SAN FRANCISCO
PLANNING DEPARTMENT

Preliminary Mitigated Negative Declaration

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Date:	July 17, 2019
Case No.:	**2017-014249ENV**
Project Title:	**Mountain Tunnel Improvements Project**
BPA Nos.:	N/A
Zoning:	Predominantly Public
Block/Lot:	N/A
Lot Size:	Various
Project Sponsor	San Francisco Public Utilities Commission Sue Chau – (415) 554-3238
Lead Agency:	San Francisco Planning Department
Staff Contact:	Timothy Johnston – (415) 575-9035 Timothy.Johnston@sfgov.org

PROJECT DESCRIPTION:

The San Francisco Public Utilities Commission (SFPUC) is proposing the Mountain Tunnel Improvements Project (project) to improve the condition of the existing Mountain Tunnel, and to ensure the tunnel's continued ability to reliably convey water to its 2.7 million customers in the Sierra foothills and San Francisco Bay Area. The project is in the central Sierra Nevada Mountain Range near the town of Groveland in Tuolumne County. The tunnel begins at Early Intake Reservoir on the Tuolumne River and extends approximately 19 miles west to Priest Reservoir, near the town of Groveland. Conditions in the tunnel interior vary along the alignment, with unlined sections on the east and concrete-lined sections on the west.

Currently, the tunnel has deficiencies that diminish its ability to reliably convey water to the Hetch Hetchy Regional Water System and increase the difficulty of performing maintenance in the tunnel during normal operation. These deficiencies include deteriorating tunnel lining, accumulation of debris in the tunnel, and increased groundwater infiltration; and reduced operational flexibility, caused by the inaccessibility of the tunnel in certain locations and flow fluctuations or unregulated flow in the tunnel.

To address these deficiencies and ensure that the tunnel satisfies the performance standards established by the SFPUC for the project, the following improvements are proposed:

- Remove debris that has settled on the bottom of the tunnel and that contributes to turbidity and is impeding hydraulic flow
- Address deterioration by repairing defects in the 11 miles of existing tunnel lining
- Improve maintenance access by paving approximately 5,000 feet of currently unlined portions of the tunnel downstream of the Adit 5/6 Portal (intermediate tunnel access)
- Reduce river water infiltration and protect tunnel water quality by constructing a 750-foot bypass tunnel (siphon extension) at South Fork Siphon

- Help protect the tunnel lining, better control pressure in the tunnel, and improve operational flexibility by constructing a new flow control facility at the downstream end of the tunnel near Priest Reservoir
- Facilitate maintenance inside the tunnel by constructing a new portal and adit[1] at the downstream end of the tunnel at Priest Reservoir, and by improving access at the upstream end of the tunnel at the Early Intake Adit
- Reduce stormwater and groundwater infiltration into the tunnel by making improvements at the Second Garrote Shaft[2]
- Reduce slope instability and erosion through improvements to some of the roads that provide access to the tunnel, and through installation of or improvements to drainage facilities along the roadways and at the adits

The proposed improvement, construction, and staging areas would be located on a mix of lands owned by the U.S. Forest Service or Bureau of Land Management, subject to rights-of-way managed by the City and County of San Francisco that were granted under the terms of the 1913 Raker Act[3]; lands owned and managed by the U.S. Forest Service; city-owned lands; and privately-owned lands.

FINDING:

This project could not have a significant effect on the environment. This finding is based on California Environmental Quality Act (CEQA) Guidelines sections 15064 (Determining Significant Effect), 15065 (Mandatory Findings of Significance), and 15070 (Decision to Prepare a Negative Declaration), and the following reasons as documented in the initial study for the project, which is attached.

Mitigation measures are included in this project to avoid potentially significant effects. See pages F-1 through F-13.

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1 An adit is a side tunnel that provides horizontal access to the main tunnel.

2 Two vertical shafts along the alignment—Big Creek and Second Garrote—serve as access points for pumping water from the Mountain Tunnel to local customers.

3 The Raker Act (38 Stat. 242) granted rights-of-way to the city over National Park, National Forest, and unclassified public lands for Hetch Hetchy project facilities, including the Mountain Tunnel.

INITIAL STUDY

Mountain Tunnel Improvements Project
Case No. 2017-014249ENV

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LIST OF ACRONYMS AND ABBREVIATIONS

AERMOD	American Meteorological Society/U.S. EPA Regulatory Model
APE	area of potential effects
bgs	below ground surface
BLM	Bureau of Land Management
B.P.	Before Present
CAL FIRE	California Department of Forestry and Fire Protection
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
CNDDB	California Natural Diversity Database
CO	carbon monoxide
CO_2e	carbon dioxide –equivalents
CRPR	California Rare Plant Rank
cy	cubic yard
dB	decibel
dBA	A-weighted decibel
ESA	federal Endangered Species Act
FEMA	Federal Emergency Management Agency
FP	fully protected
FSR	Forest Service Road
GHG	greenhouse gas
in/sec	inches per second
L_{50}	sound level 50% of the measurement period
lbs/day	pounds per day
L_{dn}	day night sound level accounting for calculated nighttime adjustments
L_{eq}	equivalent sound level
L_{max}	instantaneous maximum sound level
LT	long-term measurement
MCAPCD	Mariposa County Air Pollution Control District
$\mu g/m^3$	microgram per cubic meter
MRZ	Mineral Resource Zone
NO_x	nitrogen oxides
PM_{10}	particulate matter equal to or less than 10 microns in diameter
$PM_{2.5}$	particulate matter equal to or less than 2.5 microns in diameter
PPV	peak particle velocity
ROG	reactive organic gases
SB	Senate Bill
SFPUC	San Francisco Public Utilities Commission
SSC	Species of Special Concern
ST	short-term measurement
TCAPCD	Tuolumne County Air Pollution Control District
U.S.C.	United States Code
U.S. EPA	United States Environmental Protection Agency
USFS	United States Forest Service
UTM	Universal Transverse Mercator
waters of the U.S.	waters of the United States

INITIAL STUDY

Mountain Tunnel Improvements Project
Case No. 2017-014249ENV

A. Project Description

A.1 Introduction and Background

The Mountain Tunnel is owned and operated by the San Francisco Public Utilities Commission (SFPUC) as part of the Hetch Hetchy Regional Water System. The Mountain Tunnel is a facility of the regional water system, conveying water from the Tuolumne River watershed to customers in the Sierra Foothills and San Francisco Bay Area (Figure A-1). Water from Hetch Hetchy Reservoir flows through the Canyon Power Tunnel to Kirkwood Powerhouse, into the Early Intake Bypass, and then approximately 19 miles through the Mountain Tunnel into Priest Reservoir. Priest Reservoir serves as a regulating reservoir[4] before the water flows into Moccasin Reservoir and then passes through various conveyance systems to reach the San Francisco Bay Area.

The Mountain Tunnel, constructed between 1917 and 1925, has provided reliable water delivery conveyance for more than 90 years. Minor signs of deterioration in the concrete lining were noted as early as 1928. Subsequent inspections found that the continued deterioration in the tunnel lining and other deficiencies of the Mountain Tunnel diminish the tunnel's ability to reliably convey water to the system and increase the difficulty of performing maintenance in the tunnel.[5]

Given the age of the tunnel and the indications of its deterioration, the SFPUC is proposing the Mountain Tunnel Improvements Project to improve the condition of the tunnel and ensure its continued ability to provide reliable, high-quality drinking water to its 2.7 million customers. The project is part of a larger Hetchy Capital Improvement Program, which comprises capital improvements planned to enhance the SFPUC's ability to provide reliable, affordable, high-quality water in an environmentally sustainable manner. The goal of the Hetchy Capital Improvement Program is to implement improvements (e.g., upgrades to water conveyance, water storage, and hydropower generation facilities) needed to cost-effectively ensure the achievement of high water quality, seismic reliability, water delivery reliability, and water supply objectives that have been established for the regional water system facilities, and to optimize the benefits of hydropower facilities' operations.

A.2 Project Purpose

The Mountain Tunnel has deficiencies that diminish the tunnel's ability to reliably provide drinking water to customers and increase the difficulty of performing maintenance in the tunnel. These deficiencies include deteriorating tunnel lining, accumulation of debris in the tunnel, and increased groundwater infiltration; and reduced operational flexibility, caused by the inaccessibility of the tunnel in

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[4] A regulating reservoir is a man-made lake that is used in a water conveyance system to provide operational flexibility and maintain flows.

[5] McMillen Jacobs Associates, *Mountain Tunnel Background Information Report*, September 2016; McMillen Jacobs Associates, *Mountain Tunnel Improvements Project Inspection Report*, 2017; McMillen Jacobs Associates, *Mountain Tunnel Improvements Project Condition Assessment Report*, 2017. These documents (and all other documents cited in this report, unless otherwise noted) are available for review at the San Francisco Planning Department, 1650 Mission Street, Suite 400, as part of Case File No. 2017.014249ENV.

FIGURE A-1
Hetch Hetchy Regional Water System

certain locations and flow fluctuations or unregulated flow in the tunnel.[6] The project is proposed to address the documented deficiencies, to ensure that the Mountain Tunnel can reliably provide drinking water to customers in accordance with the Mountain Tunnel Performance Standards,[7] adopted by the SFPUC Management Oversight Committee in December 2016. The primary objectives identified for each performance standard category are summarized below.

- **Service Life:** Design and construct tunnel improvements to provide a minimum service life of 100 years.
- **Water Quality:** Limit the overall turbidity contribution from the Mountain Tunnel by reducing groundwater infiltrating into the tunnel.
- **Water Conveyance Capacity:** Provide a hydraulic capacity of 740 cubic feet per second (478 million gallons per day) to maintain the historic system conveyance capacity.[8]
- **Minimum Flow:** Deliver a minimum flow of 300 million gallons per day through the Mountain Tunnel at all times outside of planned shutdowns and unplanned outages.
- **Operational Flexibility:** Provide the SFPUC with flexibility to respond to operational factors related to water conservation, water supply, power generation, local recreational needs, and full dewatering of the tunnel.
- **Planned Shutdowns:** Enable periodic inspections and major maintenance or repairs required no more than once every 20 years and with shutdown durations limited to 100 days.
- **Unplanned Outages:** Limit the interruption in water delivery from a catastrophic event to no more than 90 days.
- **Seismic Reliability:** Deliver the minimum flow without interruption following a near-tunnel earthquake.

The performance standards listed above provide overarching guidance for operation of the Mountain Tunnel.

The specific SFPUC objectives for the proposed project that respond to the standards listed above, and that more specifically relate to existing conditions and needs for the water conveyance improvements, are identified below.

- Correct tunnel deterioration to achieve reliable operations (i.e., Mountain Tunnel performance standards) using cost-effective and proven solutions
- Construct or repair facilities to minimize infiltration into the tunnel
- Implement measures or install facilities to protect the tunnel lining, better control pressure in the tunnel, and improve operational flexibility at the downstream end of the tunnel
- Improve and maintain safe access to the tunnel by improving roads and constructing/improving adits[9]

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[6] McMillen Jacobs Associates. *Mountain Tunnel Improvements Project Condition Assessment Report*, 2017.

[7] The Performance Standards for Mountain Tunnel were originally developed between March 2016 and June 2016 as Level of Service goals through various meetings and workshops with City and County of San Francisco client staff and stakeholders. After June 2016, the goals were rebranded as Performance Standards. On December 5, 2016, the final version of the Performance Standards was approved by the Management Oversight Committee.

[8] The proposed project would not restore the Mountain Tunnel to the standard of 740 cubic feet per second, as acknowledged by the SFPUC Management Oversight Committee in July 2017 when they approved the Rehabilitation Alternative as the Preferred Project.

- Be consistent with the management objectives of the Stanislaus National Forest
- Prioritize use of lands within the Raker Act right-of-way or owned in fee by the City and County of San Francisco, to minimize land acquisition and use of federal lands outside the Raker Act rights-of-way
- Plan the capital improvements and subsequent operations and maintenance activities to be cost-effective and sustainable

A.3 Project Location

The Mountain Tunnel is in the central Sierra Nevada Mountain Range in northern California near the town of Groveland in Tuolumne County. The Mountain Tunnel begins at Early Intake Reservoir on the Tuolumne River and extends approximately 19 miles west to Priest Reservoir near the town of Groveland (Figures A-2 and A-3). With the exception of one proposed staging area near the town of Buck Meadows in Mariposa County, the project improvement, construction, and staging areas are entirely within Tuolumne County.

The proposed improvements and the associated areas for construction staging and access would be located on a mix of:

- Lands owned by the U.S. Forest Service or Bureau of Land Management subject to rights-of-way managed by the city that were granted under the terms of the 1913 Raker Act[10]
- Lands owned and managed by the U.S. Forest Service
- City-owned lands
- Privately owned lands

SFPUC activities within the city's Raker Act rights-of-way are generally authorized by the terms of the Raker Act, subject to limited U.S. Forest Service approval authority as set forth in the terms of the Raker Act and applicable law adopted after passage of the Raker Act. For improvement, construction, and staging areas on U.S. Forest Service lands outside the city's Raker Act rights-of-way, the SFPUC would need special use authorization from the U.S. Forest Service. U.S. Forest Service approval would be required for construction staging and access at Early Intake Reservoir, the South Fork Crossing, Adit 5/6, and Adit 8/9; and for proposed improvements to associated access roads and drainages.

Work in the Priest Reservoir area would occur entirely within areas owned in fee by the city or within the boundaries of Raker Act rights-of-way over unclassified public lands administered by the Bureau of Land Management.

A.4 Existing Facilities and Structures

This section describes key features of the existing Mountain Tunnel system and access points to the tunnel.

