342,054	414,193	284,990	127,440	28,820	2,108,711
1999	24,397	17,852	43,763	118,488	288,111	197,943	96,010	61,936	14,876	15,372	15,372	14,876	908,996
2000	24,397	17,852	18,447	18,447	207,006	217,038	100,903	61,936	104,647	15,372	15,372	14,876	816,293
2001	24,397	17,852	18,447	18,447	16,661	58,155	28,763	27,821	4,463	4,612	4,612	4,463	228,693
2002	9,223	8,926	9,223	9,223	8,331	9,223	32,775	31,582	4,463	4,612	4,612	4,463	136,656
Avg (21-02)	18,828	18,994	38,798	60,559	84,433	117,947	97,139	90,047	67,933	37,419	20,654	16,126	668,876
Max (21-02)	156,324	260,868	413,016	956,038	381,104	929,999	511,142	589,371	486,912	380,561	186,588	174,030	3,627,714
Min (21-02)	7,736	8,926	9,223	9,223	8,331	9,223	14,650	14,589	2,975	3,074	3,074	2,975	93,999

APPENDIX O4

Table 3.1-3
Total La Grange Release to River (Acre-feet) – Difference WSIP minus Base

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	-13,402	-3,254	0	0	0	0	0	-16,656
1922	0	0	0	0	-5,134	-7,312	-7,365	0	-16,036	-2,183	-5	0	-38,035
1923	0	0	0	0	0	0	-2,118	0	0	0	0	0	-2,118
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	-26,907	0	-8,945	-13,156	-49,008
1928	0	-20,270	-34,469	-3,128	-14,851	1	-8,905	0	0	0	0	0	-81,622
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	-247,039	-16,890	-3,635	0	0	0	0	0	-267,564
1937	0	0	0	0	-16,200	-3,195	-8,513	0	0	0	0	0	-27,908
1938	0	0	-19,590	0	0	-39	-7,143	-17,014	-4,880	0	-2,173	-5	-50,844
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	-38,195	-5,678	0	0	0	0	0	-43,873
1941	0	0	0	3,311	-446	-422	-519	0	-3,536	-2,184	-5	0	-3,801
1942	0	0	0	-5,542	1	-2,664	-5,524	-2,854	-2,762	-2,188	0	0	-21,533
1943	0	0	0	0	0	-2,001	-6,721	0	-4,299	0	-2,174	-5	-15,200
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	-37,456	-15,315	-202	0	0	0	0	0	-52,973
1946	0	7,308	106	0	0	-12,208	-3,612	0	0	0	0	0	-8,406
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	-116,554	3	0	0	0	0	0	0	0	0	-116,551
1952	0	0	0	0	-21,357	0	0	-15,879	-2,117	0	-2,174	-4	-41,531
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	-37,068	-38,536	5	-3,555	-3,068	0	-9,334	-2,188	0	0	-93,744
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	-38,458	0	-11,490	-1,013	-2,188	0	0	-53,149
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	-11,774	0	0	0	0	0	0	0	-11,774
1965	0	0	0	-185,736	-5,132	-10,710	-9,769	0	0	0	11,003	24	-200,320
1966	0	1	-1,152	0	-17,169	0	0	0	0	0	0	0	-18,320
1967	0	0	0	0	0	-18,498	0	-12,427	0	-2,188	-2,184	-5	-35,302
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	-25,244	-2,448	-10,837	-7,641	-2,188	-2,117	0	-2,174	-4	-52,653
1970	0	0	0	26,596	-5,957	-21,074	0	0	0	0	0	0	-435
1971	0	0	0	0	0	-15,532	0	0	0	0	0	0	-15,532
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	-7,204	-620	0	-60,390	0	0	0	-68,214
1974	0	0	0	-8,392	1	-10,465	-4,603	0	-9,907	0	-2,174	-5	-35,545
1975	0	0	0	0	0	0	-8,286	0	6,521	-2,183	-4	0	-3,952
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	-89,483	0	0	0	-89,483
1979	0	0	0	-3,565	0	-16,219	-2,118	-2,188	0	0	0	0	-24,090
1980	0	0	0	7,641	-1	-7,611	-4,879	-2,188	-2,118	-2,188	0	0	-11,344
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	-27,215	-11,551	0	0	-1,903	-1,841	0	-4,358	-2,127	-48,995
1983	-1,046	2,762	-952	-1	0	0	0	-9,542	-4,603	-2,188	0	-2,180	-17,750
1984	0	1,539	0	0	0	3,936	0	0	0	0	0	0	5,475
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	-17,113	-20,127	-11,300	-5,042	-4,880	0	0	-2,167	-60,629
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	-130,387	-63,291	-21,886	-4,889	-220,453
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	-9,263	-9,206	-1,903	-1,842	-2,188	0	-2,177	-26,579
1996	0	0	0	0	-1,694	0	-4,880	-5,042	-4,880	0	0	-2,167	-18,663
1997	0	-3	0	-6,208	1	0	0	0	0	0	0	0	-6,210
1998	0	0	0	-18,722	3	-3,119	-11,048	-3,900	-3,774	-2,188	0	0	-42,748
1999	0	0	0	0	0	-8,562	-10,982	0	0	0	0	0	-19,544
2000	0	0	0	0	-19,094	0	0	0	-12,476	0	0	0	-31,570
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	-13	-106	-2,557	-3,472	-5,298	-3,768	-1,849	-1,141	-4,793	-1,065	-454	-352	-24,868
Max (21-02)	0	7,308	106	26,596	5	3,936	0	0	6,521	0	11,003	24	5,475
Min (21-02)	-1,046	-20,270	-116,554	-185,736	-247,039	-38,458	-11,300	-17,014	-130,387	-63,291	-21,886	-13,156	-267,564

APPENDIX O4

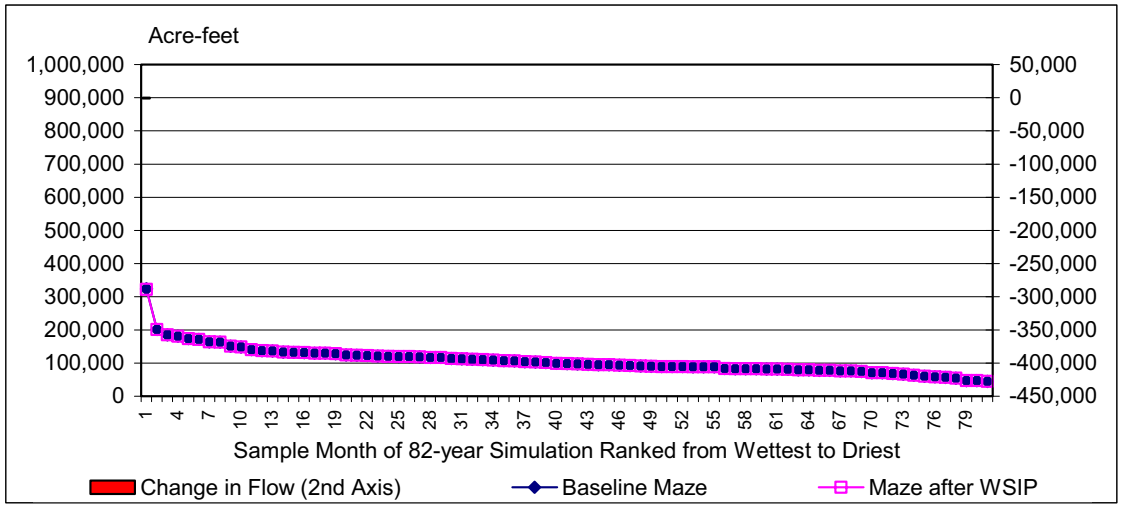
Table 3.1-4
Total La Grange Release to River (Acre-feet) – Difference WSIP minus Base
Matrix Data for Water Year 1921-2002 Rank Ordered by Descending SJR Index

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1983	-1,046	2,762	-952	-1	0	0	0	-9,542	-4,603	-2,188	0	-2,180	-17,750
1969	0	0	0	-25,244	-2,448	-10,837	-7,641	-2,188	-2,117	0	-2,174	-4	-52,653
1995	0	0	0	0	0	-9,263	-9,206	-1,903	-1,842	-2,188	0	-2,177	-26,579
1938	0	0	-19,590	0	0	-39	-7,143	-17,014	-4,880	0	-2,173	-5	-50,844
1998	0	0	0	-18,722	3	-3,119	-11,048	-3,900	-3,774	-2,188	0	0	-42,748
1982	0	0	0	-27,215	-11,551	0	0	-1,903	-1,841	0	-4,358	-2,127	-48,995
1967	0	0	0	0	0	-18,498	0	-12,427	0	-2,188	-2,184	-5	-35,302
1952	0	0	0	0	-21,357	0	0	-15,879	-2,117	0	-2,174	-4	-41,531
1958	0	0	0	0	0	-38,458	0	-11,490	-1,013	-2,188	0	0	-53,149
1980	0	0	0	7,641	-1	-7,611	-4,879	-2,188	-2,118	-2,188	0	0	-11,344
1978	0	0	0	0	0	0	0	0	-89,483	0	0	0	-89,483
1922	0	0	0	0	-5,134	-7,312	-7,365	0	-16,036	-2,183	-5	0	-38,035
1956	0	0	-37,068	-38,536	5	-3,555	-3,068	0	-9,334	-2,188	0	0	-93,744
1942	0	0	0	-5,542	1	-2,664	-5,524	-2,854	-2,762	-2,188	0	0	-21,533
1941	0	0	0	3,311	-446	-422	-519	0	-3,536	-2,184	-5	0	-3,801
1986	0	0	0	0	-17,113	-20,127	-11,300	-5,042	-4,880	0	0	-2,167	-60,629
1993	0	0	0	0	0	0	0	0	-130,387	-63,291	-21,886	-4,889	-220,453
1997	0	-3	0	-6,208	1	0	0	0	0	0	0	0	-6,210
1996	0	0	0	0	-1,694	0	-4,880	-5,042	-4,880	0	0	-2,167	-18,663
1943	0	0	0	0	0	-2,001	-6,721	0	-4,299	0	-2,174	-5	-15,200
1937	0	0	0	0	-16,200	-3,195	-8,513	0	0	0	0	0	-27,908
1974	0	0	0	-8,392	1	-10,465	-4,603	0	-9,907	0	-2,174	-5	-35,545
1975	0	0	0	0	0	0	-8,286	0	6,521	-2,183	-4	0	-3,952
1965	0	0	0	-185,736	-5,132	-10,710	-9,769	0	0	0	11,003	24	-200,320
1936	0	0	0	0	-247,039	-16,890	-3,635	0	0	0	0	0	-267,564
1984	0	1,539	0	0	0	3,936	0	0	0	0	0	0	5,475
1979	0	0	0	-3,565	0	-16,219	-2,118	-2,188	0	0	0	0	-24,090
1945	0	0	0	0	-37,456	-15,315	-202	0	0	0	0	0	-52,973
1999	0	0	0	0	0	-8,562	-10,982	0	0	0	0	0	-19,544
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	-26,907	0	-8,945	-13,156	-49,008
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	7,308	106	0	0	-12,208	-3,612	0	0	0	0	0	-8,406
1973	0	0	0	0	0	-7,204	-620	0	-60,390	0	0	0	-68,214
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	-19,094	0	0	0	-12,476	0	0	0	-31,570
1940	0	0	0	0	0	-38,195	-5,678	0	0	0	0	0	-43,873
1923	0	0	0	0	0	0	-2,118	0	0	0	0	0	-2,118
1921	0	0	0	0	0	-13,402	-3,254	0	0	0	0	0	-16,656
1970	0	0	0	26,596	-5,957	-21,074	0	0	0	0	0	0	-435
1951	0	0	-116,554	3	0	0	0	0	0	0	0	0	-116,551
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	-15,532	0	0	0	0	0	0	-15,532
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	-20,270	-34,469	-3,128	-14,851	1	-8,905	0	0	0	0	0	-81,622
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	1	-1,152	0	-17,169	0	0	0	0	0	0	0	-18,320
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	-11,774	0	0	0	0	0	0	0	-11,774
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0

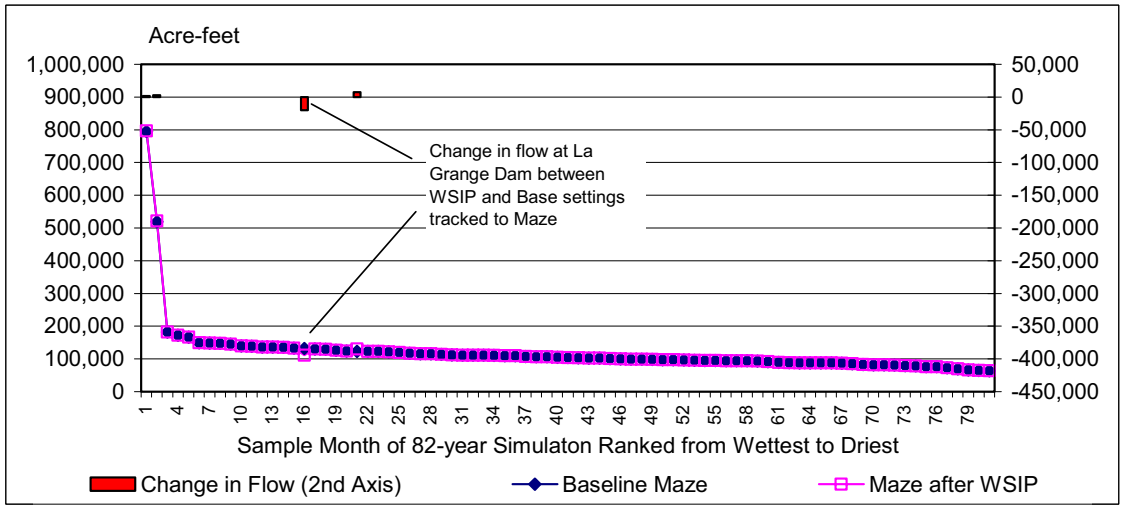
APPENDIX O4

Figure 3.2-1
San Joaquin River Flow Upstream of Stanislaus River Confluence – October through December