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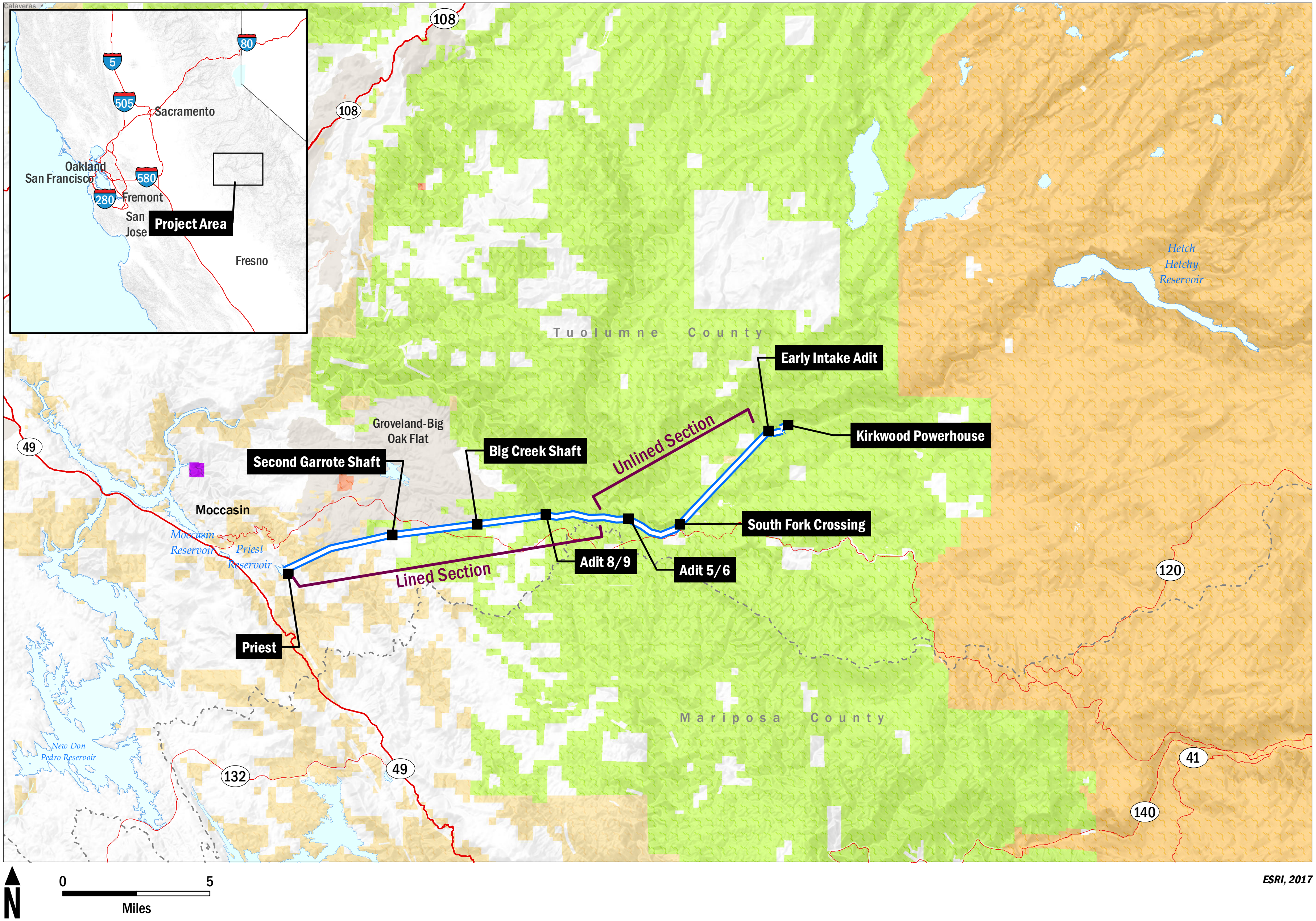
[9] An adit is a side tunnel that provides horizontal access to the main tunnel.

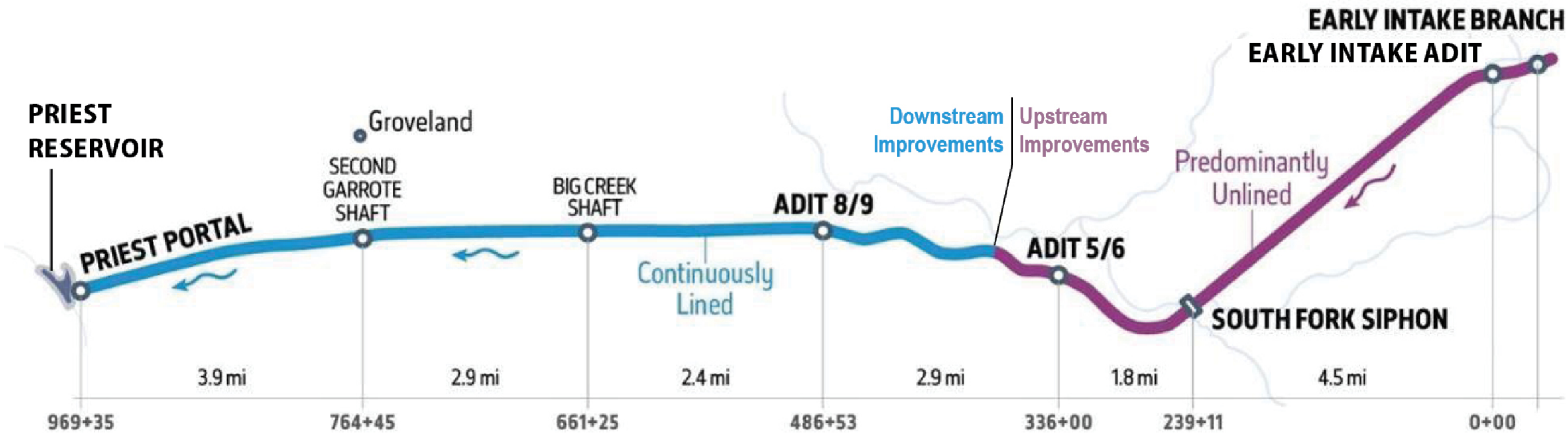
[10] The Raker Act (38 Stat. 242) granted rights-of-way to the city over National Park, National Forest, and unclassified public lands for SFPUC project facilities, including the Mountain Tunnel.



San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 10/19/2018

- Mountain Tunnel Alignment
- National Park Service
- US Bureau of Land Management
- US Forest Service
- State
- Special District

FIGURE A-2
Project Vicinity



mi = mile

0+00 = station numbering system

Source: McMillan Jacobs Associates, 2018

FIGURE A-3

Mountain Tunnel Alignment Overview

A.4.1 Mountain Tunnel Overview

The Mountain Tunnel extends from Early Intake Reservoir to Priest Reservoir (Figures A-4.1 through A-4.18). Starting at the eastern end at Early Intake Reservoir, the tunnel runs through hard granite and is predominantly unlined for less than 8 miles to Station 386+26[11] (immediately west of Adit 6/7) (Figure A-4.6). In this unlined portion, the tunnel is horseshoe-shaped and varies from 15 to 15.5 feet wide by 14 to 17 feet tall. The remainder of the tunnel, from Station 386+26 to Priest Portal at Priest Reservoir, is lined with unreinforced concrete.

The tunnel is accessed via five adits for inspections and repairs and consists of other appurtenances, including two vertical shafts that were used to construct the tunnel, as described below. The five adit locations are Early Intake Adit, eastern and western access points at South Fork Crossing, Adit 5/6, Adit 8/9, and Priest Portal. Adits 2/3, 3/4, 4/5 (Figure A-4.5), 6/7 (Figure A-4.6), and 7/8 (Figure A-4.8) were used for original tunnel construction, but because they have since been sealed with concrete, access to the tunnel is no longer available from these locations. The access roads to these locations have also not been maintained. Because no improvements are proposed at these locations, these adits are not discussed further in this document.

A.4.2 Early Intake Area

Water enters the Mountain Tunnel from the Kirkwood Powerhouse in the Early Intake Reservoir area. Early Intake is situated along Cherry Lake Road (Forest Service Road 1N07), a short distance upstream of where it spans the Tuolumne River (Figure A-4.1). SFPUC operational assets in the Early Intake area include the Kirkwood Powerhouse; Early Intake Bypass (tunnel and pipe); Early Intake Reservoir and Early Intake Adit; and power transmission and distribution facilities, including the Intake Switchyard immediately south of the Tuolumne River downstream of the reservoir.

The Early Intake Adit provides access at the easternmost end of the Mountain Tunnel. The short, unlined adit is horseshoe-shaped, with a permanent concrete plug approximately 70 feet from the adit entrance. There is a 3.5- by 5.75-foot entrance bulkhead[12] (made of cast iron) in the concrete plug to provide access to the tunnel. The Early Intake area is accessed via Cherry Lake Road (Forest Service Road 1N07), a two-lane paved road off Highway 120 that is maintained by the SFPUC and open to the public year-round.

A.4.3 South Fork Siphon and Access at South Fork Crossing

An approximately 254-foot-long inverted siphon,[13] constructed in 1970, crosses under the South Fork of the Tuolumne River (Figure A-4.4); the siphon replaced the original 9.5-foot-diameter steel pipe that crossed the South Fork of the Tuolumne River above grade. The siphon is unlined and has a width of about 14 feet and a height of 14 to 15 feet. The siphon section, approximately 40 feet beneath the river, connects to the tunnel on either side by means of an inclined shaft. Existing vent holes extend from the siphon to the surface of the rock on either side of the river.

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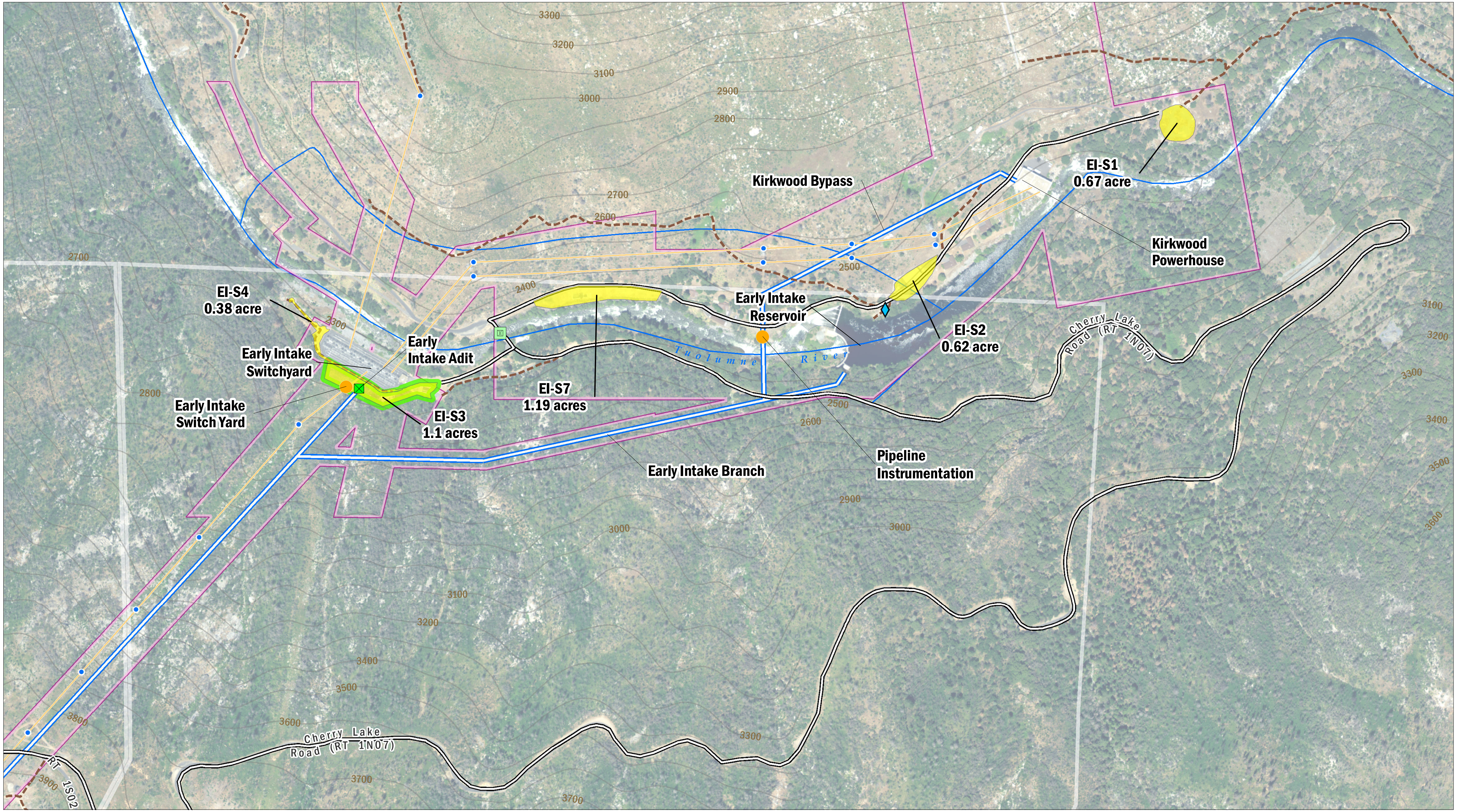
[11] Because there are limited surface landmarks along the alignment to denote specific locations, certain tunnel features are referenced in this document by station numbers indicating their location along the project alignment. Stationing (a surveying term) is an imaginary line used to measure the distance of a feature, in this case the centerline of the tunnel. Station 0 begins at the Early Intake area and station numbers increase to the west, ending at Station 969+35 at Priest Portal. One station is equal to 100 feet. Thus, Station 386+26 is equivalent to distance (or 38,626 feet) from Station 0. Refer to Figure A-3.

[12] A bulkhead is a protective barrier that prevents water in the tunnel from exiting the adit.

[13] An inverted siphon is a U-shaped pipe or conduit for conveying water under the bed of a river or channel.



ESRI, 2019; MJA, 2017

N

0 500
Feet

San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 5/20/2019

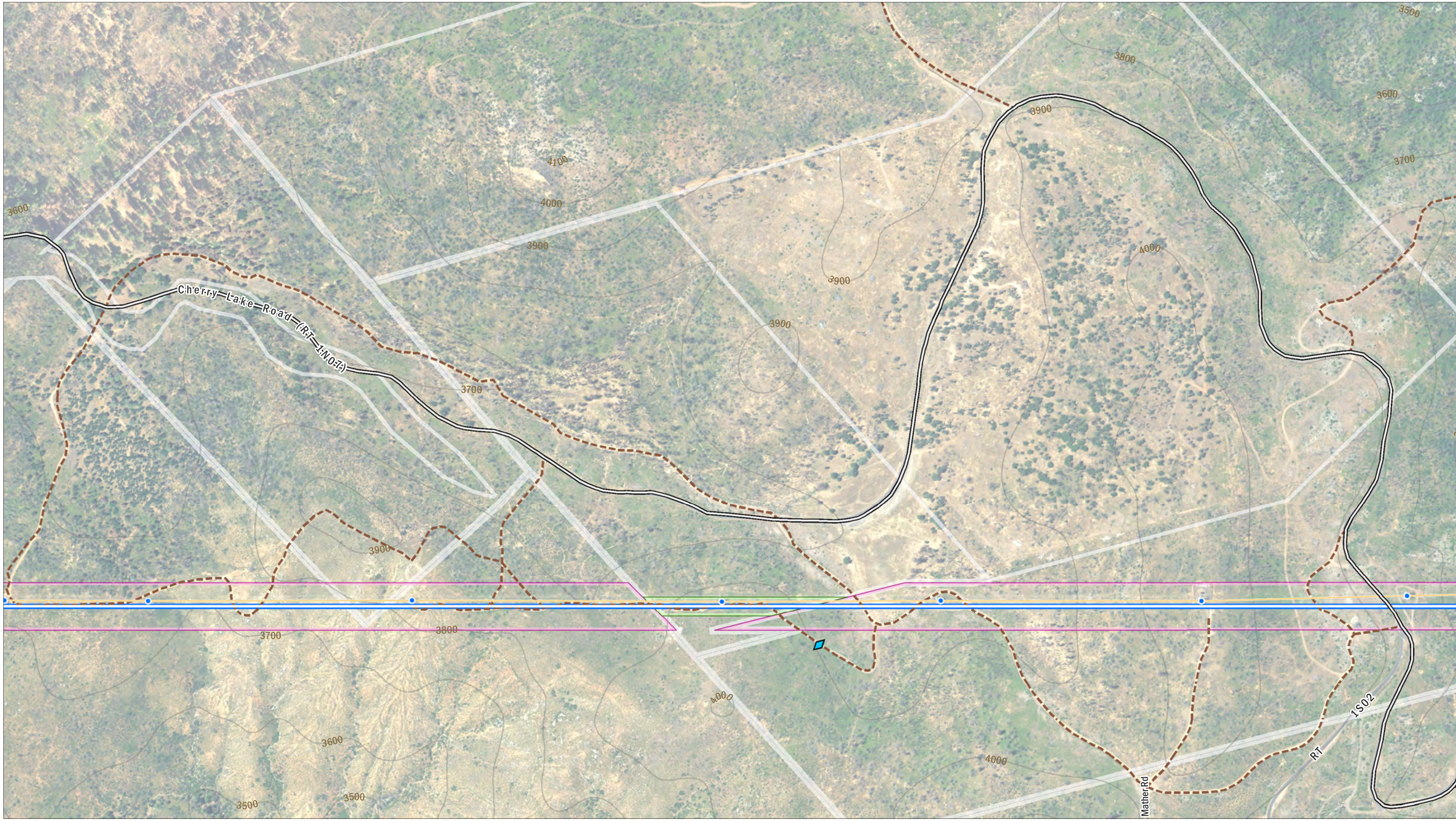
Project Component
Adit
Gate
Bridge
Tower

Mountain Tunnel Alignment
Power Lines
Unpaved Road/Trail
Existing Paved Road
Contour Line

Proposed Project Components
Staging Area
Tree/Vegetation Removal

SFPUC Parcel Type
Raker Act
County Parcel

FIGURE A-4.1
Project Components



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ESRI, 2019; MJA, 2017

San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 3/11/2019

Gate
Tower

Mountain Tunnel Alignment
Power Lines
Unpaved Road/Trail
Existing Paved Road
Contour Line

SFPUC Parcel Type
Raker Act
Fee
County Parcel

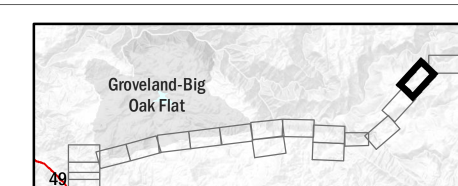
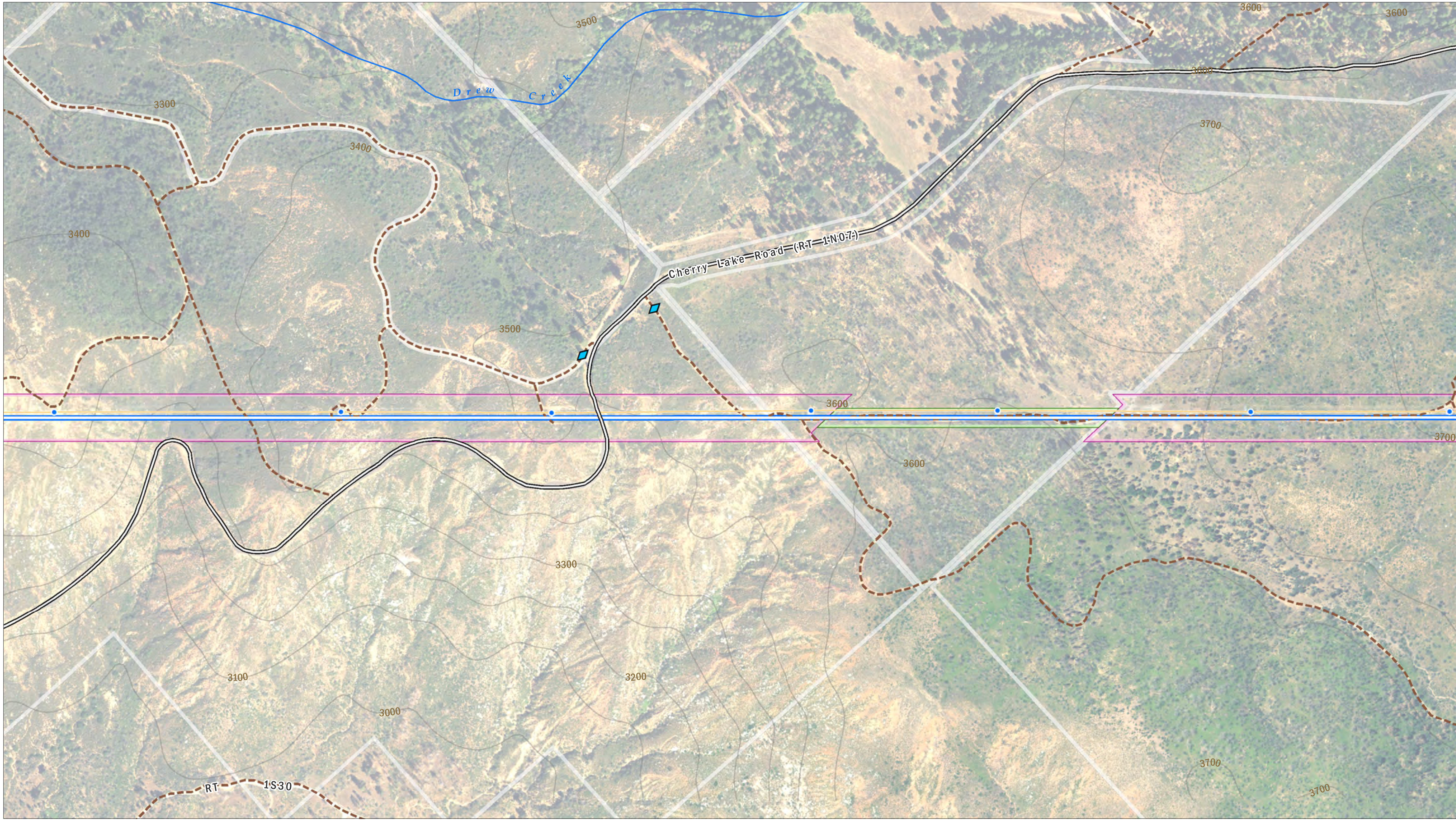


FIGURE A-4.2
Project Components



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Feet

ESRI, 2019; MJA, 2017

San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 3/11/2019

Gate
Tower
Mountain Tunnel Alignment
Power Lines
Unpaved Road/Trail
Existing Paved Road
Contour Line

SFPUC Parcel Type
Raker Act
Fee
County Parcel

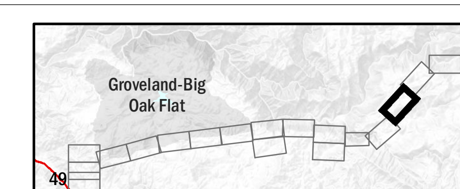
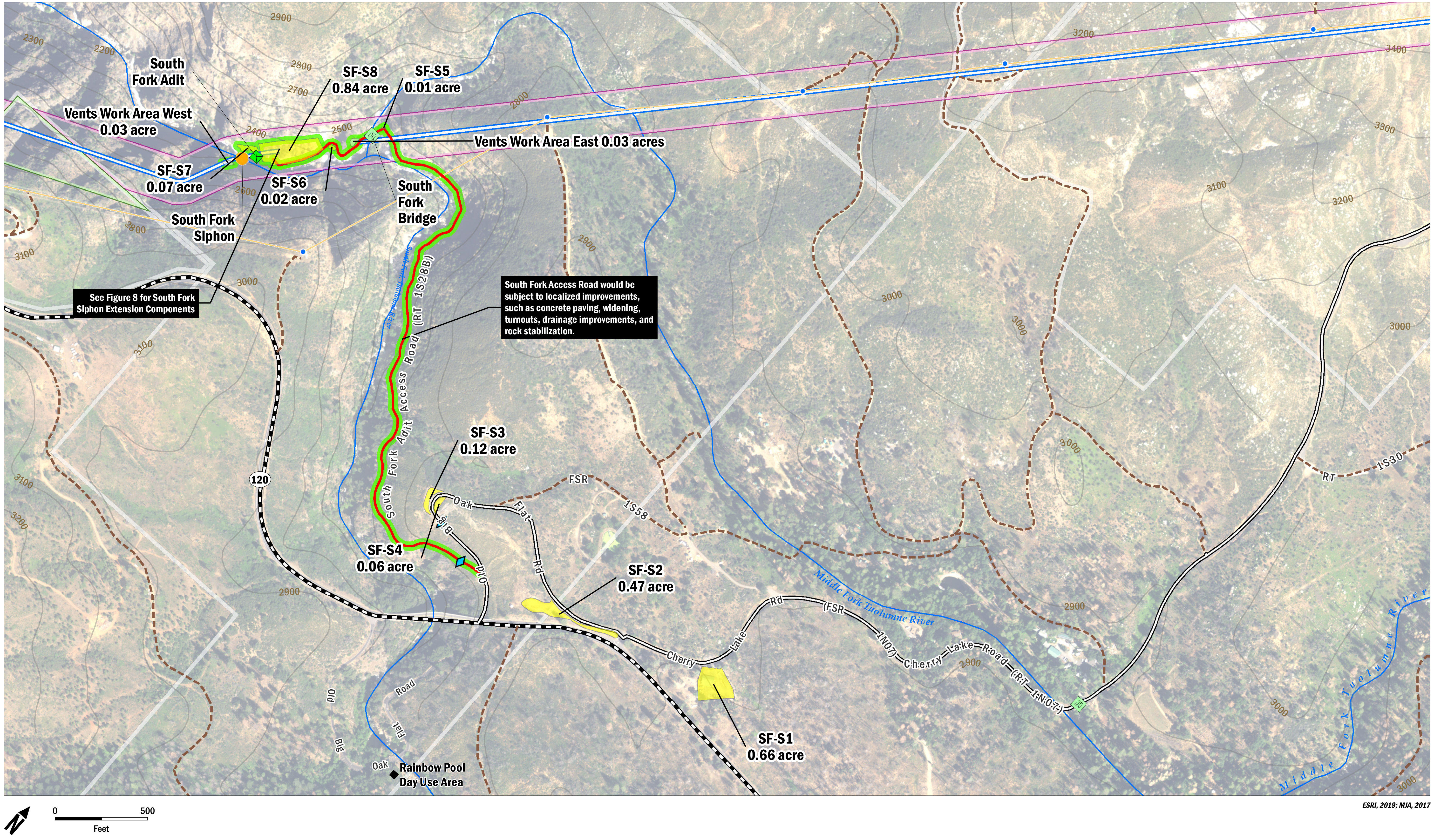


FIGURE A-4.3
Project Components



San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 5/22/2019

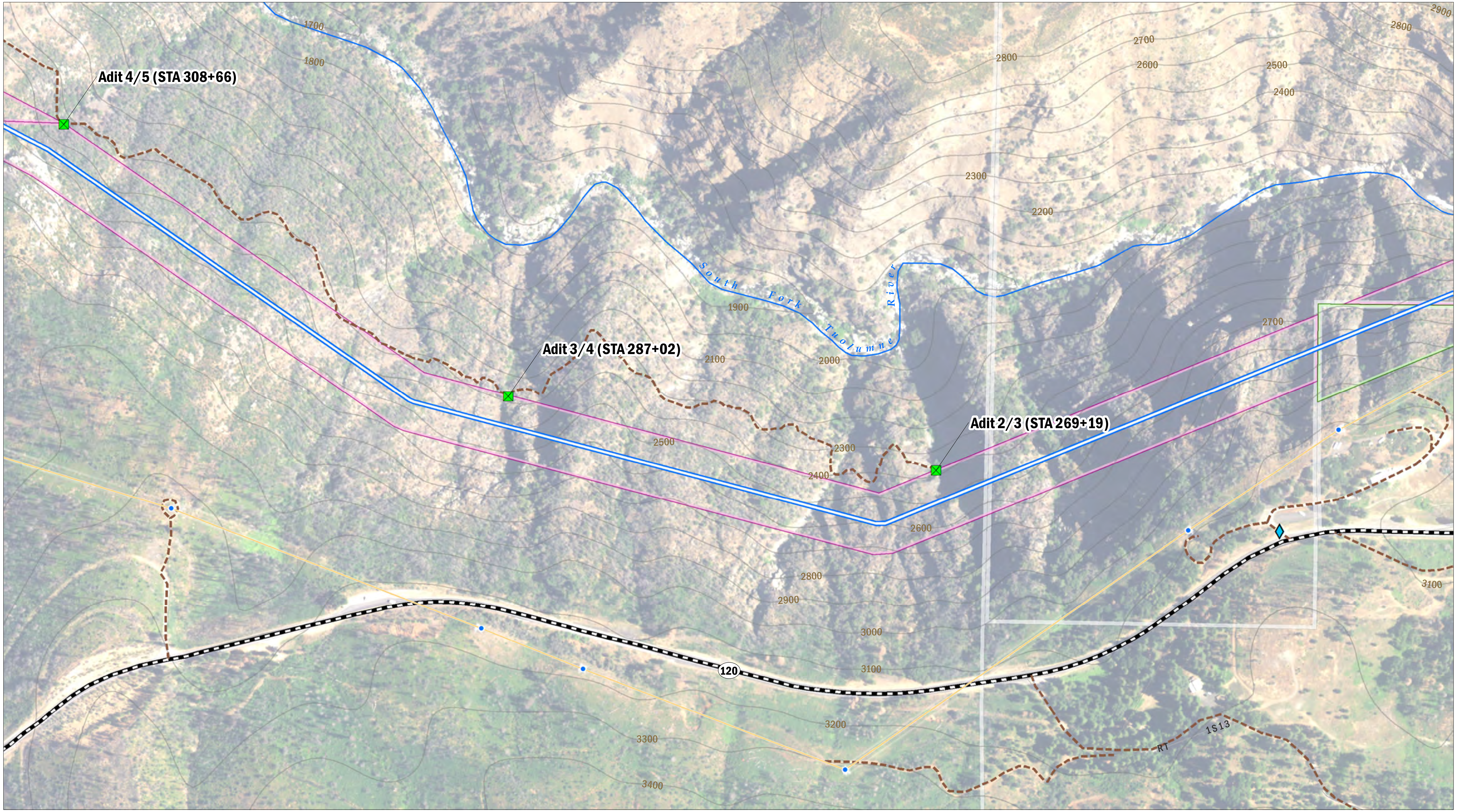
Project Component
Adit
Gate
Bridge
Tower