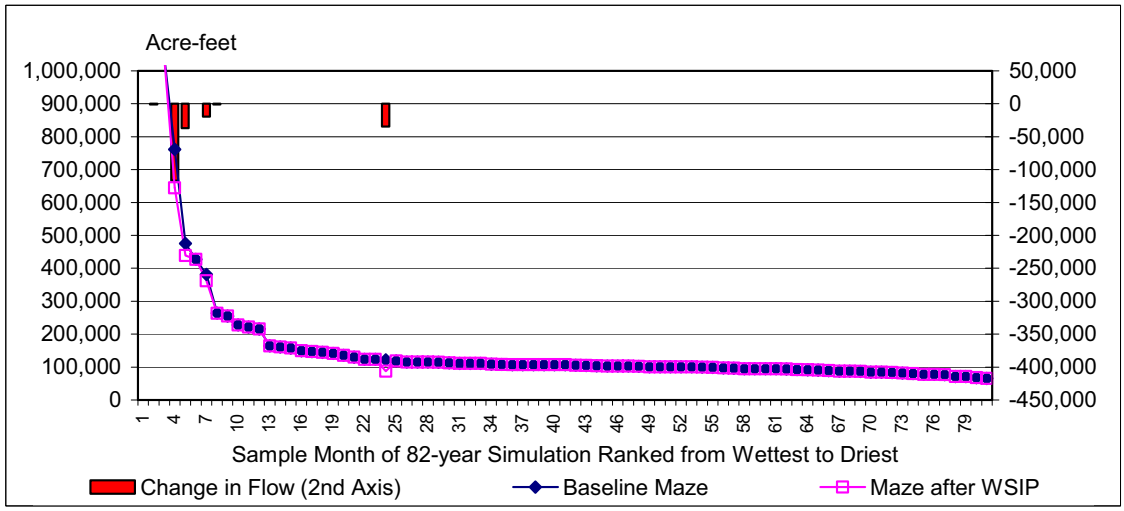
October



November



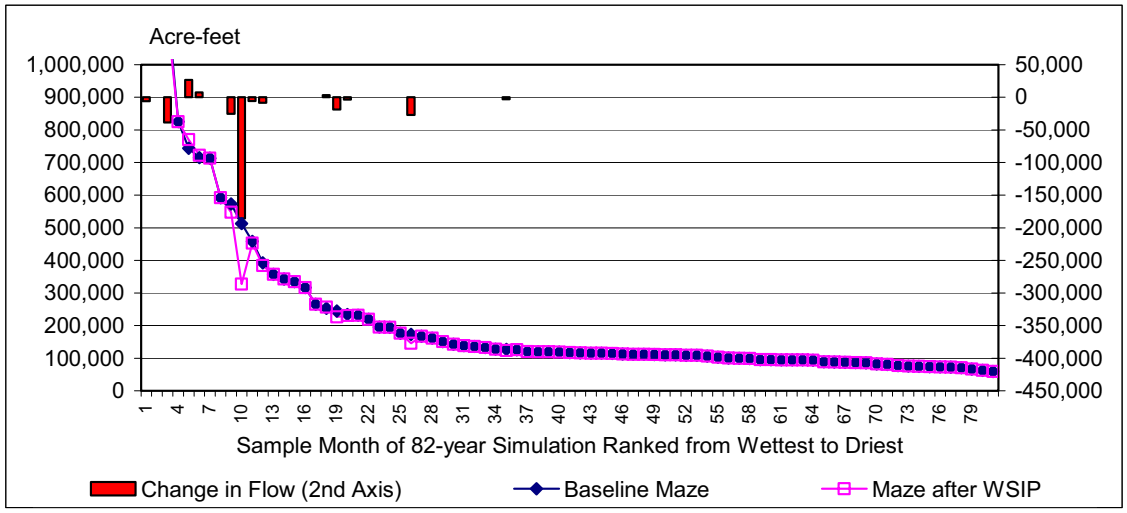
December



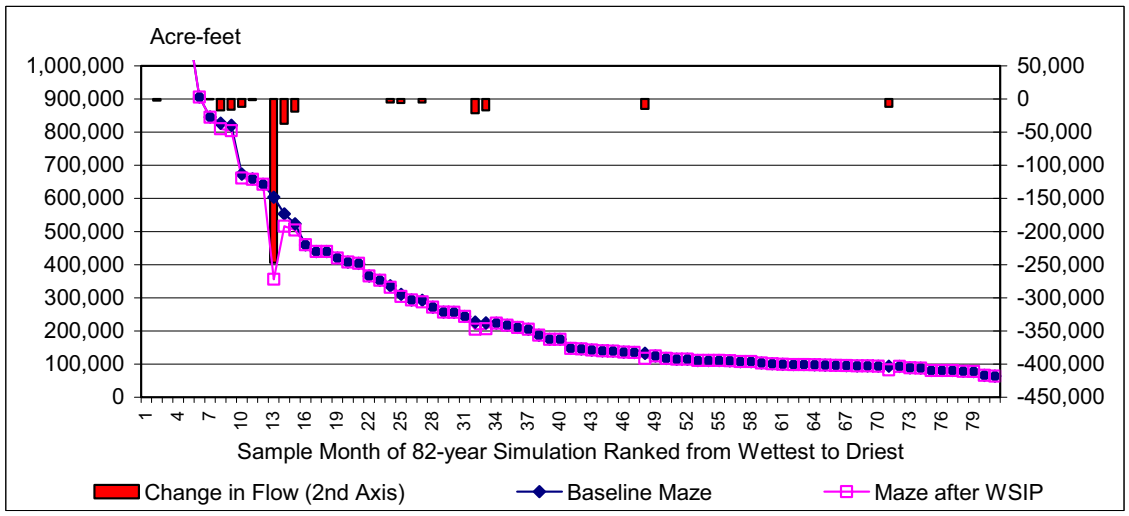
APPENDIX O4

Figure 3.2-2
San Joaquin River Flow Upstream of Stanislaus River Confluence – January through March

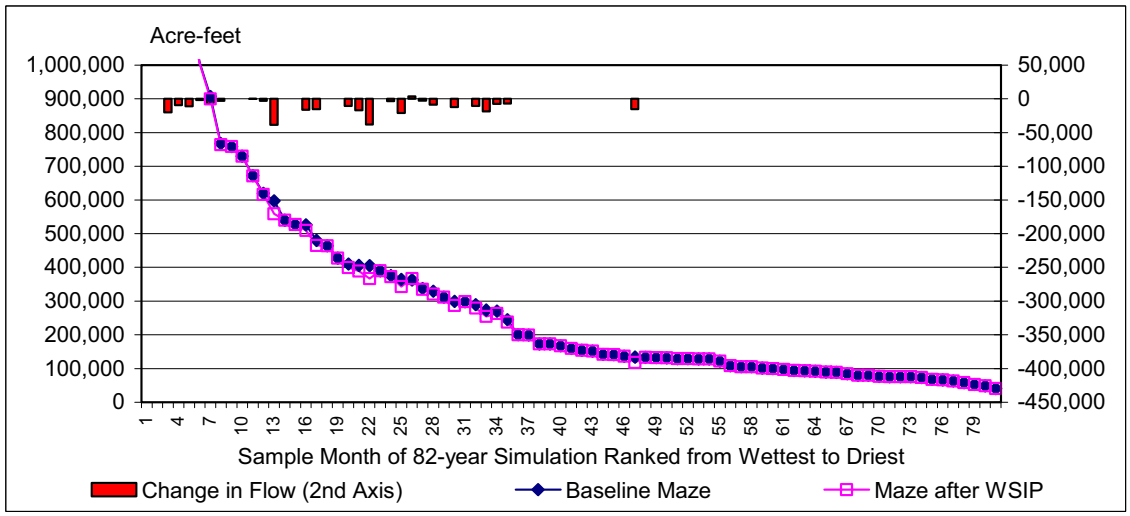
January



February



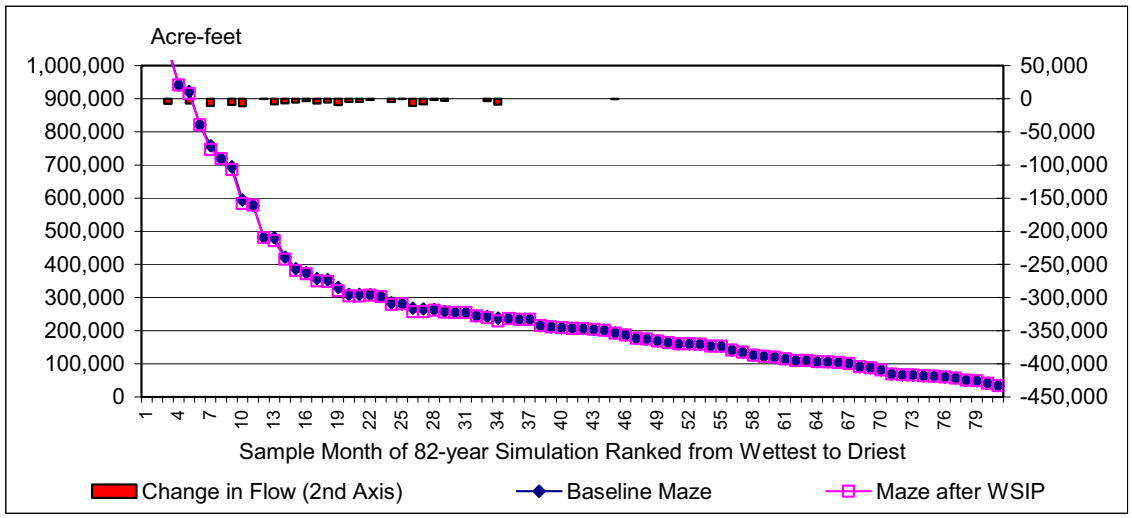
March



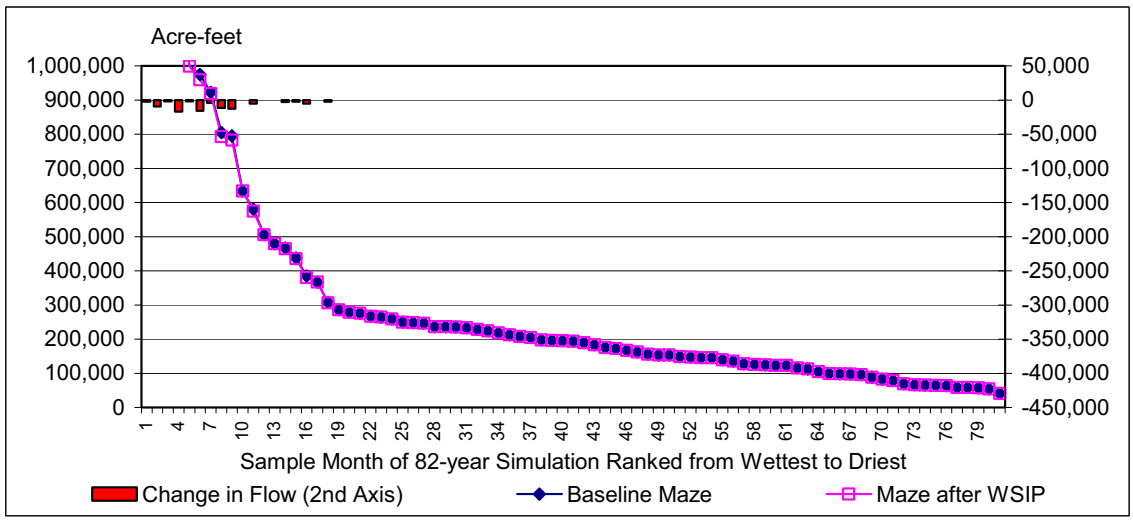
APPENDIX O4

Figure 3.2-3
San Joaquin River Flow Upstream of Stanislaus River Confluence – April through June