Highway
Mountain Tunnel Alignment
Power Lines
Unpaved Road/Trail
Existing Paved Road
Contour Line

Proposed Project Components
Proposed Road and Drainage Improvements
Staging Area
Work Area
Tree/Vegetation Removal

SFPUC Parcel Type
Raker Act
Fee
County Parcel

FIGURE A-4.4
Project Components



San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 3/11/2019

Adit
Gate
Tower
Highway
Mountain Tunnel Alignment
Power Lines
Unpaved Road/Trail
Contour Line

SFPUC Parcel Type
Raker Act
Fee
County Parcel

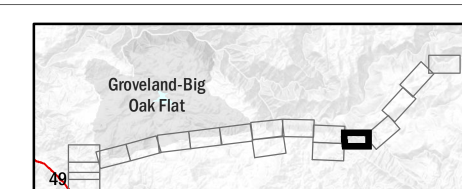
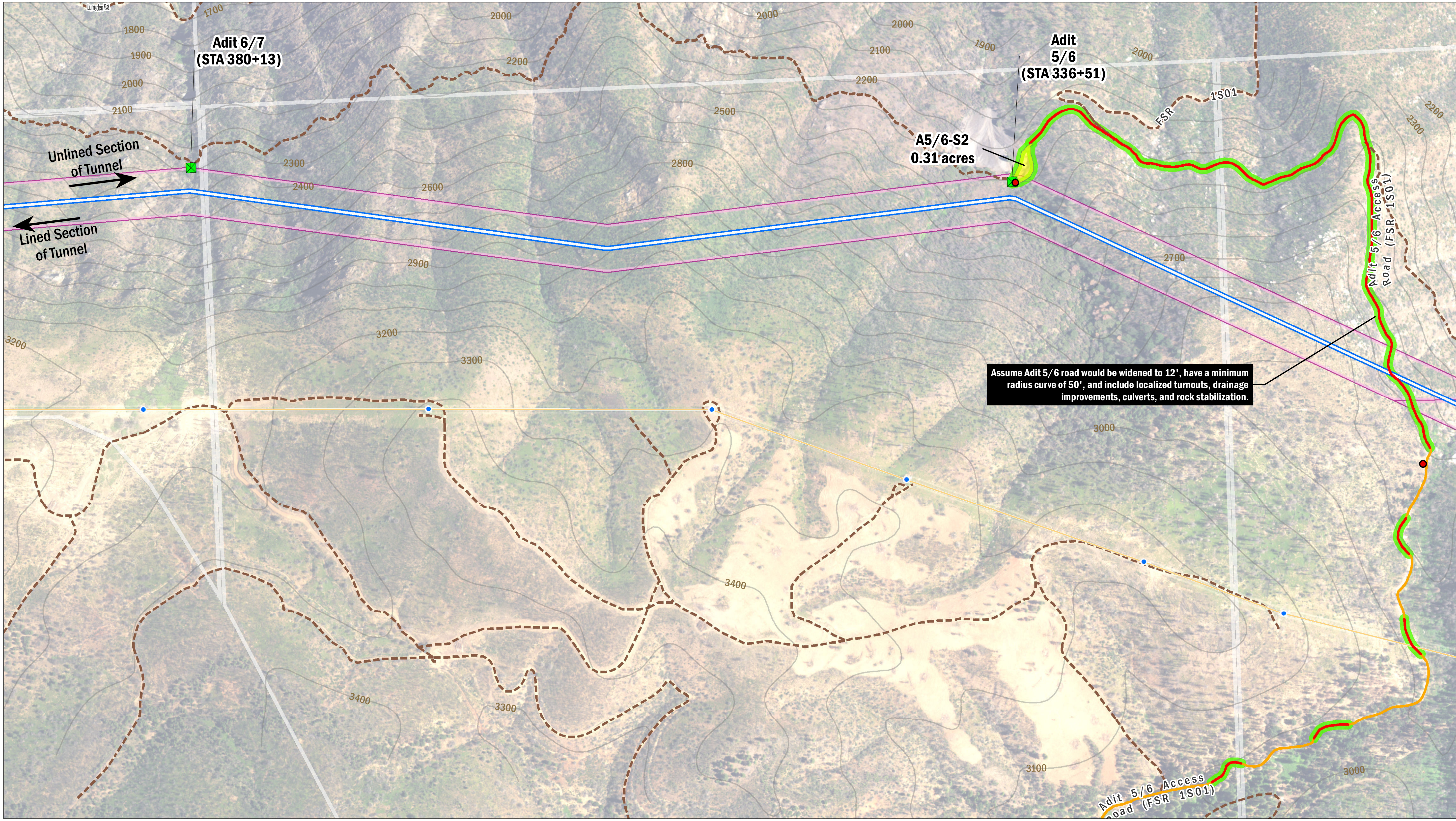


FIGURE A-4.5
Project Components



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Feet

ESRI, 2019; MJA, 2017

San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 3/12/2019

Adit
Tower
Mountain Tunnel Alignment
Power Lines
Unpaved Road/Trail
Contour Line

Proposed Project Components
Proposed Road and Drainage Improvements
Proposed Road and Drainage Improvements
Road - Potential Gravelling
Staging Area
Tree/Vegetation Removal

SFPUC Parcel Type
Raker Act
County Parcel

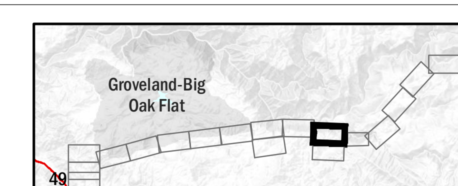
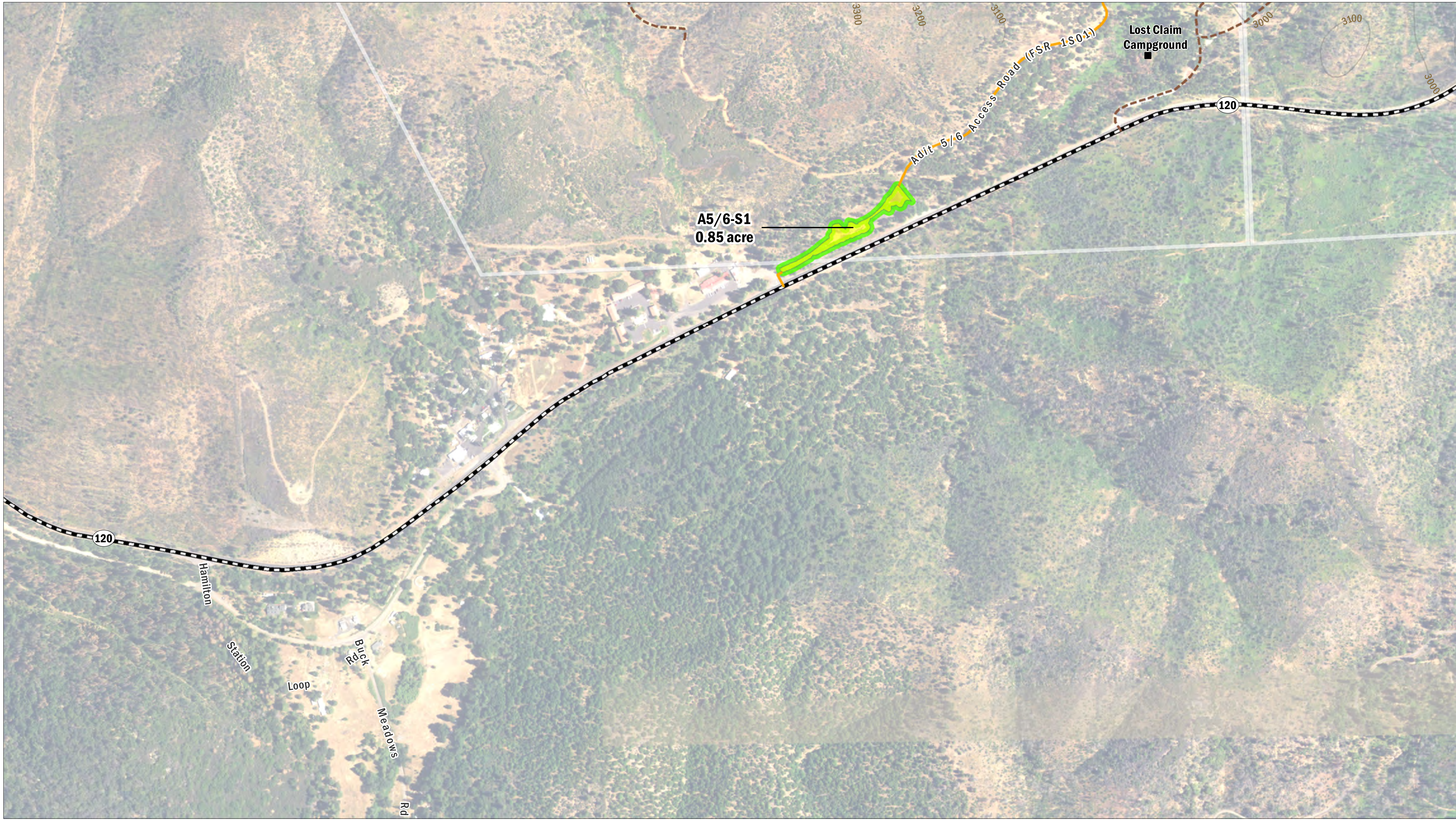


FIGURE A-4.6
Project Components



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Feet

ESRI, 2019; MJA, 2017

San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 3/11/2019

Highway
Unpaved Road/Trail
Contour Line

Proposed Project Components
Road - Potential Gravelling
Staging Area
Tree/Vegetation Removal
County Parcel

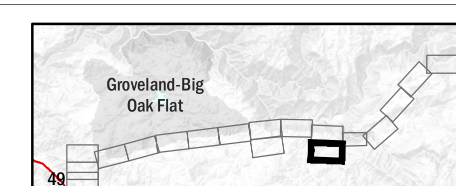
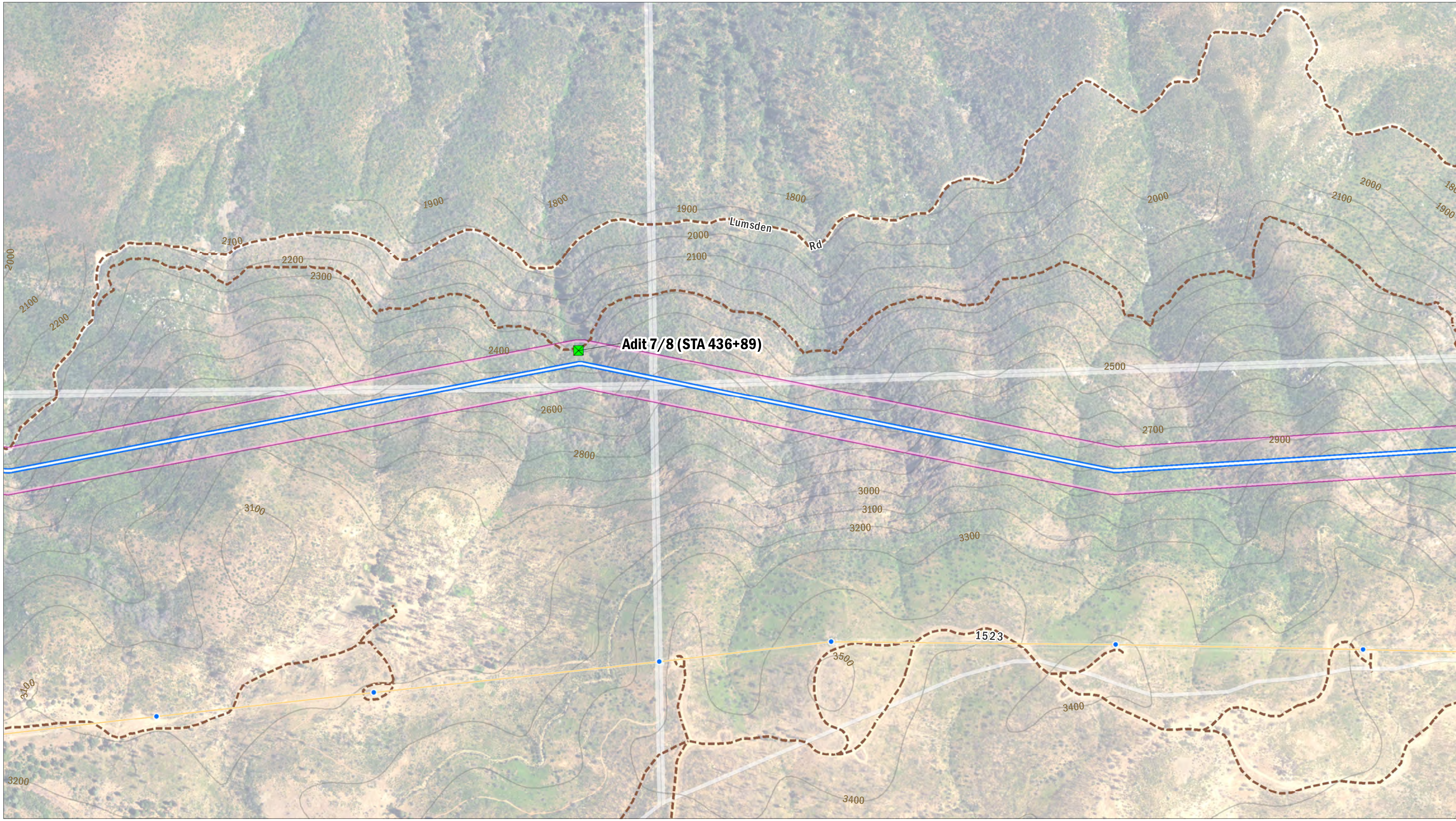