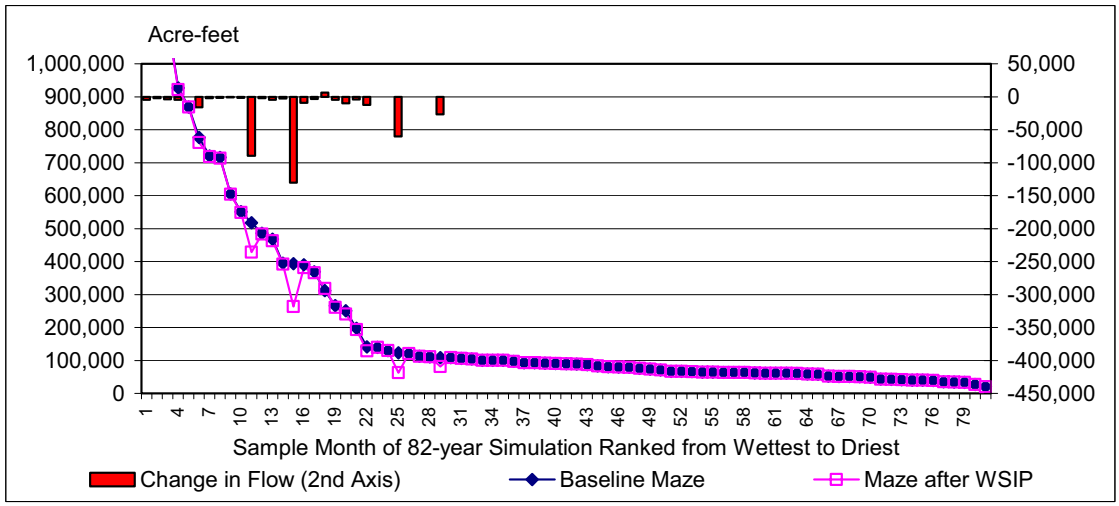
April



May



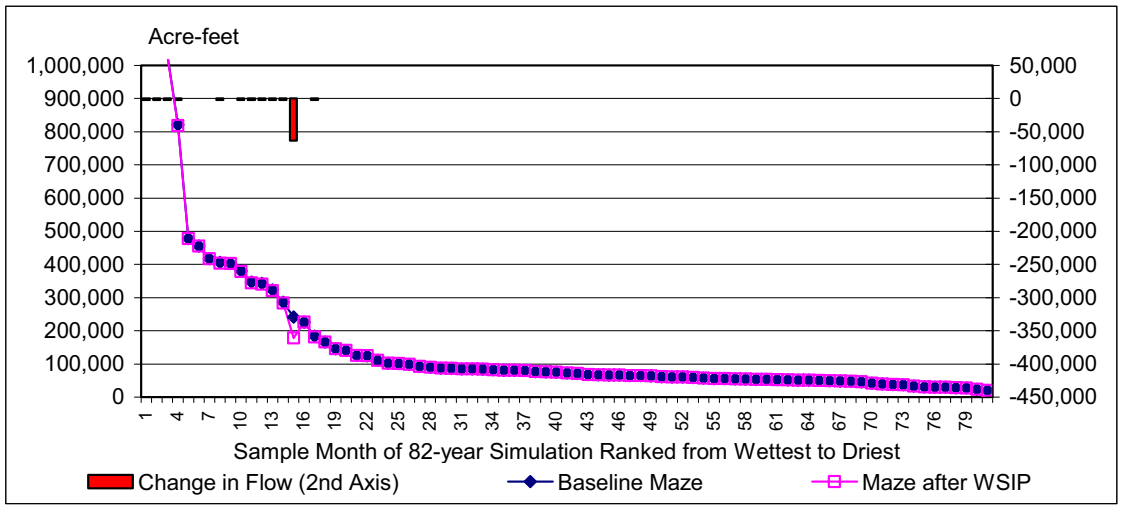
June



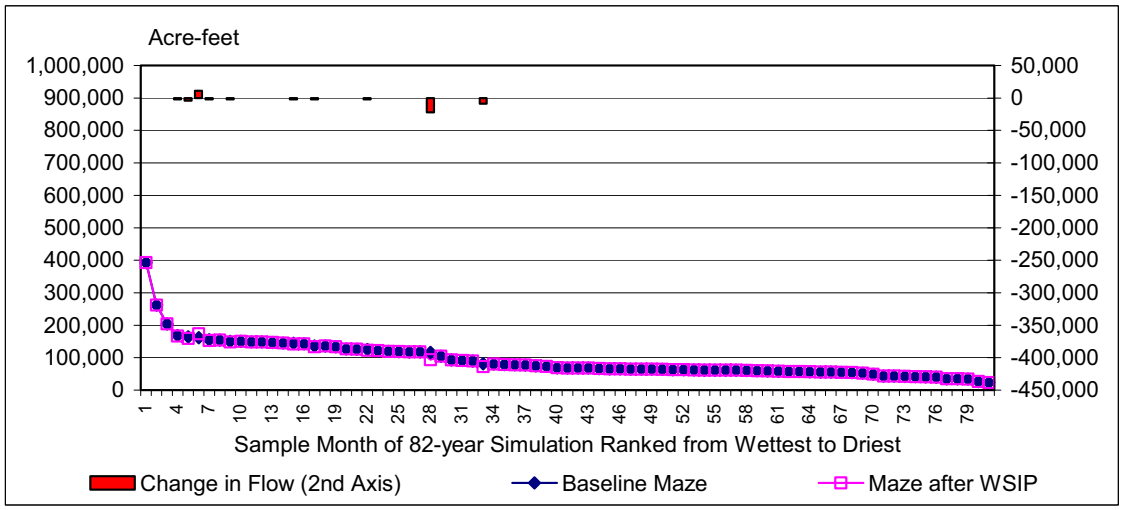
APPENDIX O4

Figure 3.2-4
San Joaquin River Flow Upstream of Stanislaus River Confluence – July through August

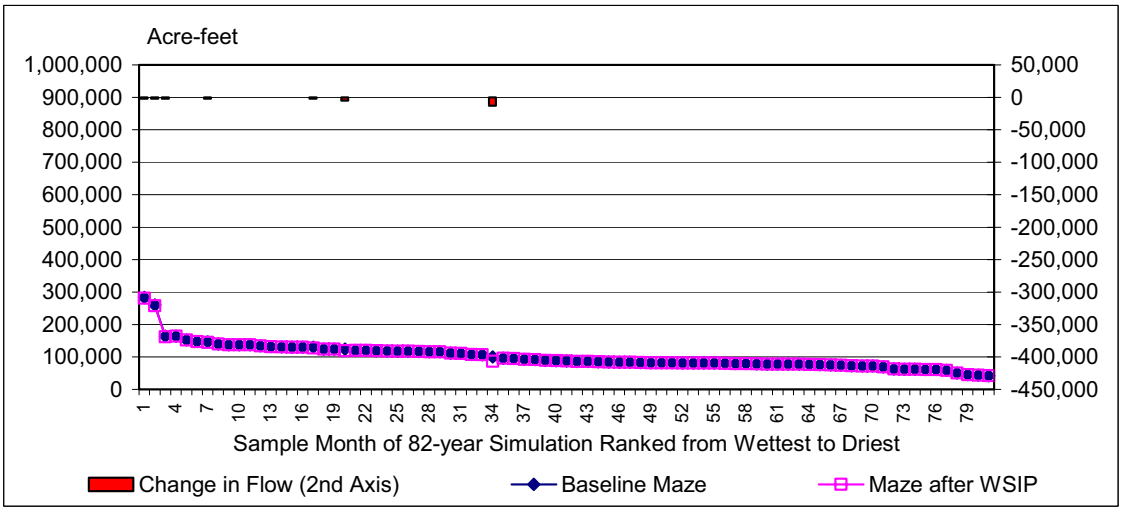
July



August



September



flow at La Grange Dam superimposed on that flow. The illustration depicts the current flow in the San Joaquin River and how the flow is projected to change due to the WSIP. Consistent with the discussion of flow changes at La Grange Dam, the figures for Maze flow illustrate that the projected flow changes at Maze would typically occur during wetter years, and that the more sizeable changes in flow would occur during years when the flows at Maze are relatively large.

3.3 Stanislaus River

The USBR operates the New Melones Project for several purposes, including flow and water quality conditions in the Stanislaus River and the San Joaquin River below the Stanislaus River confluence. Because the USBR has responsibility for San Joaquin River flow and water quality objectives, the agency will at times utilize New Melones Project releases to achieve compliance with those objectives. During these times, the USBR may provide flows from the Stanislaus River to supplement flows in the San Joaquin River. These supplemental flows may either provide for flow compliance at Vernalis or may provide dilution flow to comply with downstream water quality objectives. Changes in flow or water quality conditions upstream of the Stanislaus River such as would occur under the WSIP could at times cause a reaction of New Melones Project operations to maintain compliance with downstream water quality or flow objectives.

An analysis was conducted to identify the frequency at which the WSIP could affect the USBR's operation of the New Melones Project; the analysis consisted of superimposing the occurrence of flow changes at La Grange Dam upon the projected periods when releases from New Melones could be made explicitly for San Joaquin River flow or water quality compliance. Table 3.3-1 illustrates the results of the analysis. The numeric values shown in Table 3.3-1 represent the period and magnitude of the flow changes at La Grange Dam due to the WSIP. For instance, in June of 1922, there is a 16,000-acre-foot reduction in releases projected at La Grange Dam. In this instance, there is no release from the Stanislaus River explicitly for either water quality or flow conditions at Vernalis. Therefore, the change in releases at La Grange Dam would not lead to a change in Stanislaus River operations, and thus the change at La Grange Dam would track directly downstream in the San Joaquin River to Vernalis.

As illustrated in Table 3.3-1, only rarely (3 monthly instances within the 82-year analysis) would there be a potential conflict between WSIP-induced changes in releases and periods of controlled releases from the Stanislaus River for San Joaquin River flow or water quality conditions. The rarity of occurrence is expected, as the WSIP-induced effect would typically occur during wetter years when there are sufficient flows in the San Joaquin River and explicit releases from the Stanislaus River would not be required to achieve compliance with downstream water quality and flow objectives. The rare instances of potential conflict occurred during periods when flow objectives at Vernalis were a controlling condition of operations, and only once during a coincidental time of water quality control. If the flow in the San Joaquin River from the Tuolumne River was reduced during these periods of control, the USBR might increase its release from the Stanislaus River (or from other sources) to counter the reduction.

In those few instances, if the USBR released additional water to the Stanislaus River to offset the reduction in flow from the Tuolumne River, storage in New Melones Reservoir (maximum storage of over 2,400,000 acre-feet) could be reduced by the amount of the additional release. This reduction in storage could have an effect on a year's allocation of water to the several USBR uses of Stanislaus River water. These uses include deliveries to CVP New Melones Project water contractors and the instream fishery releases. The frequency and magnitude of such potential reductions was estimated through additional review of study results. In two of the three instances when a supplemental release by the USBR could occur (27,000 acre-feet in June 1927, and 12,000 acre-feet in February 1964), a reduction in New Melones Reservoir storage could carry into a year's allocation of deliveries to CVP contractors and fishery releases. For the 1927 example, CVP deliveries to the Stanislaus River contractors could be reduced by about 3,000 acre-feet in 1928 (out of a projected 46,000 acre-feet of delivery for that year). The allocated annual fishery releases could be reduced by about 12,000 acre-feet during a year like 1928, but that potential reduction would be incidentally countered with the 27,000 acre-feet increase in release due to the reaction to the decrease in flow from the Tuolumne River; thus, on an annual basis the Stanislaus River could experience greater flow in such a year. CVP Stanislaus River contractors currently receive an allocation of up to 90,000 afy, with sequential periods of no deliveries. The reduction in CVP deliveries

during 1928 would represent about a 6 percent reduction in CVP supply during that year, a supply that is zero during a quarter of the time.

In the second instance, February 1964, a reduction in New Melones Reservoir storage could affect the current year's allocations of water supply. The estimated effect in that year to CVP Stanislaus River contractors would be zero, as no water supply was allocated to the contractors. Annual fishery releases would again be reduced for the year (about 6,000 acre-feet), but the river would incidentally have an increase in release of 12,000 acre-feet in February. A reduction to the CVP contractors' supply would not occur until a couple of years later, if at all, and within current allocation procedures would amount to about 1,000 acre-feet.

The third instance of potential effect on New Melones Project operations (June 1973) potentially occurs subsequent to the time that the current year's water supply allocations are made, thereby not affecting 1973 operations except for a reduction in New Melones Reservoir storage carried into 1974. Hydrology during 1974 is sufficiently wet that New Melones Reservoir is projected to spill during filling; thus, the additional release during 1973 would not affect water supply allocations in a subsequent year.

3.4 San Joaquin River at Vernalis

Current flow and water quality conditions at Vernalis are described in Section 2 above, and the potential changes in flow to the San Joaquin River due to WSIP-induced changes from the Tuolumne River are shown in Table 3.1-4. As described in Section 3.3 above, there would only be a rare instance when Stanislaus River operations would react to changes in the San Joaquin River due to the WSIP. Therefore, in almost all circumstances, the change in La Grange flows would track as a change in San Joaquin River flow at Vernalis (inflow to the Delta). While the absolute water quality at Vernalis would be slightly reduced with the reduction of Tuolumne River flow (which is of better quality), water quality objectives at Vernalis would continue to be met. Flow objectives at Vernalis would continue to be met if the USBR meets those objectives.

3.5 Sacramento-San Joaquin Delta

The CVP and SWP have the responsibility of providing compliance with the Delta water quality objectives prescribed by SWRCB Decision 1641. Additional operational constraints on the CVP and SWP are in place as a result of biological opinions and court decisions. The CVP and SWP would react to WSIP-induced changes to inflow to the Delta from the San Joaquin River. These reactions could manifest as changes in upstream releases or changes in exports from the southern Delta. A post-process analysis was used to identify the frequency and magnitude of the potential reaction of the CVP and SWP. Similar to the analysis described for the Stanislaus River and San Joaquin River evaluation, this analysis contrasts changes in La Grange Dam releases against Delta operational conditions.

Two different types of indicator analysis are used. The first is used to identify the coincidence of Tuolumne River flow changes and Delta "balanced conditions." A Delta balanced condition is the period of time when the CVP and SWP are explicitly balancing reservoir releases with export operations to provide a certain Delta outflow to meet either flow or water quality objectives in the Delta. A change in flow (e.g., from the San Joaquin River) would lead to the CVP and SWP modifying their reservoir releases or exports to react to the change in flow to the Delta. During periods when the Delta is in a balanced condition, a change in San Joaquin River flow could cause a change in CVP and SWP operations. During periods when the Delta is in an "excess condition," the change in flow would not necessitate a change in releases, but could cause a change in exports, as described later.

Table 3.5-1 contrasts Tuolumne River flow changes due to the WSIP against those periods when the Delta is projected to be in a balanced condition. The CalSim II study used for this analysis is derived from the report entitled *Draft State Water Project Delivery Reliability Report* (DWR, 2007).[3] The study represents a depiction of current CVP and SWP operations as affected by current regulatory requirements, including the emergency remedy measures specified by Judge Wanger to protect delta

[3] Report and studies accessible at http://www.water.ca.gov.

APPENDIX O4

Table 3.3-1
Coincidence of Periods of New Melones Vernalis Water and Flow Releases and La Grange Flow Changes

Water Yr	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	0	0	0	0	-5	-7	-7	0	-16	-2	0	0
1923	0	0	0	0	0	0	-2	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	-27	0	-9	-13
1928	0	-20	-34	-3	-15	0	-9	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	-247	-17	-4	0	0	0	0	0
1937	0	0	0	0	-16	-3	-9	0	0	0	0	0
1938	0	0	-20	0	0	0	-7	-17	-5	0	-2	0
1939	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	-38	-6	0	0	0	0	0
1941	0	0	0	3	0	0	-1	0	-4	-2	0	0
1942	0	0	0	-6	0	-3	-6	-3	-3	-2	0	0
1943	0	0	0	0	0	-2	-7	0	-4	0	-2	0
1944	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	-37	-15	0	0	0	0	0	0
1946	0	7	0	0	0	-12	-4	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	-117	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	-21	0	0	-16	-2	0	-2	0
1953	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	-37	-39	0	-4	-3	0	-9	-2	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	-38	0	-11	-1	-2	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	-12	0	0	0	0	0	0	0
1965	0	0	0	-186	-5	-11	-10	0	0	0	11	0
1966	0	0	-1	0	-17	0	0	0	0	0	0	0
1967	0	0	0	0	0	-18	0	-12	0	-2	-2	0
1968	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	-25	-2	-11	-8	-2	-2	0	-2	0
1970	0	0	0	27	-6	-21	0	0	0	0	0	0
1971	0	0	0	0	0	-16	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	-7	-1	0	60	0	0	0
1974	0	0	0	-8	0	-10	-5	0	-10	0	-2	0
1975	0	0	0	0	0	0	-8	0	7	-2	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	-89	0	0	0
1979	0	0	0	-4	0	-16	-2	-2	0	0	0	0
1980	0	0	0	8	0	-8	-5	-2	-2	-2	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	-27	-12	0	0	-2	-2	0	-4	-2
1983	-1	3	-1	0	0	0	0	-10	-5	-2	0	-2
1984	0	2	0	0	0	4	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	-17	-20	-11	-5	-5	0	0	-2
1987	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	-130	-63	-22	-5
1994	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	-9	-9	-2	-2	-2	0	-2
1996	0	0	0	0	-2	0	-5	-5	-5	0	0	-2
1997	0	0	0	-6	0	0	0	0	0	0	0	0
1998	0	0	0	-19	0	-3	-11	-4	-4	-2	0	0
1999	0	0	0	0	0	-9	-11	0	0	0	0	0
2000	0	0	0	0	-19	0	0	0	-12	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0

Key				
	Instances of required New Melones releases for Vernalis water quality		Instances of potential conflict
	Instances of required New Melones releases for Vernalis flow	-5	La Grange flow change (TAF)

smelt. The measures required by the court will be in place for an interim period, and a revised biological opinion and OCAP (Operations Criteria & Plan) could lead to different operational requirements. However, this study provides the best available depiction of current CVP and SWP operations in a format that is usable for this analysis. Also, while measures that are ultimately implemented by the CVP and SWP may differ from those measures assumed in this analysis, the conclusions of this analysis are not expected to significantly change.