FIGURE A-4.7
Project Components



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Feet

ESRI, 2019; MJA, 2017

San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 3/11/2019

Adit
Tower

Mountain Tunnel Alignment
Power Lines
Unpaved Road/Trail
Contour Line

SFPUC Parcel Type
Raker Act
County Parcel

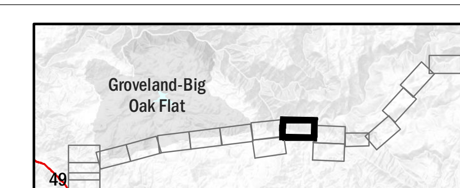
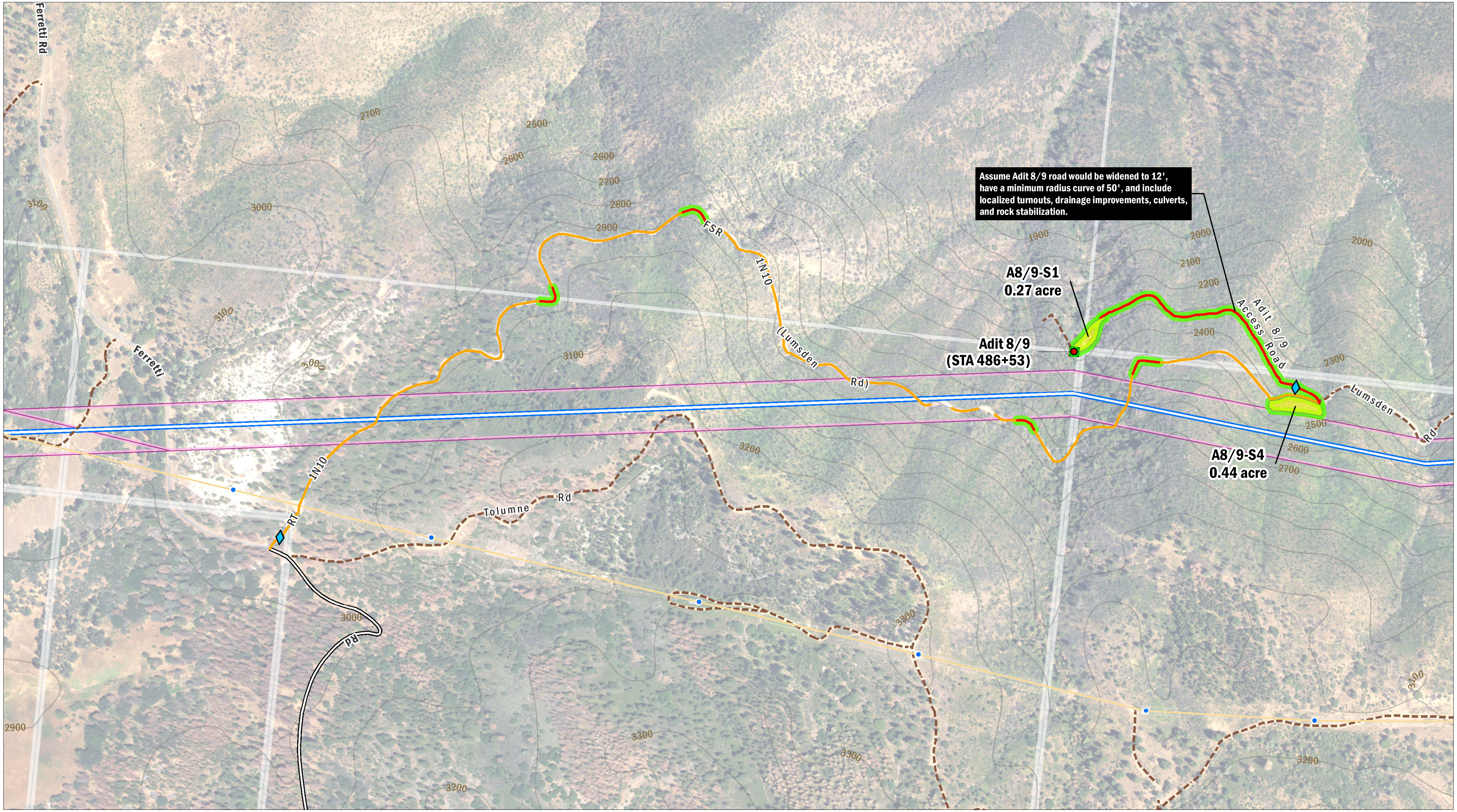


FIGURE A-4.8
Project Components



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0 500
Feet

ESRI, 2019; MJA, 2017

San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 3/12/2019

Adit
Gate
Tower

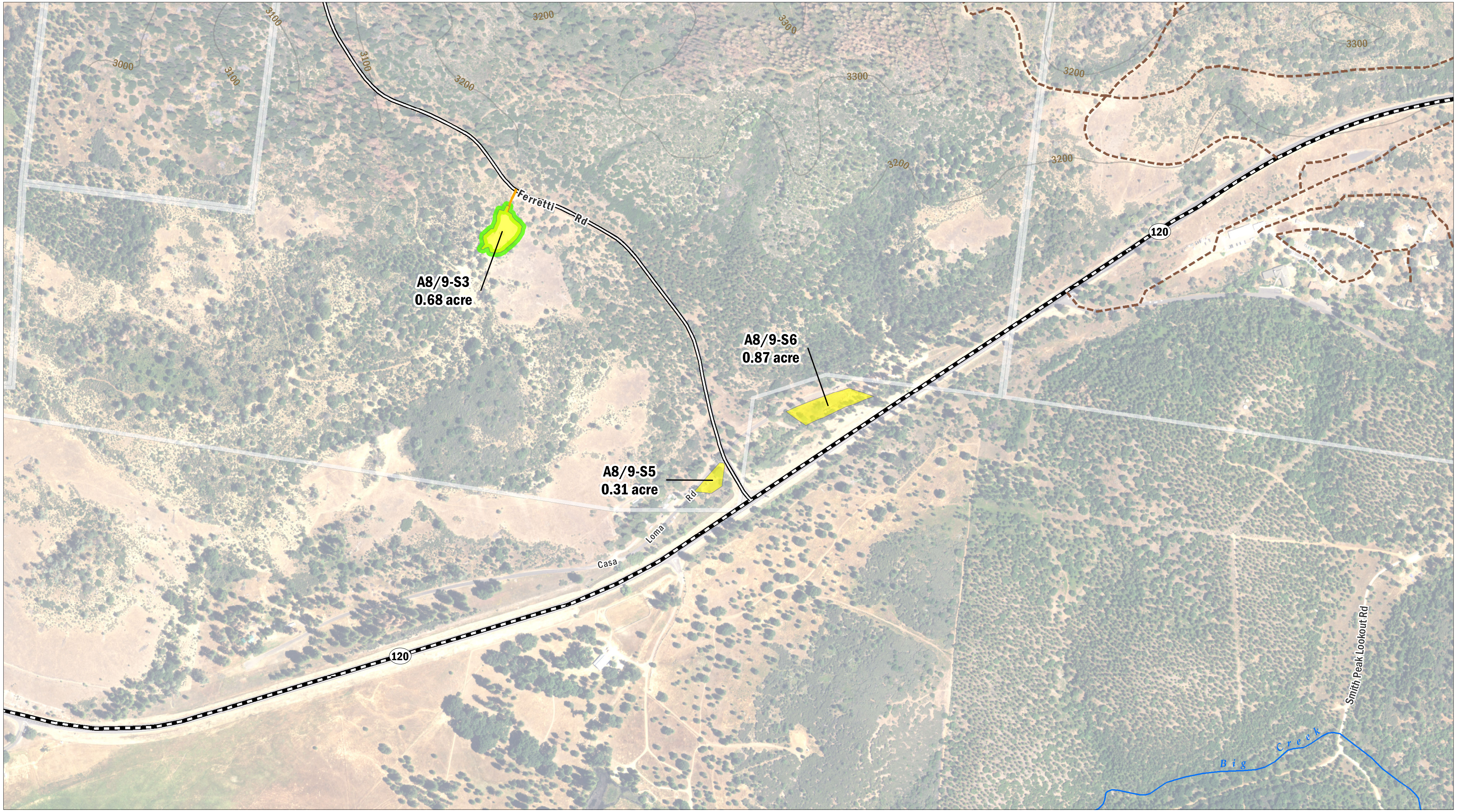
Mountain Tunnel Alignment
Power Lines
Unpaved Road/Trail
Existing Paved Road
Contour Line

Proposed Project Components
Proposed Road and Drainage Improvements
Proposed Road and Drainage Improvements
Road - Potential Gravelling
Staging Area
Tree/Vegetation Removal

SFPUC Parcel Type
Raker Act
County Parcel

Groveland-Big Oak Flat
49

FIGURE A-4.9
Project Components



N

0 500

Feet

ESRI, 2019; MJA, 2017

San Francisco Public Utilities Commission

Mountain Tunnel Improvements Project

DATE: 5/20/2019

Highway

Unpaved Road/Trail

Existing Paved Road

Contour Line

Proposed Project Components

Road - Potential Gravelling

Staging Area

Tree/Vegetation Removal

County Parcel

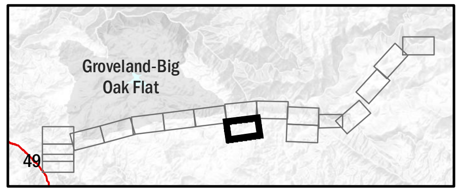
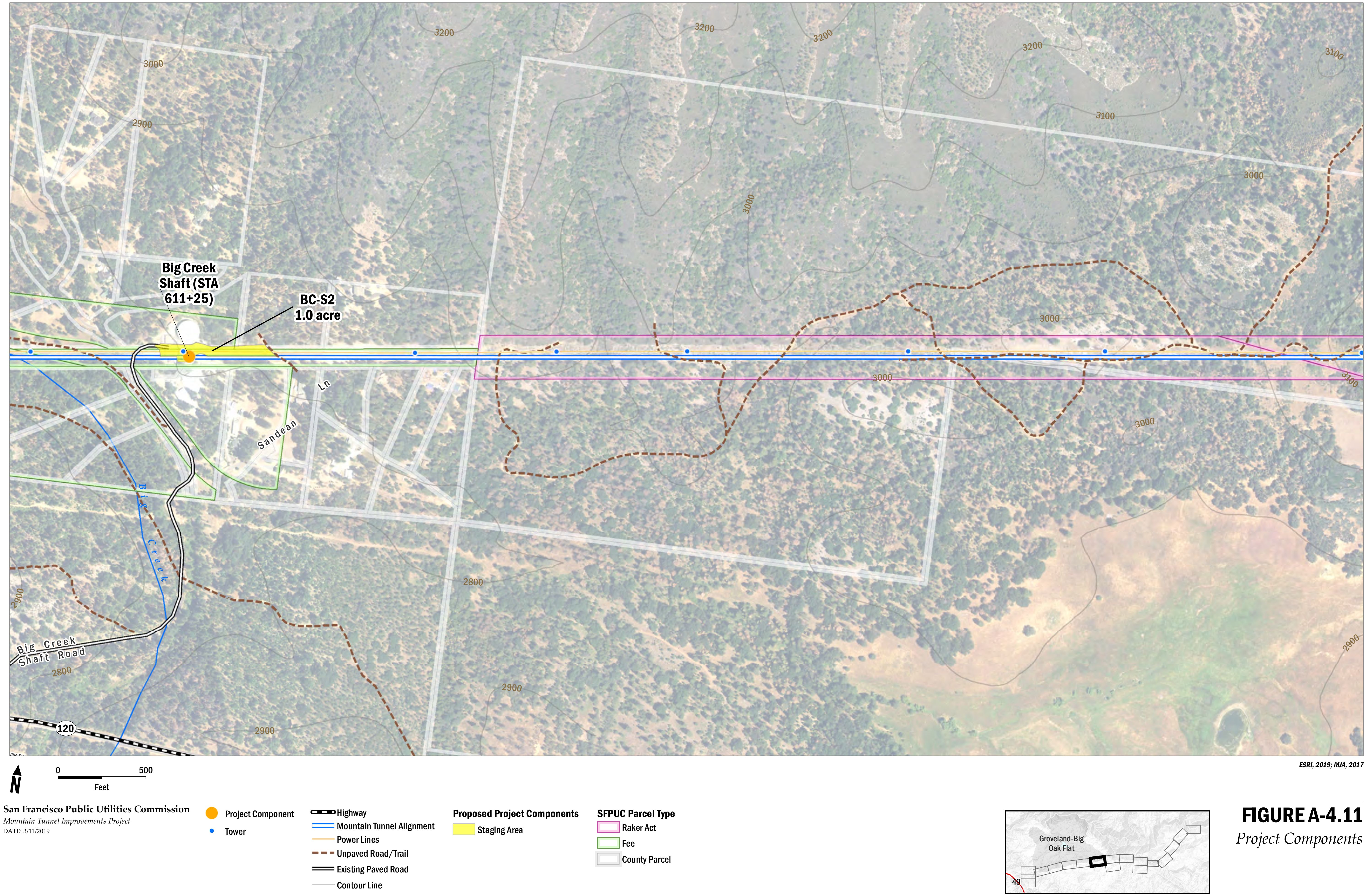