Table 3.5-1 illustrates that the vast majority of instances of Tuolumne River flow change occur during Delta excess conditions. During these periods, it is unlikely that the CVP or SWP would modify their upstream reservoir operations in reaction to a change in inflow from the San Joaquin River. There are 26 months (out of the 82-year [984-month] simulation) during which a change in flow occurs during Delta balanced conditions. When there was a change, the change ranged from minimal (17 instances less than 10,000 acre-feet in a month) to three instances of change greater than 60,000 acre-feet in a month (June 1973: 60,000 acre-feet; June 1978: 89,000 acre-feet; and July 1993: 63,000 acre-feet). The average annual reduction in inflow during balanced conditions amounts to 7,000 acre-feet. When these reductions in inflow to the Delta occur, the CVP and SWP may elect to increase reservoir releases, decrease exports, or a combination of both. The larger instances of change occur during months when Don Pedro Reservoir is refilling during wetter years subsequent to prolonged drought.

A second analysis is used to identify the potential effect on CVP and SWP exports due to San Joaquin River flow changes. This second analysis is separate, but at times linked to the analysis previously described. During Delta balanced conditions, the CVP and SWP could choose whether to adjust releases or exports in reaction to a change in San Joaquin River flow into the Delta. However, current operational constraints can separately limit exports based on hydraulic conditions in the south Delta. Table 3.5-2 illustrates a bookend potential effect that WSIP-induced San Joaquin River flow changes could have on CVP and SWP exports. The analysis is focused on the January through June time period, which is the primary focus of the Judge Wanger emergency remedy measures to protect delta smelt. During this period, the allowable reverse flows in Old and Middle River are established. These flows are dependent on the hydraulics of the south Delta, including the amount of water that enters the Delta from the San Joaquin River. A general rule-of-thumb is that about 50 percent of the flow at Vernalis affects the flow in Old and Middle Rivers, and exports have almost a direct (1:1) effect on flow in Old and Middle Rivers. Thus, about one-half of the change in flow in the San Joaquin River will affect the amount of allowed export. Table 3.5-2 reports the amount of change in allowed export (in cfs) that would occur due to WSIP-induced reductions in flow in the San Joaquin River during the January through June period. The potential average annual effect on CVP and SWP exports amounts to approximately 10,000 afy. About half of the years of the analysis resulted in essentially no change in potential exports, and the remainder of the years showed a potential annual change ranging from 5,000 acre-feet to up to about 130,000 acre-feet. This analysis may overstate the reduction of exports due to WSIP-induced reductions in inflow to the Delta. The method of the analysis does not consider the shifting of export operations by the CVP and SWP to reduce the potential loss of exports. Nor does the analysis consider the potential occurrence of extremely high flow conditions in the San Joaquin River that would ameliorate the effect of a WSIP-induced flow reduction in the San Joaquin River.

As described above, the CVP and SWP operate their systems in an integrated and coordinated fashion, and, when a difference in hydrology occurs (such as a WSIP-induced flow change to the Delta), the CVP and SWP generally have two means to react: a change in releases and/or a change in exports. The two separate isolated analyses described above indicate the magnitude and frequency of changes in Delta inflow from the WSIP-induced effect on Don Pedro Project operations. The two separate potential CVP/SWP effects described above are not always additive, as the projects could select one export or release reaction over the other, or a combination of both.

APPENDIX O4

Table 3.5-1
Coincidence of La Grange Flow Changes and Delta Balanced and Excess Conditions

Water Yr	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1922	0	0	0	0	-5	-7	-7	0	-16	-2	0	0	-38
1923	0	0	0	0	0	0	-2	0	0	0	0	0	-2
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	-27	0	-9	-13	-49
1928	0	-20	-34	-3	-15	0	-9	0	0	0	0	0	-82
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	-247	-17	-4	0	0	0	0	0	-268
1937	0	0	0	0	-16	-3	-9	0	0	0	0	0	-28
1938	0	0	-20	0	0	0	-7	-17	-5	0	-2	0	-51
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	-38	-6	0	0	0	0	0	-44
1941	0	0	0	3	0	0	-1	0	-4	-2	0	0	-4
1942	0	0	0	-6	0	-3	-6	-3	-3	-2	0	0	-22
1943	0	0	0	0	0	-2	-7	0	-4	0	-2	0	-15
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	-37	-15	0	0	0	0	0	0	-53
1946	0	7	0	0	0	-12	-4	0	0	0	0	0	-8
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	-117	0	0	0	0	0	0	0	0	0	-117
1952	0	0	0	0	-21	0	0	-16	-2	0	-2	0	-42
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	-37	-39	0	-4	-3	0	-9	-2	0	0	-94
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	-38	0	-11	-1	-2	0	0	-53
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	-12	0	0	0	0	0	0	0	-12
1965	0	0	0	-186	-5	-11	-10	0	0	0	11	0	-200
1966	0	0	-1	0	-17	0	0	0	0	0	0	0	-18
1967	0	0	0	0	0	-18	0	-12	0	-2	-2	0	-35
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	-25	-2	-11	-8	-2	-2	0	-2	0	-53
1970	0	0	0	27	-6	-21	0	0	0	0	0	0	0
1971	0	0	0	0	0	-16	0	0	0	0	0	0	-16
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	-7	-1	0	-60	0	0	0	-68
1974	0	0	0	-8	0	-10	-5	0	-10	0	-2	0	-36
1975	0	0	0	0	0	0	-8	0	7	-2	0	0	-4
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	-89	0	0	0	-89
1979	0	0	0	-4	0	-16	-2	-2	0	0	0	0	-24
1980	0	0	0	8	0	-8	-5	-2	-2	-2	0	0	-11
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	-27	-12	0	0	-2	-2	0	-4	-2	-49
1983	-1	3	-1	0	0	0	0	-10	-5	-2	0	-2	-18
1984	0	2	0	0	0	4	0	0	0	0	0	0	5
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	-17	-20	-11	-5	-5	0	0	-2	-61
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	-130	-63	-22	-5	-220
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	-9	-9	-2	-2	-2	0	-2	-27
1996	0	0	0	0	-2	0	-5	-5	-5	0	0	-2	-19
1997	0	0	0	-6	0	0	0	0	0	0	0	0	-6
1998	0	0	0	-19	0	-3	-11	-4	-4	-2	0	0	-43
1999	0	0	0	0	0	-9	-11	0	0	0	0	0	-20
2000	0	0	0	0	-19	0	0	0	-12	0	0	0	-32
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0

Key
Periods of Delta "excess condition", and no potential flow conflict
-5 La Grange flow change (TAF)

APPENDIX O4

Table 3.5-2
Coincidence of La Grange Flow Changes and CVP/SWP Export Constraints (January through June)

Water Yr	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	0	0	0	0	-46	-59	-62	0	-135	0	0	0
1923	0	0	0	0	0	0	-18	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	-226	0	0	0
1928	0	0	0	-25	-134	0	-75	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	-2226	-137	-31	0	0	0	0	0
1937	0	0	0	0	-146	-26	-72	0	0	0	0	0
1938	0	0	0	0	0	0	-60	-138	-41	0	0	0
1939	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	-311	-48	0	0	0	0	0
1941	0	0	0	27	-4	-3	-4	0	-30	0	0	0
1942	0	0	0	-45	0	-22	-46	-23	-23	0	0	0
1943	0	0	0	0	0	-16	-56	0	-36	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	-337	-125	-2	0	0	0	0	0
1946	0	0	0	0	0	-99	-30	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	-192	0	0	-129	-18	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	-313	0	-29	-26	0	-78	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	-313	0	-93	-9	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	-106	0	0	0	0	0	0	0
1965	0	0	0	-1510	-46	-87	-82	0	0	0	0	0
1966	0	0	0	0	-155	0	0	0	0	0	0	0
1967	0	0	0	0	0	-150	0	-101	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	-205	-22	-88	-64	-18	-18	0	0	0
1970	0	0	0	216	-54	-171	0	0	0	0	0	0
1971	0	0	0	0	0	-126	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	-59	-5	0	-507	0	0	0
1974	0	0	0	-68	0	-85	-39	0	-83	0	0	0
1975	0	0	0	0	0	0	-70	0	55	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	-752	0	0	0
1979	0	0	0	-29	0	-132	-18	-18	0	0	0	0
1980	0	0	0	62	0	-62	-41	-18	-18	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	-221	-104	0	0	-15	-15	0	0	0
1983	0	0	0	0	0	0	0	-78	-39	0	0	0
1984	0	0	0	0	0	32	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	-154	-164	-95	-41	-41	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	-1096	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	-75	-77	-15	-15	0	0	0
1996	0	0	0	0	-15	0	-41	-41	-41	0	0	0
1997	0	0	0	-50	0	0	0	0	0	0	0	0
1998	0	0	0	-152	0	-25	-93	-32	-32	0	0	0
1999	0	0	0	0	0	-70	-92	0	0	0	0	0
2000	0	0	0	0	-172	0	0	0	-105	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0

Key
Periods when a reduction in La Grange flow occurs during January through June
-15 La Grange flow change (cfs)

APPENDIX C

Special-Status Plant and Wildlife Species Initially Evaluated

TABLE C-1

SPECIAL STATUS PLANT SPECIES INITIALLY EVALUATED

Plant Species Common/Scientific Name	Legal Status * Federal/State/CNPS	Potential for Occurrence		Comments
		Thomas Shaft	Tesla Portal	
Sharsmith's onion *Allium sharsmithiae*	SC/-/1B	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack suitable high elevation chaparral and cismontane woodlands and serpentine soils.
Large-flowered fiddleneck *Amsinckia grandiflora*	FE/SE/1B	P	N	Suitable habitat present at Thomas Shaft project site (near Lawrence Livermore Site 300), however, none detected during 2006 (URS-ATS Joint Venture, 2008,) or 2004 surveys (Tetra Tech 2004a). Nearest occurrence is less than 4 miles away.
Bent-flowered fiddleneck *Amsinckia lunaris*	-/-/1B	P	P	Marginally suitable habitat present at Thomas Shaft project site however, no plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008). Habitat marginal at Tesla Site. Nearest occurrence is more than 14 miles away.
Suisun Marsh aster *Aster lentus*	SC/-/1B	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack suitable riverine habitat. None found during 2006 surveys (Tetra Tech, 2006).
Heartscale *Atriplex cordulata*	SC/-/1B	P	P	No suitable habitat present. Both Tesla and Thomas Shaft sites lack suitable riverine habitat. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).
Brittlescale *Atriplex depressa*	SC/-/1B	N	P	Marginally suitable habitat present at Tesla site, but no plants found during 2006 botanical surveys (URS-ATS Joint Venture, 2008). No suitable habitat, and none found in 2004 at Thomas Shaft site (Tetra Tech 2004a). Nearest occurrence is over 15 miles outside of project area.

TABLE C-1
SPECIAL STATUS PLANT SPECIES INITIALLY EVALUATED

Plant Species Common/Scientific Name	Legal Status * Federal/State/CNPS	Potential for Occurrence		Comments
		Thomas Shaft	Tesla Portal	
San Joaquin spearscale *Atriplex joaquiniana*	SC/-/1B	N	P	Marginally suitable habitat present at Tesla site, but no plants found during 2006 botanical surveys (May & Associates, 2006). No suitable habitat, and none found at Thomas Shaft site (Tetra Tech, Tetra Tech, 2006). Nearest occurrence is over 12 miles outside of project area.
Alkali milk-vetch *Astragalus tener* var. *tener*	SC/-/1B	P	P	Suitable habitat present at both Tesla and Thomas Shaft sites. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008) Nearest CNDDB occurrence is over 15 miles outside of Thomas Shaft project site.
Big-scale balsamroot *Balsamorhiza macrolepis* var. *macrolepis*	-/-/1B	N	N	No suitable habitat present. No serpentine soils present in either Tesla or Thomas Shaft sites. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).
Big tarplant *Blepharizonia plumosa*	SC/-/1B	P	P	Marginally suitable habitat present, at both Tesla and Thomas Shaft sites, but no plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).
Succulent owl's-clover *Castilleja campestris* ssp. *succulenta*	FT/SE/1B	P	P	Marginally suitable habitat present at both Tesla and Thomas Shaft sites, but no plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).
Lemmon's jewelflower *Caulanthus coulteri* var. *lemmonii*	-/-/1B	P	N	Marginally suitable habitat present at Thomas Shaft. Both Tesla and Thomas Shaft sites lack suitable pinyon and juniper woodland habitat, but some marginal grassland habitat on rocky substrates is present at Thomas Shaft site. None found during 2004 surveys (Tetra Tech 2004a).
Slough thistle *Cirsium crassicaule*	SC/-/1B	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack suitable riverine habitat. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).

TABLE C-1

SPECIAL STATUS PLANT SPECIES INITIALLY EVALUATED

Plant Species Common/Scientific Name	Legal Status * Federal/State/CNPS	Potential for Occurrence		Comments
		Thomas Shaft	Tesla Portal	
Mt. Hamilton thistle *Cirsium fontinale* var. *campylon*	SC/-/1B	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack serpentine soil. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008). Nearest known occurrences are over 10 miles outside of project area in the western foothills.
Santa Clara red ribbons *Clarkia concinna* ssp. *automixa*	-/-/2	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack suitable chaparral and cismontane woodlands. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).
Beaked clarkia *Clarkia rostrata*	SC/-/1B	P	P	Marginally suitable habitat present at both Tesla and Thomas Shaft sites, however no plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008). Knownnon-specific CNDDB occurrences present within 1 mile of Thomas Shaft site.
Hispid bird's beak *Cordylanthus mollis* ssp. *hispidus*	-/-/1B	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack suitable alkaline soils and alkali playa lake beds associated with the species. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).
Palmate-bracted bird's beak *Cordylanthus palmatus*	FE/SE/1B	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack suitable alkaline soils and alkali playa lake beds associated with the species. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008). Known from only a few occurrences in Contra Costa and Alameda counties.
Mt. Hamilton coreopsis *Coreopsis hamiltonii*	SC/-/1B	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack suitable talus slopes habitat and the project area is well below the elevational range for the species. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).

TABLE C-1

SPECIAL STATUS PLANT SPECIES INITIALLY EVALUATED

Plant Species Common/Scientific Name	Legal Status * Federal/State/CNPS	Potential for Occurrence		Comments
		Thomas Shaft	Tesla Portal	
Mariposa cryptantha *Cryptantha mariposae*	-/-/1B	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack serpentine soils and chaparral. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).
Livermore tarplant *Deinandra bacigalupii*	-/-/1B	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack suitable meadow and seep wet habitats. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).
Hospital Canyon larkspur *Delphinium californicum* ssp. *interius*	SC/-/1B	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack suitable high elevation chaparral and cismontane woodlands and wet boggy meadows. The study areas are outside of the elevational range for the species.
Recurved larkspur *Delphinium recurvatum*	SC/-/1B	P	P	Marginally suitable grassland, oak woodland and scrub habitat present at both Tesla and Thomas Shaft sites, but no plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008). Nearest known CNDDB occurrence is over 14 miles outside of the Thomas Shaft project area.
Dwarf downingia *Downingia pusilla*	-/-/2	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack vernal pool and other seasonal wetland habitats.
Mt. Diablo buckwheat *Eriogonim truncatum*	-/-/1A	N	N	Considered unlikely to occur—presumed extirpated in California. Last seen 1940.
Round-leaved filaree *Erodium macrophyllum*	-/-/2	P	P	Marginally suitable habitat present at both Thomas Shaft and Tesla sites, but no plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008). Nearest known occurrence is approximately 15 miles outside of the project area.
Delta button-celery *Eryngium racemosum*	-/SE/1B	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack vernal pool and other seasonal wetland habitats. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).

TABLE C-1

SPECIAL STATUS PLANT SPECIES INITIALLY EVALUATED

Plant Species Common/Scientific Name	Legal Status * Federal/State/CNPS	Potential for Occurrence		Comments
		Thomas Shaft	Tesla Portal	
Diamond-petaled California poppy *Eschscholzia rhombipetala*	SC/-/1B	P	P	Suitable grassland habitat present at both Tesla and Thomas Shaft sites, however no plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008). Nearest known occurrence is approximately 3.5 miles outside of the project area.
Talus fritillary *Fritillaria falcata*	SC/-/1B	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack shale, granite, and serpentine talus. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008). Nearest known CNDDB occurrence is over 10 miles outside of the Thomas Shaft project area.
Diablo helianthella *Helianthella castanea*	SC/-/1B	N	N	No suitable habitat present. No suitable oak woodland habitat within footprint of either Tesla or Thomas Shaft sites. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).
Napa western flax *Hesperolinon serpentinum*	SC/-/1B	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites do not support serpentine soils and are not within elevational range for the species. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008). Nearest known occurrence is over 10 miles outside Thomas Shaft project area.
Rose-mallow *Hibiscus lasiocarpus*	-/-/2	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack suitable riverine habitat. None found during 2003 surveys (Weiss 2003).
Knotted rush *Juncus nodosus*	-/-/2	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack suitable riverine habitat. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).
Contra Costa goldfields *Lasthenia conjugens*	FE/-/1B	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack suitable vernal pool habitat. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a). or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).

TABLE C-1
SPECIAL STATUS PLANT SPECIES INITIALLY EVALUATED

Plant Species Common/Scientific Name	Legal Status * Federal/State/CNPS	Potential for Occurrence		Comments
		Thomas Shaft	Tesla Portal	
Legenere *Legenere limosa*	SC/-/1B	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack suitable vernal pool habitat. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).
Mason's lilaeopsis *Lilaeopsis masonii*	SC/-/1B	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack suitable riverine habitat. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).
Delta mudwort *Limosella subulata*	-/-/2	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack suitable slow-moving tributary waterways. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008). Nearest known occurrence is approximately 17 miles outside of the Tesla project area.
Showy madia *Madia radiata*	SC/-/1B	P	P	Marginally suitable grassland habitat and nearby oak woodland habitats present at both Tesla and Thomas Shaft sites however, no plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).
Hall's bush mallow *Malacothamnus hallii*	-/-/1B	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack serpentine soils or chaparral. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech, 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008). Nearest known occurrence is approximately 6 miles outside of the Thomas Shaft project area.
Mt. Diablo cottonweed *Micropus amphibolus*	-/-/2	C	P	Present in nearby Thomas Shaft roadway project area, however none located within footprint of the Thomas Shaft water quality facility project site (Weiss 2003).
Mt. Diablo phacelia *Phacelia phacelioides*	SC/-/1B	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites are outside the elevational range for the species. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).

TABLE C-1

SPECIAL STATUS PLANT SPECIES INITIALLY EVALUATED

Plant Species Common/Scientific Name	Legal Status * Federal/State/CNPS	Potential for Occurrence		Comments
		Thomas Shaft	Tesla Portal	
Hairless popcorn flower *Plagiobothrys glaber*	-/-/1A	N	N	Considered extirpated in California. Considered Extinct (last seen in 1957). Not likely to occur at either Tesla or Thomas Shaft sites. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).
Sanford's arrowhead *Sagittaria sanfordii*	SC/-/1B	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack suitable habitat. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).
Rayless ragwort *Senecio aphanactis*	-/-/2	P	P	Marginally suitable oak woodland habitat present outside the project footprints. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).
Wright's trichocoronis *Trichocoronis wrightii* var. *wrightii*	-/-/2	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack vernal pool and other seasonal wetland habitats. No plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).
Showy Indian clover *Trifolium amoenum*	FE/-/1B	P	P	Suitable grassland habitat present at both Tesla and Thomas Shaft sites, however no plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).
Caper-fruited tropidocarpum *Tropidocarpum capparideum*	SC/-/1A	N	N	Considered extirpated in California. Suitable grassland habitat present at both Tesla and Thomas Shaft sites, however no plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site ((URS-ATS Joint Venture, 2008).
Greene's tuctoria *Tuctoria greenei*	FE/SR/1B	N	N	No suitable habitat present. Both Tesla and Thomas Shaft sites lack vernal pool and other seasonal wetland habitats. no plants found during 2004 botanical surveys of Thomas Shaft site (Tetra Tech 2004a) or 2006 surveys of Tesla site (URS-ATS Joint Venture, 2008).

Federal

FE Endangered

FT Threatened

California Native Plant Society (CNPS) Categories

1A Plants presumed extinct in California

1B Plant species considered rare, threatened, or endangered in

TABLE C-1

SPECIAL STATUS PLANT SPECIES INITIALLY EVALUATED

Plant Species Common/Scientific Name	Legal Status * Federal/State/CNPS	Potential for Occurrence Thomas Shaft	Tesla Portal	Comments

California and elsewhere

FD De-listed

SC Federal Species of Concern

2 Plant species considered rare, threatened, or endangered in California but more common elsewhere

4 Plants of Limited Distribution- A Watch List

State

SE Endangered

ST Threatened

SR Rare

SSC Species of Special Concern

FP Fully Protected

Occurrence Information

P Potential for Occurrence based on CNDDB records search of 6-Quad area around site (CNDDB, 2007)

C Species Reported to be Present at site

N No suitable habitat

TABLE C-2

SPECIAL-STATUS WILDLIFE SPECIES INITIALLY EVALUATED

Wildlife Species Common/Scientific Name	Legal Status Federal/State	Potential for Occurrence		Comments
		Thomas Shaft	Tesla Portal	
Mammals				
Pallid bat *Antrozous pallidus*	-/SSC	P(F)	P(F)	No potential roosting trees on the Thomas Shaft site; limited and marginal potential roost tree habitat on the Tesla site (pepper trees). Unlikely to use existing structures as roosts due to levels of human activity. Species is known to occur in the region and could potentially forage in grassland habitats on both sites. But with no unique features relative to the surrounding landscape, the degraded habitat conditions, the small acreage of the project study area, and lack of roosting habitat onsite or in the immediate vicinity, the potential for occurrence is considered low.
Townsend's big eared bat *Corynorhinus townsendii townsendii*	SC/SSC	P(F)	P(F)	Unlikely to use existing structures as roost sites due to levels of human activity. No other potential roosting habitat on either site. Species is known to occur in the region and could potentially forage in grassland habitats on both sites. But with no unique features relative to the surrounding landscape, the degraded habitat conditions, the small acreage of the project study area, and lack of roosting habitat onsite or in the immediate vicinity, the potential for occurrence is considered low.
Greater Western mastiff bat *Eumops perotis californicus*	SC/SSC	P(F)	P(F)	Unlikely to use existing structures as roost sites due to levels of human activity. Species is know to occur in the region and could potentially forage in the grassland habitats on both sites. But with no unique features relative to the surrounding landscape, degraded habitat conditions, the small acreage of the project study area, and the lack of roosting habitat onsite or in the immediate vicinity, the potential for occurrence is considered low.
Berkeley kangaroo rat *Dipodymus heermani berkeleyensis*	-/-/-	N	N	Both sites support marginally suitable grassland habitat; however both lack a shrub component, The species is not expected to occur on either site due to degraded habitat conditions and the highly restricted and localized distribution based on unsubstantiated records.

TABLE C-2

SPECIAL-STATUS WILDLIFE SPECIES INITIALLY EVALUATED

Wildlife Species Common/Scientific Name	Legal Status Federal/State	Potential for Occurrence		Comments
		Thomas Shaft	Tesla Portal	
Riparian (San Joaquin) woodrat *Neotoma fuscipes riparia*	FE/SSC	N	N	Neither site supports suitable habitat for this species. No suitable habitat or evidence of the species was observed during site assessments (Tetra Tech, 2006, May & Associates 2007).
San Joaquin pocket mouse *Perognathus inoratus inoratus*	SC/-	P(B), P(F)	P(B), P(F)	Both sites support marginally suitable annual grassland habitat. The potential for occurrence is considered low due to degraded habitat conditions.
San Joaquin kit fox *Vulpes macrotis mutica*	FE/ST	P(B), P(F)	P(B), P(F)	Both sites support suitable but degraded foraging and denning habitat (i.e. annual grassland habitat with ground squirrel dens and holes (Tetra Tech 2004e). No fox or evidence of fox observed during field assessments, The potential for occurrence is considered low due to degraded habitat conditions, level of human activity, and the rarity of the species in northern California.
Birds				
Tricolored blackbird *Agelaius tricolor*	SC/SSC (nesting colonies)	P(F)	C(F)	Many individuals observed in a mixed flock with red winged blackbirds at Tesla site during 2007 site assessment. Both sites support suitable annual grassland foraging habitat. Neither site supports suitable breeding habitat.
Golden eagle *Aquila chrysaetos*	-/SSC, FP	C(F)	P(F)	Two adults observed during 2007 site assessment at Thomas Shaft site, and at the Carnegie SVRA. Both sites support suitable annual grassland foraging habitat. Neither site supports suitable nesting habitat. The species is known to nest locally.
Burrowing owl *Athene cunicularia*	SC/SSC, -	N	P(B), P(F)	Assumed present based on range, habitat suitability (Tetra Tech, 2004b). Site supports suitable grassland foraging and nesting habitat. This species is tolerant of degraded conditions and low-level human disturbances.
Ferruginous hawk *Buteo regalis*	SC/SSC	P(F)	C(F)	Two adults observed foraging during the 2007 site assessment near the Tesla project site. Both sites support suitable annual grassland foraging habitat.
Swainson's hawk *Buteo swainsoni*	-/ST	N	P(B), P(F)	The eucalyptus trees bordering the existing facility on the Tesla site is considered potential nesting habitat for this species. The Tesla site also supports suitable grassland foraging habitat.

TABLE C-2

SPECIAL-STATUS WILDLIFE SPECIES INITIALLY EVALUATED

Wildlife Species Common/Scientific Name	Legal Status Federal/State	Potential for Occurrence: Thomas Shaft	Potential for Occurrence: Tesla Portal	Comments
Northern harrier *Circus cyaneus*	SC/SSC, -	P(F)	C(F)	Several northern harriers observed foraging during Oct 2006 habitat assessment at Tesla site. Both sites support suitable foraging habitat; neither site supports suitable nesting habitat.
California horned lark *Eremophilia alpestris actia*	-/SSC	P(B), P(F)	P(B), P(F)	Both sites support suitable annual grassland foraging and nesting habitat. The potential for occurrence is considered high.
White-tailed kite *Elanus leucurus*	-/FP	P(F)	C(F), P(B)	Species observed foraging during 2007 habitat assessment at Tesla site. No potential nest trees at Thomas Shaft site; several marginally potential nest trees (ornamental pepper trees) at Tesla site. No nests have been found during any of the field surveys. Both sites support suitable grassland foraging habitat.
Prairie falcon *Falco mexicanus*	-/SSC	C(F)	P(F)	One adult observed foraging at the Thomas Shaft Road during the 2007 site assessment; both sites support suitable annual grassland foraging habitat. Neither site supports suitable nesting habitat.
California black rail *Laterallus jamaicensis coturniculus*	SC/ST, -	N	N	Neither site supports suitable marsh habitat for this species.
Bald eagle *Haliaeetus leucocephalus*	FT/SE	N	N	Neither site supports suitable nesting or foraging habitat for bald eagle.
Bank swallow *Riparia riparia*	-/ST	N	N	Neither site supports suitable habitat for this species.
California least tern *Sternula antillarum*	FE/-	N	N	Neither site supports suitable habitat for this species. The project sites are outside the current range of the species.
Reptiles and Amphibians				
California tiger salamander, Critical Habitat for species *Ambystoma californiense*	FT/SSC	P	P	Possible, but unlikely to occur. No suitable aquatic habitat at the Thomas Shaft or Tesla sites. Marginally suitable upland aestivation habitat present at both sites – but is dependent on the presence of potential breeding ponds in the vicinity. None are present in the immediate vicinity but additional potential breeding ponds may occur within the maximum migratory distance of both species. Past CNDDB records indicate occurrences in the general vicinity (Tetra Tech 2004c, Baseline 2006).