FIGURE A-4.10

Project Components



San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
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FIGURE A-4.11
Project Components

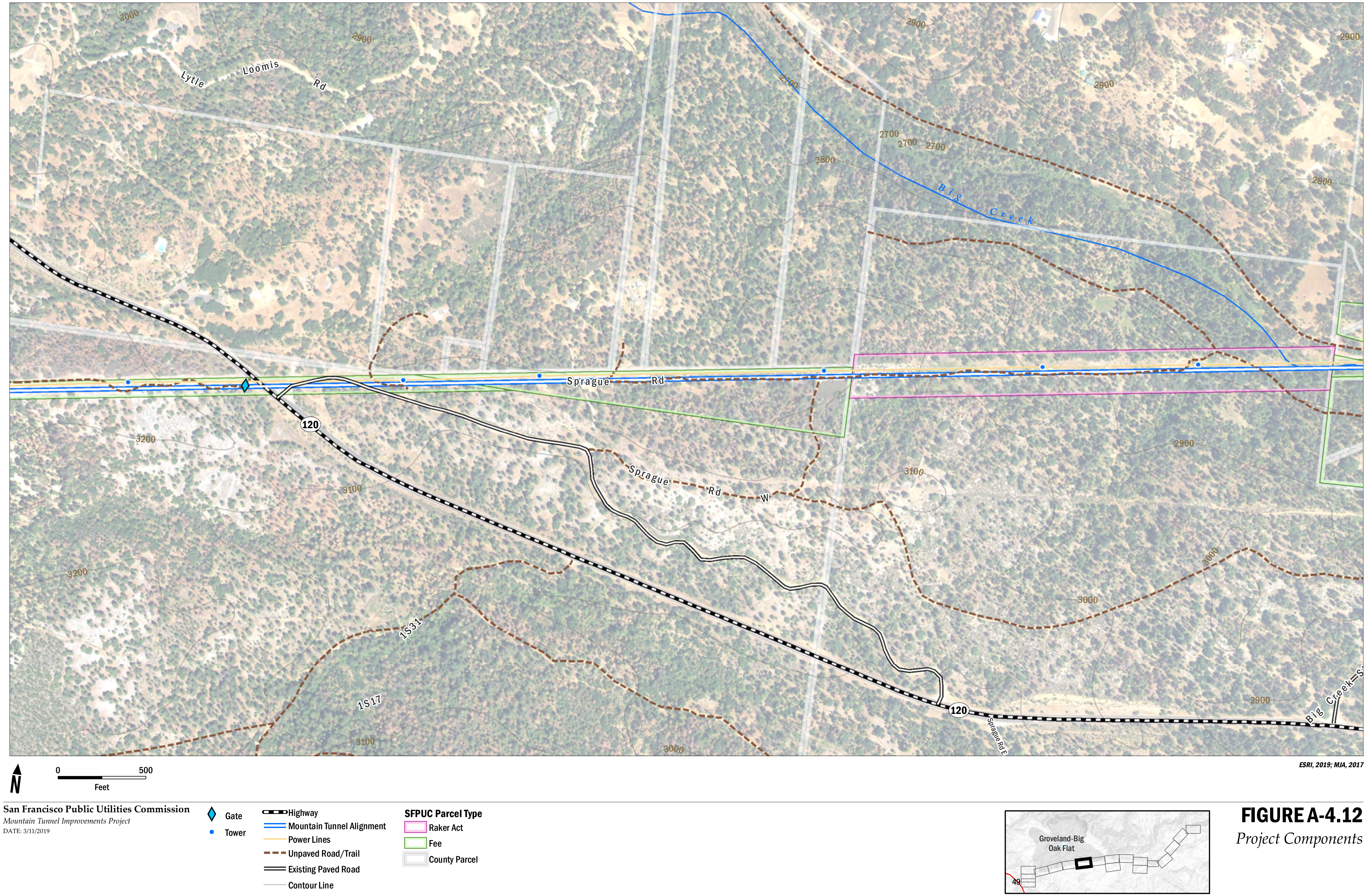

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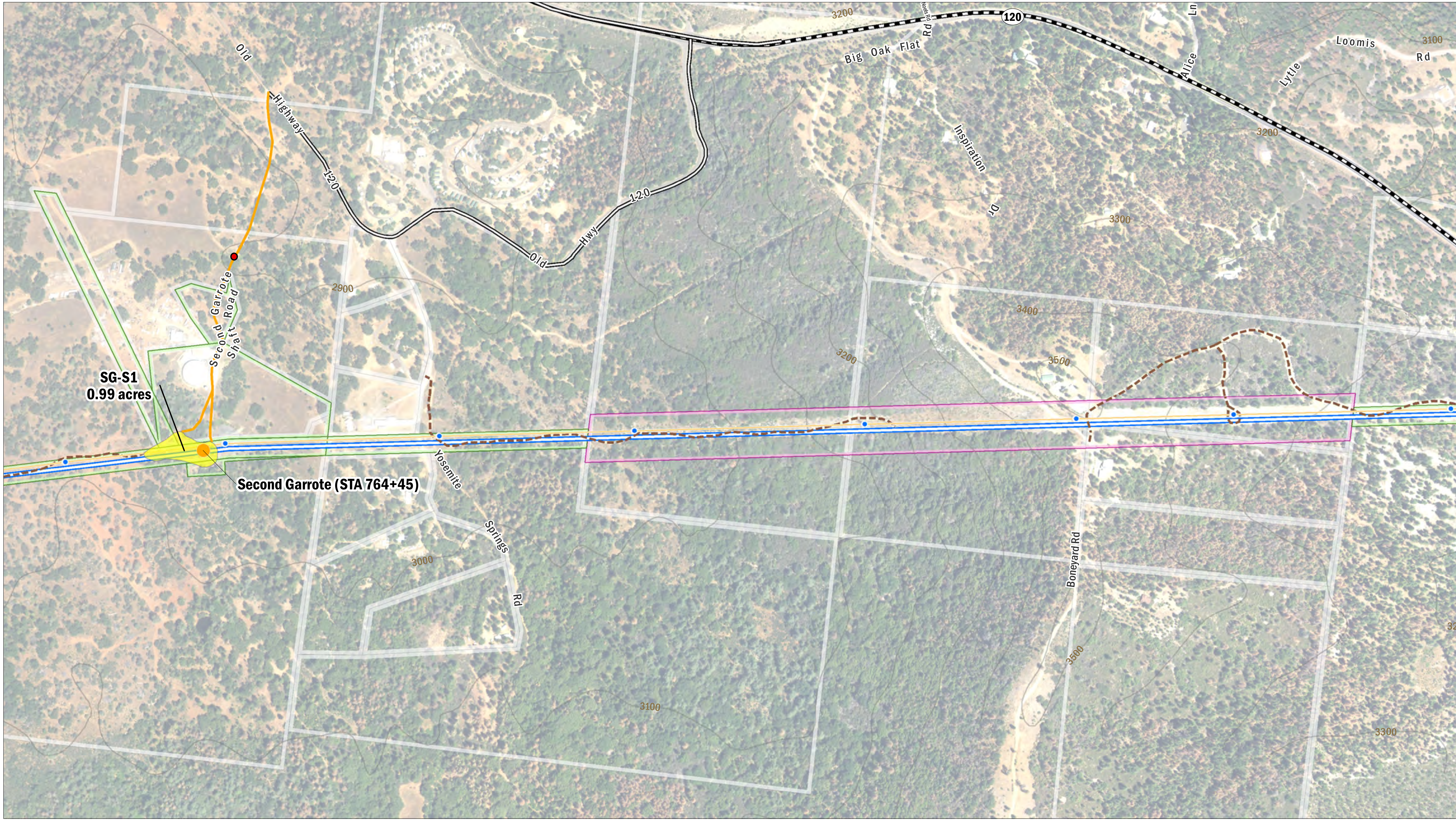
FIGURE A-4.12
Project Components



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Project Component
Tower

Highway
Mountain Tunnel Alignment
Power Lines
Unpaved Road/Trail
Existing Paved Road
Contour Line

Proposed Project Components
Proposed Road and Drainage Improvements
Road - Potential Gravelling
Staging Area

SFPUC Parcel Type
Raker Act
Fee
County Parcel

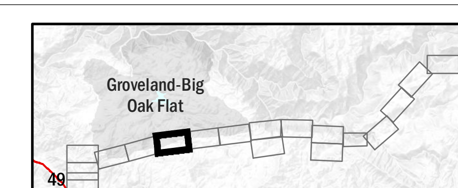

FIGURE A-4.13
Project Components

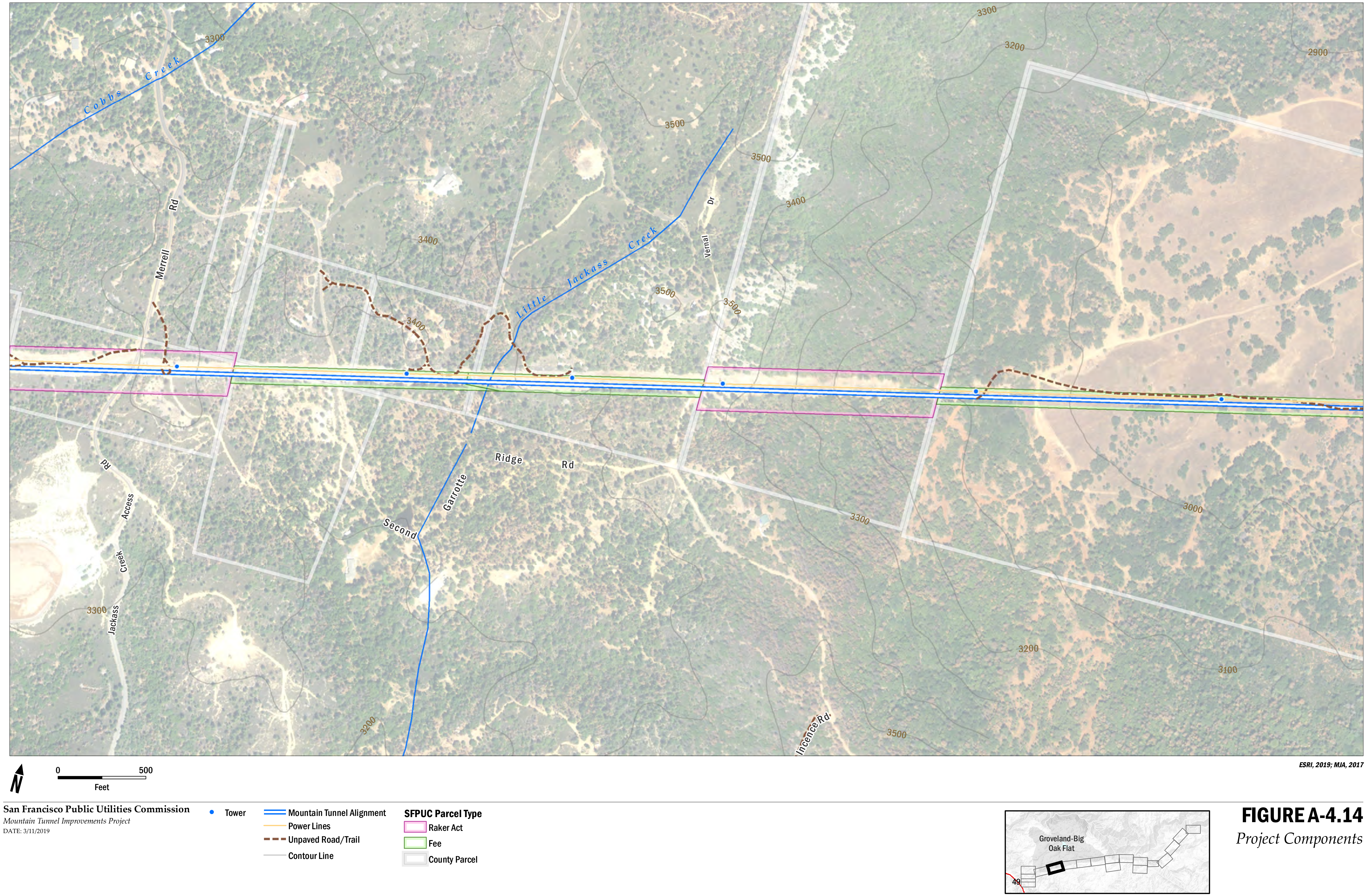

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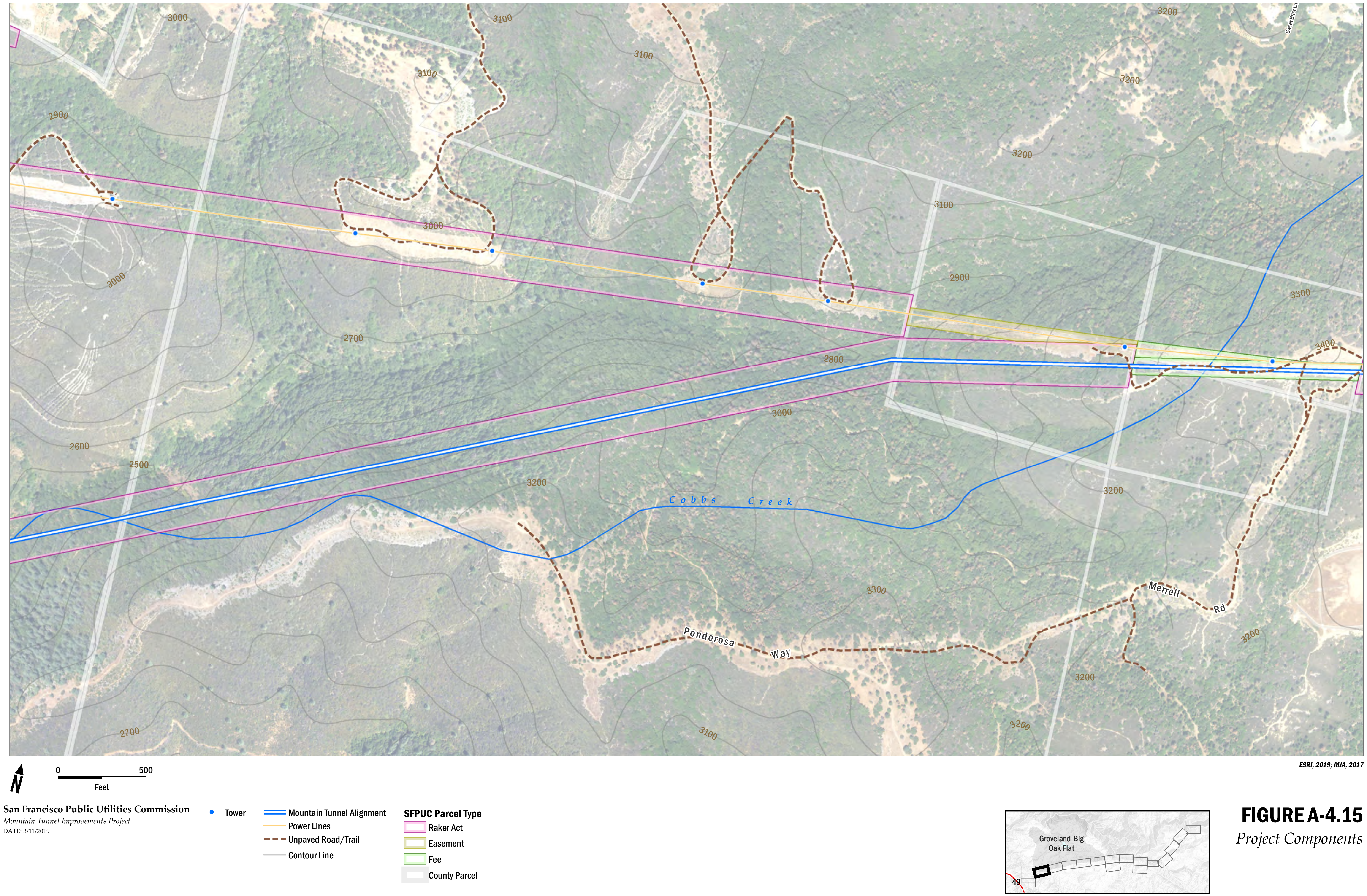
FIGURE A-4.14
Project Components