TABLE C-2

SPECIAL-STATUS WILDLIFE SPECIES INITIALLY EVALUATED

Wildlife Species Common/Scientific Name	Legal Status Federal/State	Potential for Occurrence		Comments
		Thomas Shaft	Tesla Portal	
Western pond turtle *Clemys marmorata marmorata*	SC/SSC	N	N	Neither site supports suitable aquatic habitat for this species. None observed during habitat assessment.
San Joaquin whipsnake *Masticophis flagellum ruddocki*	SC/SSC	P(B), P(F)	P(B), P(F)	Both sites support marginally suitable (degraded) grassland habitat for this species.
Alameda whipsnake *Masticophis lateralis euryxanthus*	FT/ST	N	N	No Suitable habitat present. Neither site supports chaparral or other scrub habitats and none is present in the immediate vicinity of either site.
California horned lizard *Phrynosomatidae coronatum frontale*	SC/SSC	P(B), P(F)	P(B), P(F)	Both sites support marginally suitable annual grassland habitat and generally lack sandy soils typical of the species' habitat. None detected during 2006 site assessments (URS-ATS Joint Venture, 2008, Baseline 2006) Potential for occurrence is considered low.
California red-legged frog *Rana aurora draytonii*	FT/SSC	P	P	Possible, but unlikely to occur. No suitable aquatic habitat at the Thomas Shaft or Tesla sites. Marginally suitable upland aestivation habitat present at both sites – but is dependent on the presence of potential breeding ponds in the vicinity. None are present in the immediate vicinity but additional potential breeding ponds may occur within the maximum migratory distance of both species. Past CNDDB records indicate occurrences in the general vicinity (Tetra Tech 2004d, Baseline 2006).
Foothill yellow-legged frog *Rana boylii*	SC/SSC	N	N	Neither site supports suitable habitat for this species. Species was not observed during habitat assessment. Weiss (2006) notes possible dispersal habitat near Thomas Shaft site, but considered unlikely to occur within the Project Study Area.
Western spadefoot toad *Scaphiopus hammondii*	SC/SSC	N	N	Neither site supports suitable aquatic habitat for this species. Some suitable habitat exists in the vicinity of the sites according to Weiss Associates (2003) who notes a CNDDB occurrence in the vicinity of the Thomas Shaft site). None detected during 2004 site assessments (Tetra Tech 2004f, Baseline, 2006). The species is considered unlikely to occur.
Giant garter snake *Thamnophis gigas*	FT/SSC	N	N	Neither the Tesla or Thomas Shaft sites support suitable aquatic habitat for this species.

TABLE C-2

SPECIAL-STATUS WILDLIFE SPECIES INITIALLY EVALUATED

Wildlife Species Common/Scientific Name	Legal Status Federal/State	Potential for Occurrence		Comments
		Thomas Shaft	Tesla Portal	
Invertebrates				
Conservancy fairy shrimp *Branchinecta conservatio*	FE/-	N	N	Neither site supports suitable seasonal aquatic habitat for this species.
Longhorn fairy shrimp, Critical Habitat *Branchinecta longiantennae*	FE/-	N	N	Neither site supports suitable seasonal aquatic habitat for this species.
Vernal pool fairy shrimp *Branchinecta lynchi*	FT/-	N	N	Neither site supports suitable seasonal aquatic habitat for this species.
Valley elderberry longhorn beetle *Desmocerus californicus demorphus*	FT/-	N	N	There are no elderberry shrubs present on either the Tesla or Thomas Shaft sites.
Ricksecker's water scavenger beetle *Hydrochara rickseckeri*	-/-	N	N	Neither site supports suitable aquatic habitat for this species.
Curve-footed diving beetle *Hygrotus curvipes*	SC/-	N	N	Neither site supports suitable aquatic habitat for this species.
Vernal pool tadpole shrimp *Lepidurus packardi*	FE/-	N	N	Neither site supports suitable aquatic habitat for this species.

Federal

- FE Endangered
- FT Threatened
- FD Delisted
- SC Federal Species of Concern

State

- SE Endangered
- ST Threatened
- SR Rare
- SSC Species of Special Concern
- FP State Fully Protected Species

Occurrence Information

- N Not likely to occur
- C Confirmed presence of the species in the Project Study Area
- P Potential to occur based on habitat suitability
- P(B) Potential breeding habitat present
- P(F) Potential foraging habitat present
- C(F) Confirmed presence, foraging habitat only

APPENDIX D

Mitigation Measure Consistency with the WSIP PEIR Mitigation Measures

Introduction

- The Water System Improvement Program (WSIP) Program Environmental Impact Report (PEIR) mitigation measures were each evaluated for their applicability to the proposed San Joaquin Regional Water Quality Improvement Project. In some cases, the mitigation measures proposed in the PEIR were relevant to the proposed project, but because more project specific information is now available and project impacts are known, the PEIR mitigation measure content was edited to better reflect project specific information. Those mitigation measures that were edited, but achieve comparable reductions in impacts as the PEIR measures, are listed in the table below. Some mitigation measures from the PEIR included as project measures were edited to where appropriate for document consistency, or other minor text edits were made for clarification, including cross-references to project-specific impact and mitigation measure numbers. Where these were the only edits made to a mitigation measure it was not considered a substantive edit and is not discussed below.

- The WSIP PEIR also includes mitigation measures that are not applicable to the San Joaquin Regional Water Quality Improvement Project. The PEIR mitigation measures that were not incorporated into this project Draft EIR are also listed below.

- For WSIP PEIR mitigation measures that have been edited for use in this project EIR, this section includes an explanation is provided regarding the rationale for edits made.

PEIR Mitigation Measures	Applicable to Proposed Project? (Y/N)		Notes
	Tesla Portal Site	Thomas Shaft Site	
Land Use and Visual Resources			
Measure 4.3-2, Facility Siting Studies: Conduct project-specific facility siting studies for non-SFPUC land and implement these studies' recommendations to avoid or minimize impacts on existing land uses.	N	N	All activities sited on SFPUC-owned land.
Measure 4.3-4a, Architectural Design: Design permanent new, aboveground facilities to be compatible with existing visual character of the site and surrounding area.	Y	N	Project Mitigation Measure 4.3-5a. Applicable to the Tesla Portal site. Thomas Shaft site is not visible from scenic areas.
Measure 4.3-4b, Landscaping Plans: Prepare and implement landscaping plans to restore (recontour, revegetate, landscape) sites to preconstruction conditions. Monitor landscape plantings.	N	N	Landscape screening at the Tesla Portal site would be required per Project Mitigation Measure 4.3-5b. Thomas Shaft site is not visible from scenic areas.
Measure 4.3-4c, Landscape Screens: Include new plantings and landscape berms to screen views of new structures and equipment from scenic roads.	Y	N	Project Mitigation Measure 4.3-5b. Applicable to the Tesla Portal site. Thomas Shaft site is not visible from a scenic road.
Measure 4.3-4d, Minimize Tree Removal: Minimize or avoid the removal of trees that screen existing and proposed WSIP facility sites; implement tree replacement plan.	N	N	No trees that screen existing or proposed facilities would be removed.
Measure 4.3-5, Reduce Lighting Effects: Use cut-off shields and nonglare fixture design, direct lighting onsite and downward, prevent use of highly reflective building materials or finishes.	N	N	Lighting effects would be minimal at the Tesla Portal site given the distance to nearby highway and residences and design of new lighting. No new outdoor lighting is proposed at the Thomas Shaft site.
Geology			
Measure 4.4-1, Quantified Landslide Analysis: Avoid sites with landslide hazards; where they cannot be avoided, conduct site-specific slope stability analyses and implement recommendations.	N	N	The Tesla Portal and Thomas Shaft sites are located in areas with low potential for landslides.
Measure 4.4-4, Subsidence Monitoring Program: Monitor subsidence and implement corrective actions as warranted.	N	N	No tunneling is proposed at either project site.
Measure 4.4-9, Characterize Extent of Expansive and Corrosive Soil: Characterize presence of expansive/corrosive soils; implement recommendations.	Y	Y	Project Mitigation Measure 4.4-9
Hydrology			
Measure 4.5-2, Site-Specific Groundwater Analysis and Identified Measures: Conduct project-specific analysis of dewatering and implement measures to ensure that groundwater resources beneficial uses of groundwater not adversely affected.	N	N	The absence of shallow groundwater at either of the project sites would preclude the need for dewatering.

PEIR Mitigation Measures	Applicable to Proposed Project? (Y/N)		Notes
	Tesla Portal Site	Thomas Shaft Site	
Measure 4.5-4a, Flood Flow Protection Measures: Preclude exposure of stockpiled soils, hazardous materials, and construction materials to flood flows.	N	N	Both project sites are outside of the 100- and 500-year flood hazard zones.
Measure 4.5-4b, Site-Specific Flooding Analysis and Identified Measures: Implement design measures to preclude projects from causing flooding or damage from redirected flood flows.	N	N	Both project sites are outside of the 100- and 500-year flood hazard zones.
Measure 4.5-5, **Stormwater Treatment and Groundwater Monitoring:** If treated stormwater is used to maintain Lake Merced water levels, monitor surface water and groundwater quality in the vicinity of Lake Merced. Identify and implement corrective actions (e.g., treatment).	N	N	Project would not impact water levels in or near Lake Merced.
Measure 4.5-6, Appropriate Source Controls and Site Design Measures: If a WSIP project will affect jurisdictional wetlands, implement source control and site design measures to ensure compliance with applicable water quality criteria and goals and protect the beneficial uses of the receiving water.	N	N	Project would not affect jurisdictional wetlands.
Biology			
Measure 4.6-1a, Wetlands Assessment: Wetland scientist will determine whether wetlands could be affected by the project, and if so, perform a wetland delineation and develop mitigation.	N	N	A wetland delineation was prepared for the Tesla Portal site, and Project Mitigation Measures 4.6-1a – 4.6-1b were developed to reduce impacts to the artificial (non-jurisdictional) wetland at the Tesla Portal site with project-specific detail. No wetlands are present near the development or construction area on the Thomas Shaft site.
Measure 4.6-1b, Compensation for Wetlands and Other Biological Resources: If a WSIP project will affect jurisdictional wetlands, implement avoidance measures, restoration procedures, and compensatory creation or enhancement to ensure no net loss of wetland extent or function. Compensate for sensitive riparian and upland habitats supporting key special-status species. Obtain permits for each project and comply with applicable regulations addressing sensitive habitats and species. The Habitat Reserve Program is an alternative for implementing offsite habitat compensation.	Y	N	Project Mitigation Measures 4.6-1a – 4.6-1b were developed as project-level mitigation for impacts at the Tesla Portal site. These measures implement the intent of WSIP Draft PEIR Mitigation Measure 4.6-1b, and require the SFPUC to participate in the San Joaquin County Multi-Species Habitat Conservation and Open Space Plan (SJMSCP) and implement best management practices (BMPs).
Measure 4.6-2, Habitat Restoration/Tree Replacement: Restore temporarily affected sensitive habitats. Replace trees designated as heritage trees (or similar local designation) consistent with requirements of local ordinances. Minimize loss of sensitive habitats by coordinating WSIP projects.	Y	N	Project Mitigation Measure 4.6-2: Applicable to the Tesla Portal site only. Revised to provide project-level detail and requires revegetation of disturbed areas to return site to pre-construction condition. Impacts to sensitive habitats at the Thomas Shaft site would be less than significant.

PEIR Mitigation Measures		Applicable to Proposed Project? (Y/N)		Notes
		Tesla Portal Site	Thomas Shaft Site	
Measure 4.6-3a, Protection Measures During Construction for Key Special-Status Species and Other Species of Concern: Where key special-status species and other species of concern are potentially present, implement general practice measures (preconstruction surveys, worker awareness program, environmental inspector, minimization of habitat loss).		Y	Y	Project Mitigation Measures 4.6-3a – 4.6-3l address project-level impacts to key special-status species and other species of concern at the Tesla Portal and Thomas Shaft sites. These measures require implementation of a worker awareness program, and Incidental Take Mitigation Measures (ITMMs) under the SJCMSCP and pre-construction surveys.
Measure 4.6-3b, Standard Mitigation Measures for Key Special-Status Plants and Animals: Implement measures to reduce impacts on key special-status species. ***See below for specific species and corresponding sub-Draft PEIR mitigation number.***		Y	Y	Project Mitigation Measures 4.6-3a – 4.6-3l address project-level impacts to key special-status species and other species of concern at the Tesla Portal and Thomas Shaft sites. These measures require implementation of ITMMs under the SJCMSCP and pre-construction surveys. See below for detail.
Invertebrates				
Valley Elderberry Longhorn Beetle	I.1	N	N	Species not present at the Tesla Portal or Thomas Shaft sites.
Vernal Pool Crustaceans (Vernal pool fairy shrimp; Conservancy fairy shrimp; Vernal pool tadopole shrimp)	I.2	N	N	Species not present at the Tesla Portal or Thomas Shaft sites.
Bay Checkerspot Butterfly; Callippe Silverspot Butterfly	I.3	N	N	Species not present at the Tesla Portal or Thomas Shaft sites.
Fish				
Central Valley fall- and late-fall run DPS Chinook salmon; Central Valley DPS steelhead; Green sturgeon Southern District DPS; Central Coast DPS Steelhead; Rainbow trout	F.1	N	N	Species not present at the Tesla Portal or Thomas Shaft sites.
Reptiles and Amphibians				
California Red-Legged Frog; Foothill yellow-legged frog	RA.1	N	N	Species not present at the Tesla Portal or Thomas Shaft sites.
California Tiger Salamander	RA.2	N	N	Species not present at the Tesla Portal or Thomas Shaft sites.
San Francisco Garter Snake	RA.3	N	N	Species not present at the Tesla Portal or Thomas Shaft sites.
Alameda Whipsnake	RA.4	N	N	Species not present at the Tesla Portal or Thomas Shaft sites.
Birds				
Swainson's Hawk	B.1	Y	Y	Project Mitigation Measure 4.6-3h.
Western Burrowing Owl	B.2 and B.3	Y	Y	Project Mitigation Measures 4.6-3e, 4.6-3f and 4.6-3g.

PEIR Mitigation Measures		Applicable to Proposed Project? (Y/N)		Notes
		Tesla Portal Site	Thomas Shaft Site	
Raptors (including bald eagle)	B.4	Y	Y	Project Mitigation Measures 4.6-3i (WhiteTailed Kite), 4-6-3k (Golden Eagle), and 4.6-3l (Ferruginous Hawk and Prairie Falcon).
Least Bell's vireo	B.5	N	N	Species not present at the Tesla Portal or Thomas Shaft sites.
California Black Rail, California Clapper Rial	B.6	N	N	Species not present at the Tesla Portal or Thomas Shaft sites.
Western Snowy Plover	B.7	N	N	Species not present at the Tesla Portal or Thomas Shaft sites.
Mammals				
Salt Marsh Harvest Mouse	M.1	N	N	Species not present at the Tesla Portal or Thomas Shaft sites.
San Joaquin Kit Fox	M.2	Y	Y	Project Mitigation Measure 4.6-3c.
Riparian Woodrat	M.3	N	N	Species not present at the Tesla Portal or Thomas Shaft sites.
Plants				
Vernal Pool Plants (Succulent Owl's Clover; Hoover's Spurge; Colusa Grass; San Joaquin Valley Orcutt grass; Greene's Tuctoria; Hairy Orcutt Grass)	P.1	N	N	Species not present at the Tesla Portal or Thomas Shaft sites.
Riparian Plants				
Delta button-celery	P.2	N	N	Species not present at the Tesla Portal or Thomas Shaft sites.
Large-Flowered Fiddleneck	P.3	N	N	Species not present at the Tesla Portal or Thomas Shaft sites.
San Francisco Woolly Sunflower; Marin Western Flax; Fountain thistle	P.4	N	N	Species not present at the Tesla Portal or Thomas Shaft sites.
Measure 4.6-4, Pipeline and Water Treatment Plant Treated Water Discharge Restrictions: Design planned discharges from the WSIP pipelines and water treatment plants to natural water bodies to minimize impacts on riparian and aquatic resources and to avoid or minimize temperature effects on aquatic resources.		N	N	Project would not discharge to natural water bodies. Therefore, mitigation measure is not applicable.
Cultural				
Measure 4.7-1, Suspend Construction Work if Paleontological Resource is Identified: Suspend work and notify a qualified paleontologist when a paleontological resource is discovered at any of the project sites. The paleontologist will document the discovery as needed, evaluate the potential resource, and assess the significance of the find under CEQA criteria. Temporarily halt or divert excavation within 50 feet of a fossil find until the discovery is examined by a paleontologist. If avoidance is not feasible, the paleontologist will prepare an excavation plan.		Y	Y	Project Mitigation Measure 4.7-1b.

PEIR Mitigation Measures	Applicable to Proposed Project? (Y/N)		Notes
	Tesla Portal Site	Thomas Shaft Site	
Measure 4.7-2a, Archaeological Testing, Monitoring, and Treatment of Human Remains: Determine if implementation of an archeological testing or archaeological monitoring program or both is the appropriate strategy for avoidance of potential adverse effects on significant archaeological resources. Review any requirements approved by the State Historic Preservation Officer. Prepare an archeological testing plan, an archeological monitoring plan, final archeological resources report and, if applicable, a archeological data recovery plan. The treatment of human remains and of associated or unassociated funerary objects discovered during any soil-disturbing activity will comply with applicable state laws.	Y	Y	Project Mitigation Measure 4.7-2b. Mitigation measure revised to address discovery of human remains only. There is a low potential to encounter archaeological resources during project construction. SFPUC Standard Construction Measure No. 9 and Project Mitigation Measure 4.7-2a address the potential to encounter previously unidentified archaeological resources.
Measure 4.7-2b, Accidental Discovery Measures: Distribute archaeological resource "ALERT" to contractors. If an archeological resource may be present within the project site, an archeological consultant will evaluate it and make a recommendation as to what action (e.g., preservation in situ) is warranted. The project sponsor will implement appropriate measures.	Y	Y	Project Mitigation Measure 4.7-2a.
Measure 4.7-3, Protection of Historic Districts: A qualified historian will assess the city's water system facilities affected by WSIP facility projects for their potential contribution to a historic district. If a historic district would be affected by one or more proposed WSIP facility projects, develop and implement mitigation measures for effects with attention to the potential district as a whole. Should a historic district be identified at the project level, it should be recorded as such, using National/California Register criteria of significance. Document the district by completing the State of California Department of Parks and Recreation 523 forms and submit to the State Historic Preservation Officer.	N	N	The project would not affect a historic district.
Measure 4.7-4a, Alternatives Identification and Resource Relocation: Identify feasible project alternatives to eliminate or reduce the need for demolition or removal of a historic resource to the greatest extent possible. If preservation of the affected historical resource at the current site is determined to be infeasible, the structure will, if feasible, be stabilized and relocated to other appropriate nearby sites. After relocation, the resource will be treated according to the Secretary of the Interior's *Standards for the Treatment of Historic Properties.* If the affected historical resource is to be demolished, consult with local historical societies and governmental agencies regarding salvage of materials for public information or reuse in other locations.	N	N	Historic resources would not be demolished or removed.
Measure 4.7-4b, Historical Resources Documentation: Prepare documentation of historical resources prior to any construction work associated with demolition or removal. The appropriate level of documentation will be selected by a qualified professional who meets the standards for history, architectural history, and/or architecture (as appropriate) set forth by the Secretary of the Interior's *Professional Qualification Standards* (36 CFR 61) in consultation with a preservation specialist assigned by the San Francisco Planning Department and the local jurisdiction, if deemed appropriate by the Planning Department.	N	N	Historic resources would not be demolished or removed.

PEIR Mitigation Measures	Applicable to Proposed Project? (Y/N)		Notes
	Tesla Portal Site	Thomas Shaft Site	
Measure 4.7-4c, Secretary of the Interior's Standards for Treatment of Historic Properties: Prepare materials describing and depicting the proposed project. Review the proposed project for compliance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties*. If a project is determined to be inconsistent with the *Standards for the Treatment of Historic Properties*, pursue and implement redesign of the project such that consistency with the standards is achieved.	N	N	Historic resources would not be demolished or removed.
Measure 4.7-4d, Historic Resources Survey and Redesign: Undertake a historic resources survey to identify and evaluate potential historical resources that may exist in the project's area of potential effect. If a survey identifies one or more historical resources, assess the impact the project may have on those historical resources. If the project will cause a substantial adverse change to a historical resource, assign a preservation specialist to review the proposed project, for compliance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties*. If the project is determined to be inconsistent with those standards, pursue and implement redesign of the project such that consistency with the standards is achieved.	N	N	Historic resources would not be demolished or removed.
Measure 4.7-4e, Historic Resources Protection Plan: A qualified historian will prepare a plan that specifies procedures for protecting and monitoring historical resources during construction.	Y	N	Project Mitigation Measure 4.7-3 applicable at the Tesla Portal site. Not applicable at the Thomas Shaft site where no historical resources would be affected.
Measure 4.7-4f, Preconstruction Surveys and Vibration Monitoring: Include geotechnical investigations if vibration-related impacts could affect historical resources. Follow recommendations of the final geotechnical reports. Conduct a preconstruction survey of existing conditions and monitor the adjacent buildings for damage during construction, if recommended.	N	N	Project Mitigation Measures 4.7-3 and 4.10-2 would provide necessary protection of historical resources at Tesla Portal site. Not applicable at the Thomas Shaft site where no historical resources would be affected.
Traffic			
Measure 4.8-1a, Traffic Control Plan Measures: Elements of the traffic control plan could include: circulation and detour plans, designated truck routes, sufficient staging area, access to driveways, use of standard construction specifications for controlling construction vehicle movements, restrictions on truck trips during peak morning and evening commute hours, lane closure restrictions, maintenance of alternate one-way traffic flow, detour signing, pedestrian and bicycle access and circulation, equipment and materials storage, construction worker parking, roadside safety protocols, considerations for sensitive land uses, coordination with local transit service providers, roadway repair, conformance with the *California Manual on Uniform Traffic Control Devices for Streets and Highways: Part 6 Temporary Traffic Control and Caltrans' 2006 Standard Plans*.	N	N	Construction at the project sites would result in a minor amount of construction related trips, and construction staging and site access would be confined within the existing SFPUC right-of-way. In addition, SFPUC Construction Measure #5 would require SFPUC or its contractor to prepare a traffic control plan to reduce off-site construction related traffic impacts.

PEIR Mitigation Measures	Applicable to Proposed Project? (Y/N)		Notes
	Tesla Portal Site	Thomas Shaft Site	
Measure 4.8-1b, Coordination of Individual Traffic Control Plans: In the event that more than one construction contract is issued for work along existing or new pipelines, and where construction could occur within and/or across multiple streets in the same vicinity, coordinate the traffic control plans in order to mitigate the impact of traffic disruption by including measures that address overlapping construction schedules and activities, truck arrivals and departures, lane closures and detours, and the adequacy of on-street staging requirements.	N	N	Construction at the project sites would result in a minor amount of construction related trips, and therefore, would result in a less than significant impact. In addition, SFPUC Construction Measure #5 would require SFPUC or its contractor to prepare a traffic control plan and coordinate with the local transit and traffic agencies.
Measure 4.8-4, Accommodation of Displaced Public Parking Supply for Recreational Visitors: Include an additional measure in the traffic control plans to accommodate any anticipated visitor parking demand that would be displaced by proposed projects at public recreational facilities.	N	N	The project would be confined within the existing SFPUC right-of-way and would not result in the displacement of public parking.
Air Quality			
Measure 4.9-1a, SJVAPCD Dust Control Measures: Include San Joaquin Valley Air Pollution Control District (SJVAPCD) Basic Control Measures in contract specifications for all construction sites. Include SJVAPCD Enhanced Control Measures in contract specifications when required to mitigate significant PM_{10} impacts. Include SJVAPCD Additional Control Measures in contract specifications for construction sites that are large in area, located near sensitive receptors, or which for any other reason warrant additional emissions reductions. Include SJVAPCD Rule 9510, Indirect Source Review, Section 6.1, Construction Equipment Emissions in contract specifications for any project subject to discretionary approval by a public agency that ultimately results in the construction of a new building, facility, or structure or reconstruction of a building, facility, or structure for the purpose of increasing capacity or activity and also involving 9,000 square feet of space.	Y	Y	Project Mitigation Measure 4.9-1a.
Measure 4.9-1b, SJVAPCD Exhaust Control Measures: Include SJVAPCD Exhaust Control Measures in contract specifications, where applicable, for heavy-duty equipment to limit exhaust emissions within the San Joaquin Region.	Y	Y	Project Mitigation Measure 4.9-1b.
Measure 4.9-1c, BAAQMD Dust Control Measures: For projects in the Sunol Valley, Bay Division, Peninsula, and San Francisco Regions, include Bay Area Air Quality Management District (BAAQMD) Basic Control Measures in contract specifications for all construction sites. Include BAAQMD Enhanced Control Measures in contract specifications for sites over four acres. Include BAAQMD Optional Control Measures in contract specifications for sites that are large in area, located near sensitive receptors, or which for any other reason warrant additional emissions reductions.	N	N	Project sites are not located in BAAQMD.
Measure 4.9-1d, BAAQMD Exhaust Control Measures: For projects in the Sunol Valley, Bay Division, Peninsula, and San Francisco Regions, include BAAQMD Exhaust Control Measures to limit exhaust emissions, where applicable.	N	N	Project sites are not located in BAAQMD.

PEIR Mitigation Measures	Applicable to Proposed Project? (Y/N)		Notes
	Tesla Portal Site	Thomas Shaft Site	
Measure 4.9-2a, Health Risk Screening or Use of Soot Filters: Complete a health risk screening if truck volumes associated with a particular project along a particular haul route exceed 40,000 truck trips over the entire construction period. If a potentially significant impact is indicated, complete a site-specific health risk assessment. Consider diesel particulate matter (DPM) emission rates in separate project-level analysis at the time of construction. Develop a mitigation program based on the site-specific health risk assessment implementing methods of reducing DPM emission or exposure to a less-than-significant level.	N	N	Project construction would not exceed 40,000 truck trips over the construction period.
Measure 4.9-2b, Vacate SFPUC Land Managers' Residences in Sunol Valley: Vacate the two SFPUC Land Managers' residences in the Sunol Valley during construction of the Calaveras Dam or SVWTP – Treated Water Reservoirs projects or complete a health risk screening (and, if warranted, a health risk assessment) to determine health risks at these residences from either of these two projects.	N	N	Project sites are not located in the Sunol Valley.
Measure 4.9-3, Tunnel Gas Odor Control: Add water scrubbers and appropriate chemicals to tunnel ventilation systems if odorous gases become a nuisance odor problem (i.e., odor complaints are received).	N	N	No tunnels would be constructed.
Noise/Vibration			
Measure 4.10-1a, Noise Controls: For all WSIP projects located within 500 feet of any noise-sensitive receptors, implement appropriate noise controls to reduce daytime construction noise levels to meet the 70-dBA daytime speech interference criterion to the extent feasible. For all WSIP projects involving nighttime construction and located within 3,000 feet of any noise-sensitive receptors, implement appropriate noise controls to maintain noise levels at or below any applicable ordinance nighttime noise limits or the 50-dBA nighttime sleep interference criterion to the extent feasible.	N	N	The measure is not applicable to the project because there would be limited nighttime construction and, regarding daytime construction, the project sites are not located within 500 feet of a noise sensitive receptor, with one exception, the caretaker's residence at Tesla Portal. There is a separate mitigation measure for this impact.
Measure 4.10-1b, Vacate SFPUC Caretaker's Residence at Tesla Portal: Vacate caretaker's residence at Tesla Portal during construction of the Advanced Disinfection and Tesla Portal Disinfection Station projects as well as those portions of the San Joaquin Pipeline System and Rehabilitation of Existing San Joaquin Pipelines projects located at Tesla Portal.	Y	N	Project Mitigation Measure 4.10-1. Mitigation measure revised to address only the Tesla Portal site. Also revised to require the residence be vacated only when the standard (speech interference criterion) would be exceeded. Not applicable to the Thomas Shaft site; no sensitive receptors are located nearby.
Measure 4.10-2a, Limit Hourly Truck Volumes: Haul and delivery truck routes for all WSIP projects will, to the extent feasible, avoid local residential streets and follow local designated truck routes. Total project-related haul and delivery truck volumes on any particular haul truck route will be limited to 80 trucks per hour.	N	N	The project would involve 50 to 60 trips per day (25 to 30 round trips at Tesla Portal and 10 trips (5 round trips) at Thomas Shaft, except for brief periods for concrete pouring, so there is no need to include this limitation.