ESRI, 2019; MJA, 2017

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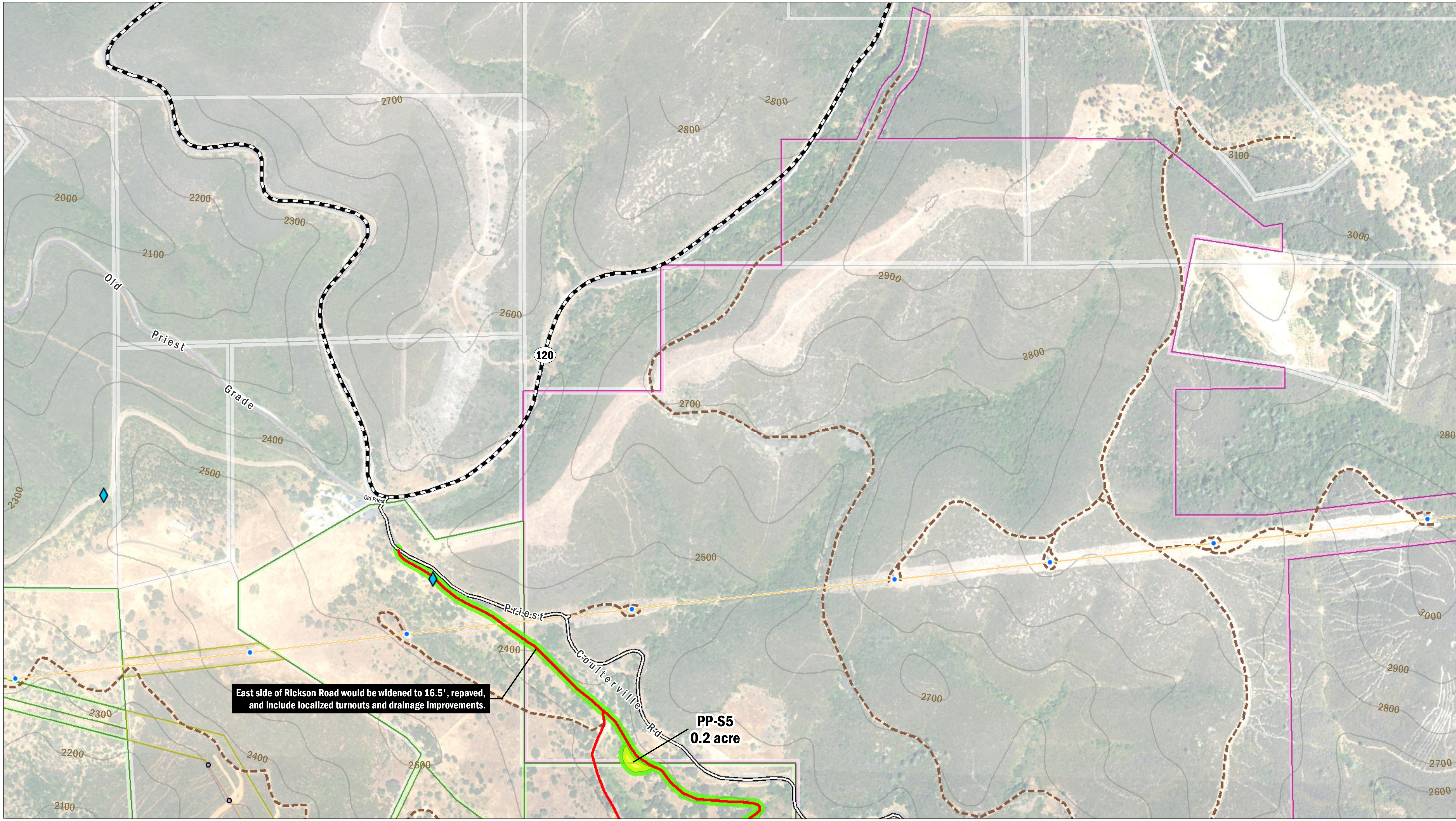
FIGURE A-4.15
Project Components



0 500
Feet
N

ESRI, 2019; MJA, 2017

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Existing Power Distribution Alignment
Gate
Tower

Highway
Existing Power Distribution Alignment
Power Lines
Unpaved Road/Trail
Existing Paved Road
Contour Line

Proposed Project Components
Proposed Road and Drainage Improvements
Staging Area
Tree/Vegetation Removal

SFPUC Parcel Type
Raker Act
Easement
Fee
County Parcel

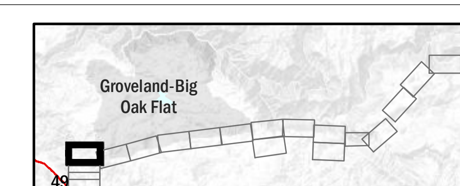

FIGURE A-4.16
Project Components

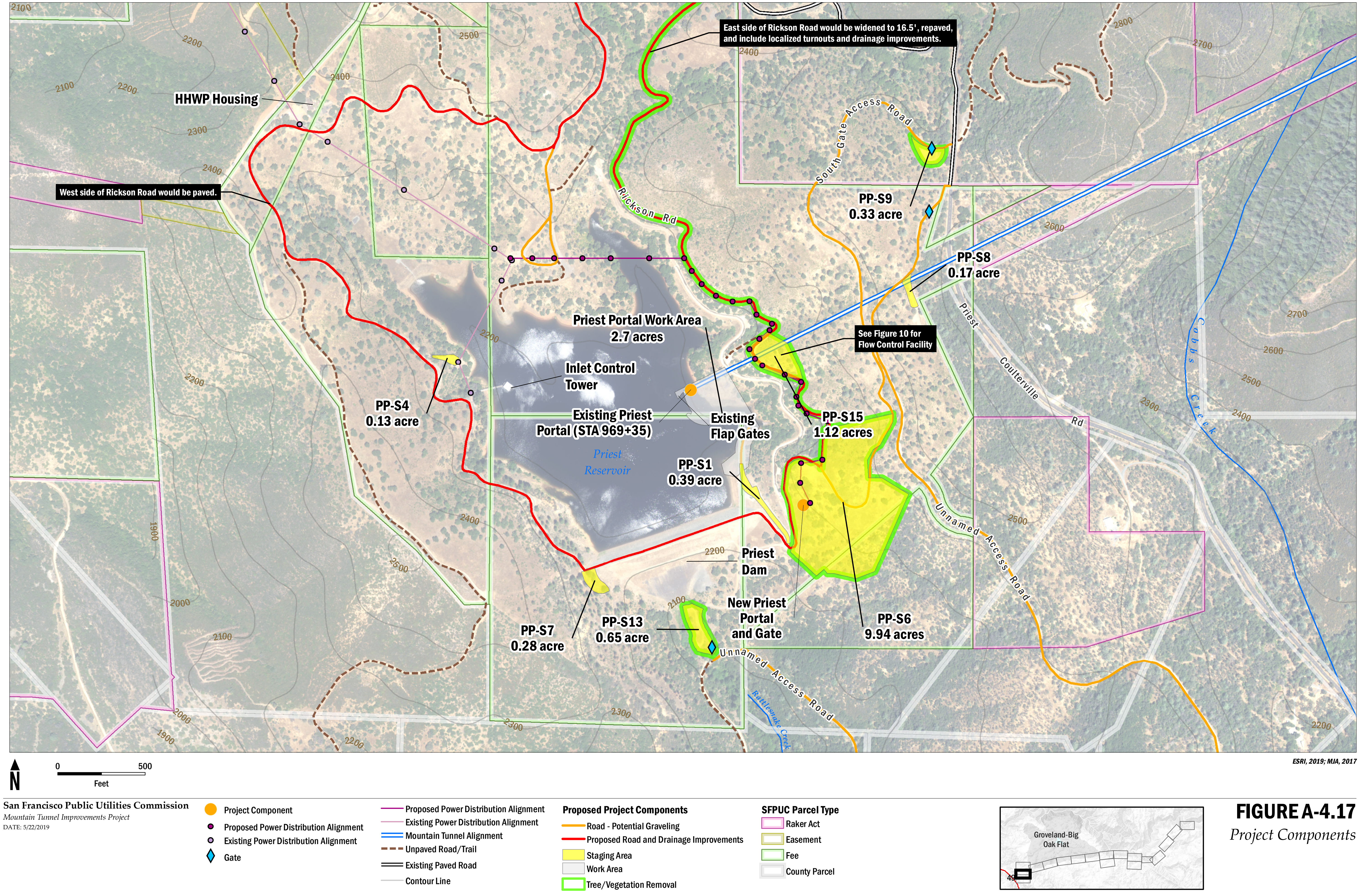

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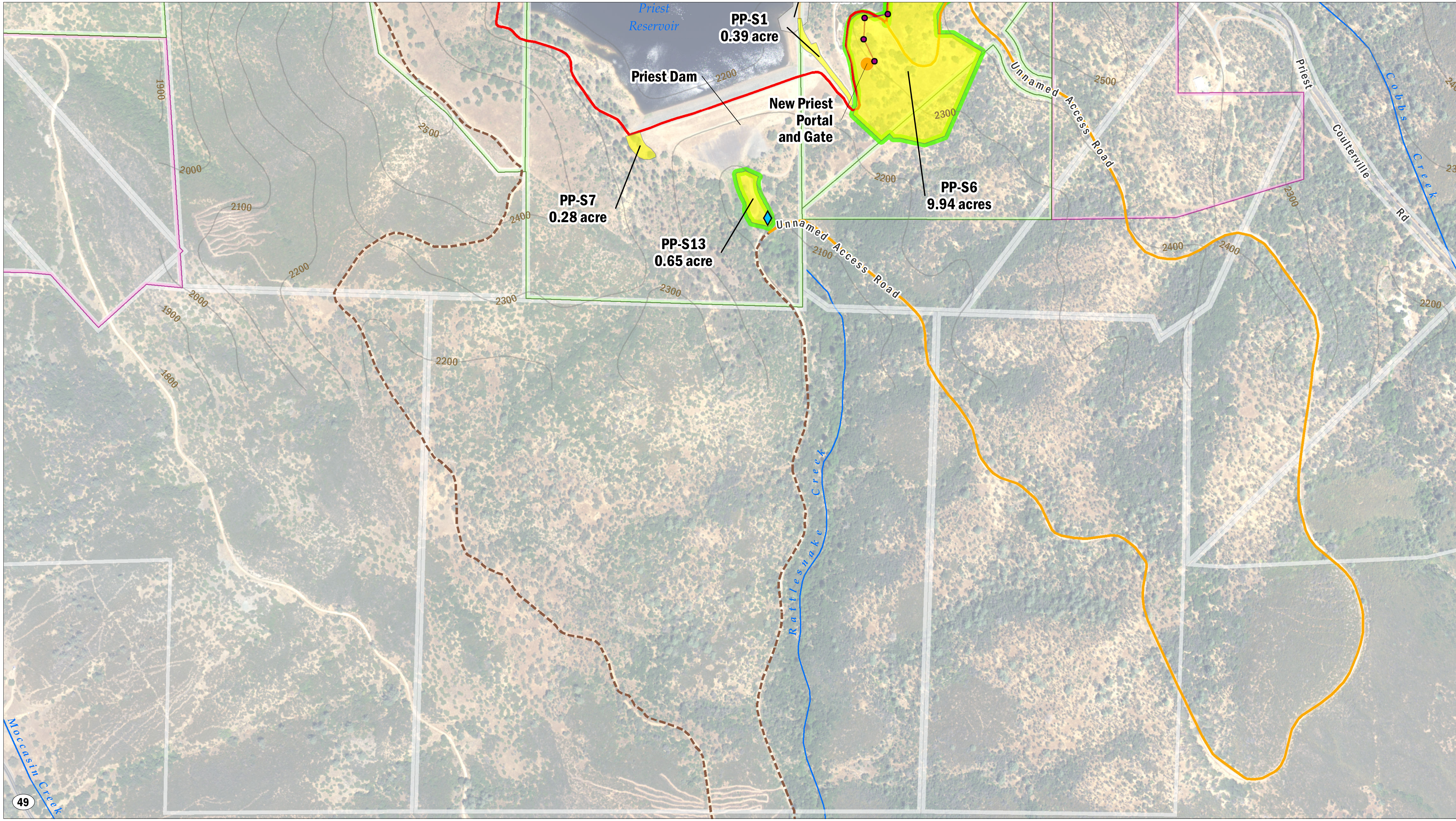
FIGURE A-4.17
Project Components



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- Project Component
- Proposed Power Distribution Alignment
- Gate
- Proposed Power Distribution Alignment
- Unpaved Road/Trail
- Contour Line

Proposed Project Components
- Road - Potential Graveling
- Proposed Road and Drainage Improvements
- Staging Area
- Work Area
- Tree/Vegetation Removal

SFPUC Parcel Type
- Raker Act
- Fee
- County Parcel

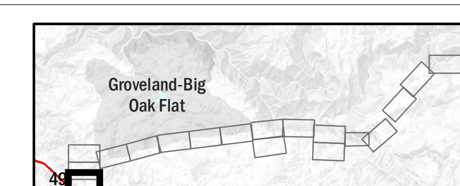

FIGURE A-4.18
Project Components

There are two tunnel access points on either side of the South Fork of the Tuolumne River. The eastern access point at South Fork Crossing is accessed via a steep, narrow (generally 9- to 12-foot-wide), one-lane access roadway (South Fork Access Road) off Old Big Oak Flat Road near Cherry Lake Road (Forest Service Road 1N07) and Highway 120. Vehicle access to the South Fork Access Road (Forest Service Road 1S28B) is restricted to SFPUC and U.S. Forest Service personnel via a locked gate. The southern two-thirds of the access road is gravel, and the northern third closer to the South Fork Crossing is concrete-paved and supported by concrete/rock-and-mortar retaining walls.[14] This access point is reached by stairs from the landing pad at the end of the access road, and only permits personnel access via a 30-inch manhole in the bulkhead.