PEIR Mitigation Measures	Applicable to Proposed Project? (Y/N)		Notes
	Tesla Portal Site	Thomas Shaft Site	
Measure 4.10-2b, Restrict Truck Operations: Prohibit haul and delivery trucks from operating within 200 feet of any residential uses during the nighttime hours. For receptors beyond 200 feet from a haul route, limit noise levels to the 50-dBA sleep interference criterion at the closest receptor.	N	N	No nighttime haul and delivery truck trips would be involved.
Measure 4.10-2c, Vacate SFPUC Land Manager's Residence: Vacate Land Manager's residence adjacent to Alameda East Portal during offsite truck operations associated with the New Irvington Tunnel project, if truck operations occur during the nighttime hours (10 p.m. to 7 a.m.) and are estimated to exceed the 50-dBA sleep interference criterion at this residence.	N	N	Measure refers to effects associated with the New Irvington Tunnel Project and is not relevant to project.
Measure 4.10-3a, Vibration Controls to Prevent Cosmetic or Structural Damage: Incorporate restrictions into all contract specifications (primarily for sheetpile driving, pile driving, or tunnel construction activities), whereby surface vibration will be limited to 0.2 in/sec peak particle velocity (PPV) for continuous vibration (e.g., vibratory equipment and impact pile drivers) and 0.5 in/sec PPV for controlled detonations at the closest receptors to ensure that cosmetic or structural damage does not occur.	N	N	None of the referenced activities of concern would take place at either site.
Measure 4.10-3b, Limit Vibration Levels at or Below Vibration Perception Threshold: Maintain vibration levels at or below the vibration perception threshold at adjacent properties to the extent feasible during nighttime. If vibration complaints are received, operational adjustments will be made to reduce vibration annoyance effects.	N	N	Limited nighttime construction activities would be involved.
Measure 4.10-3c, Limit Tunnel-Related Detonation to Daylight Hours: Limit controlled detonation associated with tunnel construction to daylight hours, Monday through Saturday.	N	N	No detonations would occur
Services/Utilities			
Measure 4.11-1a, Notify Neighbors of Potential Utility Service Disruption: Notify residents and businesses in project area of potential utility service disruption two to four days in advance of construction.	N	N	Utility service would not be disrupted outside of the project site.
Measure 4.11-1b, Locate Utility Lines Prior to Excavation: Locate overhead and underground utility lines prior to excavation work.	N	N	Utility lines have already been located.
Measure 4.11-1c, Confirmation of Utility Line Information: Find the exact location of underground utilities by safe and acceptable means. Confirm information regarding the size, color, and location of existing utilities before construction activities commence.	N	N	Underground utilities have been located.
Measure 4.11-1d, Safeguard Employees from Potential Accidents Related to Underground Utilities: While any excavation is open, protect, support, or remove underground utilities as necessary to safeguard employees.	N	N	All improvements within existing water system facility boundaries. Underground utilities have been located.

PEIR Mitigation Measures	Applicable to Proposed Project? (Y/N)		Notes
	Tesla Portal Site	Thomas Shaft Site	
Measure 4.11-1e, Notify Local Fire Departments: Notify local fire departments any time damage to a gas utility results in a leak or suspected leak, or whenever damage to any utility results in a threat to public safety.	N	N	All improvements within existing water system facility boundaries. Underground utilities have been located.
Measure 4.11-1f, Emergency Response Plan: Develop an emergency response plan in the event of a leak or explosion prior to commencing construction activities.	N	N	All improvements within existing water system facility boundaries. Underground utilities have been located.
Measure 4.11-1g, Prompt Reconnection of Utilities: Promptly reconnect any disconnected utility lines.	N	N	All improvements within existing water system facility boundaries. Underground utilities have been located.
Measure 4.11-1h, Coordinate Final Construction Plans with Affected Utilities: Coordinate final construction plans and specifications with affected utilities.	N	N	All improvements within existing water system facility boundaries. Underground utilities have been located.
Measure 4.11-2, Waste Reduction Measures: Incorporate into contract specifications for each WSIP project the requirement to obtain any necessary waste management permits prior to construction and to comply with conditions of approval attached to project implementation.	N	N	Solid waste generation at both sites would be minimal
Recreation			
Measure 4.12-1, Coordination with Golf Course/Recreational Facility Managers: Coordinate with managers of golf courses or other recreational facilities directly affected by pipeline construction to minimize adverse impacts on golfers and other recreational users.	N	N	Project does not involve pipeline construction within golf courses or other recreational facilities.
Measure 4.12-2, Appropriate Siting of Proposed Facilities: Locate WSIP project facilities on park and recreation properties in consultation with park planning staff to minimize the direct loss of recreation and play space and to minimize inconvenience to park and recreation users.	N	N	Project proposes improvements to existing facilities located on lands owned and used by the SFPUC for its regional water system.
Agriculture			
Measure 4.13-1a, Supplemental Noticing and Soil Stockpiling: For the San Joaquin Pipeline projects (San Joaquin System and Rehabilitation of Existing San Joaquin Pipeline), stockpile and replace topsoil in mapped areas of Prime and Unique Farmland and Farmland of Statewide Importance that would be temporarily disturbed by pipeline construction, unless other actions are required under specific agreements with individual landowners.	N	N	Project does not include these San Joaquin Pipeline projects.
Measure 4.13-1b, Avoidance or Soil Stockpiling: Minimize any potential impacts on agricultural lands in the Sunol Valley by avoiding these resources wherever possible. Where this is not possible, stockpile, replace, and hydroseed topsoil to prevent erosion, unless other actions are required as a result of contracts affecting use of the property or under specific agreements with individual landowners.	N	N	Project is not located in Sunol Valley.

PEIR Mitigation Measures	Applicable to Proposed Project? (Y/N)		Notes
	Tesla Portal Site	Thomas Shaft Site	
Measure 4.13-2, Siting Facilities to Avoid Prime Farmland: Avoid areas identified as Prime Farmland, Unique Farmland, or Farmland of Statewide Importance. If avoidance is not feasible, adopt a permanent set-aside for an equivalent acreage of similarly valued farmland in the area.	N	N	Project is not located on land identified as Prime Farmland, Unique Farmland, or Farmland of Statewide Importance.
Hazards			
Measure 4.14-1a, Site Health and Safety Plan: For all projects where the site assessment indicates the potential to encounter hazardous materials, prepare a site health and safety plan identifying the chemicals present, potential health and safety hazards, monitoring, soils-handling methods, appropriate personnel protective equipment, and emergency response procedures.	N	N	The measure is not applicable for the same reasons that it was determined not to be applicable in the Draft PEIR for these projects.
Measure 4.14-1b, Materials Disposal Plan: For all projects where the site assessment indicates the potential to encounter hazardous materials in the soil, prepare a materials disposal plan that specifies the disposal method and approved disposal site for the soil.	N	N	The measure is not applicable for the same reasons that it was determined not to be applicable in the Draft PEIR for the project.
Measure 4.14-1c, Coordination with Property Owners and Regulatory Agencies: Based on regulatory agency file reviews, assess the potential to encounter unacceptable levels of hazardous materials at known environmental cases, for construction activities to cause groundwater plume migration or interfere with ongoing remediations at known environmental cases, and for increased water levels in reservoirs or lakes to inundate known environmental cases. Modify construction or remediation activities.	N	N	The measure is not applicable for the same reasons that it was determined not to be applicable in the Draft PEIR for the project.
Measure 4.14-2, Health Risk Screening and Airborne Asbestos Monitoring Plan: For tunneling projects where soil or rock may contain naturally occurring asbestos, conduct a health risk screening assessment to identify acceptable levels of asbestos in tunnel emissions. Prepare an airborne asbestos monitoring plan for approval by the BAAQMD.	N	N	The measure is not applicable for the same reasons that it was determined not to be applicable in the Draft PEIR for the project.
Measure 4.14-5, Hazardous Building Materials Surveys and Abatement: For all WSIP projects involving demolition or renovation of existing facilities, perform a hazardous building materials survey for each structure prior to demolition or renovation activities. If any friable asbestos-containing materials, lead-containing materials, or hazardous components of building materials are identified, implement adequate abatement practices prior to demolition or renovation.	N	N	No demolition or renovation would occur under the proposed project, except the installation of a new valve head enclosure at Thomas Shaft, in a recently-constructed building containing no asbestos.
Energy			
Measure 4.15-2, Incorporation of Energy Efficiency Measures: Consistent with the Energy Action Plan II priorities for reducing energy usage, ensure that energy-efficient equipment is used in all WSIP projects. Prepare a repair and maintenance plan for each facility to minimize power use. Evaluate the potential for use of renewable energy resources.	Y	Y	Project Mitigation Measure 4.14-1.

PEIR Mitigation Measures	Applicable to Proposed Project? (Y/N)		Notes
	Tesla Portal Site	Thomas Shaft Site	
Collective Impacts			
Measure 4.16-1a, Construction Coordination at Irvington Portal: If construction schedules of multiple WSIP projects occurring at and near Irvington Portal coincide or overlap, the SFPUC will coordinate with construction contractor(s) and neighbors to minimize disturbance of residents in the adjacent neighborhood to minimize disturbance of residents in the adjacent neighborhood to the extent practicable. Such coordination will need to balance the duration of construction with the magnitude of construction related impacts on the same sensitive receptors.	N	N	Project does not involve work at or near the Irvington Portal.
Measure 4.16-4a, Bioregional Habitat Restoration Measures: Address the following bioregional effects and implement conservation principles when implementing habitat compensation mitigation required for individual WSIP facility projects: compound impacts on functional units of habitat as WSIP projects simplify vegetation structure and increase "edge" (the boundary between two different habitats); increased habitat impacts due to the spread of weedy, non-native plant species; genetic diversity impacts on small populations; impacts on wildlife movement due to habitat fragmentation; suppression of natural disturbance regimes; and reduced population recovery opportunities from stochastic events.	N	N	No cumulative bioregional effects were identified at either the Tesla Portal or Thomas Shaft sites.
Measure 4.16-4b, Coordination of Construction Staging and Access: Coordinate construction contractor(s) to minimize surface disturbance when construction schedules for WSIP projects affecting the same areas overlap.	N	N	No cumulative impacts associated with construction staging and access were identified at either the Tesla Portal or Thomas Shaft sites.
Measure 4.16-6a, SFPUC WSIP Projects Construction Coordinator: Identify a qualified construction coordinator to coordinate project-specific traffic control plans; develop a public information campaign to inform the public of construction activities, detour routes, and alternate routes; work with local and regional agencies to pursue additional traffic mitigation measures and incorporate such measures into the project-specific traffic control plans.	Y	Y	Project Mitigation Measure 4.15-1a.
Measure 4.16-6b, Combined San Joaquin Traffic Control Plan: Develop a San Joaquin Traffic Control Plan that coordinates the project-specific traffic control plans and identifies additional measures (consistent with the standards of San Joaquin County, Stanislaus County, and Caltrans) to minimize the combined impacts of multiple WSIP project construction traffic on I-580, Chrisman Road, and Vernalis Road.	Y	Y	Project Mitigation Measure 4.15-1b.
Measure 4.16-6c, Combined Sunol Valley Traffic Control Plan: Develop a Sunol Valley Traffic Control Plan that coordinates the project-specific traffic control plans and identifies additional measures (consistent with the standards of Alameda County and Caltrans) to minimize the impacts of construction traffic on Calaveras Road and I-680.	N	N	Project does not involve work in the Sunol Valley.

PEIR Mitigation Measures	Applicable to Proposed Project? (Y/N)		Notes
	Tesla Portal Site	Thomas Shaft Site	
Measure 4.16-7a, Dust and Exhaust Control Measures for All WSIP Projects: Require implementation of Air Quality Measures 4.9-1a thru 4.9-1d for all WSIP projects to address collective construction-related air quality impacts.	N	N	Applicable dust and exhaust control measures will be implemented as part of Project Mitigation Measures 4.9-1a and 4.9-1b.
Measure 4.16-7b, Health Risk Screening or Use of Soot Filters for All Projects in the San Joaquin and Sunol Valley Regions: Require Measure 4.9-2a for all WSIP projects in the San Joaquin and Sunol Valley Regions to address collective DPM impacts. When this requirement is applied to the New Irvington Tunnel project, it will be applied to both the Sunol Valley and Fremont tunnel portals, taking into account truck traffic from other WSIP projects in the vicinity of both portals.	N	N	No cumulative DPM impacts were identified at either the Tesla Portal or Thomas Shaft sites.
Measure 4.16-7c, Vacate SFPUC Land Managers' Residences for All Projects in the Sunol Valley Region: Require Measure 4.9-2b for all WSIP projects in the Sunol Valley Region to address collective DPM impacts.	N	N	Project does not involve work in the Sunol Valley.
Measure 4.16-8a, Limiting Hourly Truck Volumes and Restricting Truck Operations on Haul Routes for Multiple WSIP Projects: Apply Measures 4.10-2a and 4.10-2b to total haul and delivery truck volumes attributable to all WSIP projects on any particular haul truck route (including haul routes in the Tesla Portal, Irvington Portal, and Lower Crystal Springs Dam vicinities as well as haul routes in the San Francisco Region) to address collective truck-related noise impacts.	N	N	Project would implement Mitigation Measures 4.15-1a and 4.15-1b to address impacts associated with short-term cumulative impacts from construction traffic.
Measure 4.16-8b, Vacate Land Manager's Residence for All Projects in Sunol Valley Region: To address collective noise impacts, vacate Land Manager's residence adjacent to Alameda East Portal during construction truck operations associated with all WSIP projects in this region if collective daytime truck volumes exceed the 70-dBA speech interference criterion or nighttime truck volumes exceed the 50-dBA sleep interference criterion.	N	N	Project does not involve work in the Sunol Valley.
Cumulative Effects			
Measure 4.17-6, SFPUC WSIP Projects Construction Coordinator – Other Agencies: The SFPUC WSIP construction coordinator designated in accordance with Measure 4.16-6a will also consider the effects of any traffic generated by SFPUC maintenance activities and other SFPUC projects; and coordinate with Caltrans, other county agencies, and local jurisdictions regarding construction of other private and public development projects so as to minimize traffic impacts on local access roads.	Y	Y	Project Mitigation Measure 4.15-1c.
Measure 4.17-8, Coordination of Truck Traffic on Local Streets: The SFPUC WSIP construction coordinator designated in Measure 4.17-6 will also be responsible for coordinating truck traffic generated on these same streets by SFPUC maintenance activities and other SFPUC projects so that SFPUC-related truck noise increases are maintained at or below threshold levels specified in Measures 4.10-2a and 4.10-2b to the extent feasible.	Y	Y	Project Mitigation Measure 4.15-1b.

APPENDIX E
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APPENDIX F
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APPENDIX G

Draft EIR Distribution List

List of Those to Receive Mailed Copies of the Draft EIR

Copies of the Draft EIR and the Draft EIR hearing notice were mailed or delivered to the following public agencies, organizations, and individuals. In addition, Notices of Availability of the Draft EIR were mailed to parties who are neighbors of the project site.

Last Name	First Name	Title	Organization	Address	City	State	Zip Code
PUBLIC AGENCIES							
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			Government Publications Dept. – San Francisco State University Library	1630 Holloway Avenue	San Francisco	CA	94132
			Hastings College of the Law – Library	200 McAllister Street	San Francisco	CA	94102-4978
			Institute of Government Studies – University of California	109 Moses Hall	Berkeley	CA	94720
			Stanford University Libraries – Jonsson Library of Government Documents	State and Local Documents Division	Stanford	CA	94305
			Tracy Public Library	20 E. Eaton Avenue	Tracy	CA	95376-3100

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