Personnel access is also possible via the western access point at South Fork Crossing; however, this access point is highly restricted, because crews must cross the river via a suspended two-person tramway and then enter through a 24-inch opening. As a result, the western access point at South Fork Crossing is not suitable for work entry, but can be used for ventilation when the river levels are low.

A.4.4 Adit 5/6

Adit 5/6 is a tunnel access point near Station 336+00 (Figures A-3 and A-4.6). This adit access point was improved in 2017 as part of a previous project to facilitate equipment access during operations and maintenance of the tunnel. Improvements included a new 8-foot by 8-foot bulkhead entry, a new security gate, new valves and tunnel drainage piping, new pressure monitoring equipment, and clearing and graveling of the area immediately outside the adit. The initial 16 feet of the adit is an approximately 9-foot-wide concrete-lined section. The remaining 20 feet of the adit (to the bulkhead door) is unlined, with an approximately 13-foot-tall by 11-foot-wide horseshoe shape.

Adit 5/6 is accessed via a steep, single-lane, dirt road known as Forest Service Road 1S01 that ranges in width from about 9 to 12 feet, and a short spur road off Forest Service Road 1S01 that provides direct access to the adit. Together, these roads are referred to as the Adit 5/6 Access Road. Most of the road was graveled as part of previous projects. Use of this road is limited to U.S. Forest Service administrative uses (including permittees) and the SFPUC; there is no public vehicular access.

A.4.5 Adit 8/9

Adit 8/9 is an access point near Station 486+53 (Figures A-3 and A-4.9). The same improvements made to Adit 5/6 described above were also made to Adit 8/9 in 2017. This adit is fully lined with concrete and has a horseshoe shape, an approximate width of 9 feet, and an approximate length of 190 feet.

Adit 8/9 is accessed via a steep, single-lane, publicly accessible, dirt road (Forest Service Road 1N10/Lumsden Road), ranging in width from about 9 to 12 feet, and by a restricted graveled access road off Forest Service Road 1N10/Lumsden Road. Together, Forest Service Road 1N10/Lumsden Road and this spur access road are referred to as the Adit 8/9 Access Road. Forest Service Road 1N10/Lumsden Road is unimproved and open year-round, according to the U.S. Forest Service Motorized Travel Management

[14] Due to the excavation methods used to build the original road, the rock on the adjacent steep slope was damaged in such a way that significant rockfall hazard exists along the road, particularly from the ford crossing to the concrete landing at the bottom of the road.

Plan.[15] The spur road to the adit from Forest Service Road 1N10/Lumsden Road is restricted to SFPUC and U.S. Forest Service personnel via a locked gate.

A.4.6 Shafts

Two vertical shafts along the alignment—Big Creek and Second Garrote—serve as access points for pumping water from the Mountain Tunnel to customers of the Groveland Community Services District.

Big Creek Shaft is immediately east of Big Creek Shaft Road, north of Highway 120. The shaft is 649 feet deep and is situated at Station 611+25 along the tunnel alignment (Figures A-3 and A-4.11). The shaft is 3 feet in diameter and is lined with concrete. Big Creek Shaft is accessed from Big Creek Shaft Road off Highway 120.

Second Garrote Shaft is south of Old Highway 120 and west of Yosemite Springs Road. The shaft is 786 feet deep and is situated at Station 764+45 along the tunnel alignment (Figures A-3 and A-4.13). The shaft is 3 feet in diameter and lined with concrete. Second Garrote Shaft is accessed from unpaved Second Garrote Shaft Road off Highway 120.

A.4.7 Priest Reservoir

Priest Reservoir is at the western terminus of the Mountain Tunnel, and serves as the regulating reservoir to downstream Moccasin Powerhouse (Figure A-4.17). Priest Reservoir has a capacity of 1,850 acre-feet. Priest Portal is a submerged outlet of the Mountain Tunnel, with six flap gates in Priest Reservoir. Access to the tunnel via Priest Portal is submerged below the water surface in Priest Reservoir during normal operations, but is accessible via a bulkhead at the tunnel terminus on the eastern side of the reservoir when water levels are lowered.

Priest Reservoir has gated road access from Priest-Coulterville Road. There is no public access to Priest Reservoir. The gated entrance on Priest-Coulterville Road connects to Rickson Road, an approximately 3.5-mile-long paved road that rings the reservoir and is generally between 11 and 14 feet wide.

A.5 Proposed Project

A.5.1 Summary of Proposed Improvements

The project consists of rehabilitation of the tunnel lining and construction of new underground components and surface improvements. A summary of the proposed improvements by project component is shown in Table A-1. Additional details on the proposed improvements to the tunnel and associated subsurface and surface features are presented in the following sections.

A.5.2 Internal Tunnel Improvements

Tunnel improvements include debris removal, lining repairs, invert[16] paving, steel lining placement, and pressure grouting.[17] The locations of these improvements are shown on Figure A-5.

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[15] USFS. Motorized Travel Management (17305) Environmental Impact Statement Stanislaus National Forest. November 2009. Based on the map (https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5112662.pdf).

[16] The invert is the floor or bottom of the tunnel.

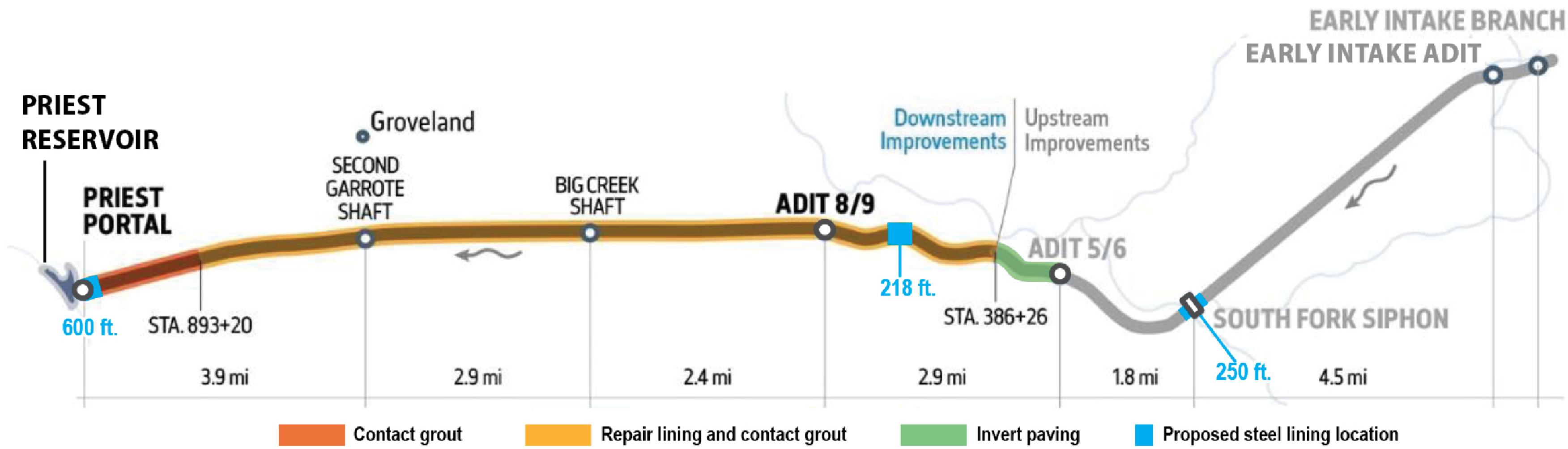
[17] Pressure grouting refers to the injection of grout under pressure to seal off cracks and fissures that allow water to infiltrate into the tunnel.

Table A-1
Summary of Proposed Improvements

Component	Improvements	Objective
Internal Tunnel Improvements (Figures A-5 and A-6)	• Remove debris • Repair concrete lining, including contact grouting • Pave the unlined tunnel invert from Adit 5/6 to Station 386+26 • Install localized steel lining • Conduct pressure grouting	• Prevent further deterioration and possible collapse of the lining • Facilitate maintenance in the tunnel • Improve water quality
Early Intake Adit Improvements (Figures A-4.1 and A-7)	• Replace adit and tunnel access features	• Allow equipment passage into the upstream portions of the tunnel • Improve access to limit the duration of unplanned outages
South Fork Siphon Extension (Figures A-4.4 and A-8)	• Install 750-foot underground siphon extension and associated features (e.g., new shafts, rock trap) • Retrofit existing plug on the western side of the proposed siphon extension	• Reduce river water infiltration to protect water quality • Improve maintenance access for equipment and personnel
Second Garrote Shaft Improvements (Figure A-4.13)	• Install a nonpermeable membrane and gravel around shaft • Improve drainage around shaft • Pressure grouting around the shaft	• Reduce stormwater and groundwater infiltration • Protect water quality
New Flow Control Facility at Priest Reservoir (Figures A-4.17, A-9, and A-10)	• Install new flow control valves, isolation valves, and appurtenant facilities with permanent structure • Construct an approximately 190–foot-deep access shaft that is approximately 55 feet in finished (internal) diameter, with a 55-foot by 66-foot bottom bell • Install power line to new flow control facility	• Protect the existing aged concrete lining from erosive effects of turbulence and surge during transitions from low flow to high flow by maintaining the tunnel full of water
New Priest Portal and Adit (Figures A-4.17 and A-9)	• Construct new portal and adit for access • Install a new rock trap in the tunnel upstream of the intersection with the new Priest Adit	• Improve tunnel access and maintenance flexibility
Drainage Improvements Outside Adits 5/6 and 8/9 (Figures A-4.6 and A-4.9)	• Install culverts in front of adit entrances	• Convey natural runoff from surrounding hillside to existing natural drainages • Protect adit entrances from erosion • Improve tunnel access

Table A-1
Summary of Proposed Improvements (Continued)

Component	Improvements	Objective
Tunnel Access Roadway and Drainage Improvements	South Fork Access Road (Figure A-4.4) • Rebuild approximately 2,510 linear feet of roadbed and gravel • Repair concrete pavement • Widen road/construct turnouts • Install drainage features • Install slope stabilization • Gravel roads that rut during construction	• Enhance roadway conditions for safety and for erosion protection • Facilitate project construction activities and long-term maintenance of the tunnel • Improve tunnel access
	Forest Service Road 1S01/Adit 5/6 Access Road (Figures A-4.6 and A-4.7) • Widen and install drainage facilities along approximately 4,580 linear feet of road • Construct turnouts • Install slope stabilization • Gravel roads that rut during construction	
	Forest Service Road 1N10 (Lumsden Road)/Adit 8/9 Access Road (Figure A-4.9) • Widen approximately 2,720 linear feet of road • Construct turnouts • Install slope stabilization • Gravel roads that rut during construction	
	Second Garrote Road (Figure A-4.13) • Lay down geotextile fabric and gravel on an approximately 2,725-foot segment of road • Replace damaged culvert • Gravel roads that rut during construction	
	Rickson Road (at Priest Reservoir) (Figures A-4.16 and A-4.17) • Widen and pave approximately 6,600 linear feet of road along the eastern side of the reservoir • Improve drainage features • Install slope protection • Construct turnouts • Improve curve radii to facilitate access by long and wide vehicles	



Source: McMillan Jacobs Associates, 2018

FIGURE A-5
Internal Tunnel Improvements

Debris Removal (Unlined Tunnel Section)

Debris in the tunnel reduces the capacity of the tunnel to convey water, can impair water quality, and can hinder maintenance activities. More than 130 rock piles (mostly the result of minor rock falls) and 100 cubic yards of sand and gravel were documented during a 2017 inspection in the upstream portion of the tunnel (Station 0 to Station 386+26). Rocks and debris are prone to collect in the South Fork Siphon, which affect flows.

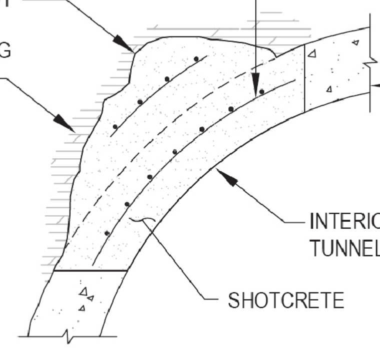
To improve hydraulic performance by reducing the potential for further debris blockage in the siphon, and to reduce the potential for water quality impacts, removal of the rock debris in the upstream portions of the tunnel is proposed. Rock debris may be removed via vacuum (for small particles) or by mechanized equipment. Larger rocks may need to be broken into a smaller size via controlled detonation prior to removal by mechanized means. Rock debris would typically be removed through the nearest practical portal, either at Early Intake, the eastern access point at South Fork Crossing, potentially including the new siphon shaft, or Adit 5/6, depending on the location and size of the material, as well as the equipment used to transport the material (refer to Section A.6.8 for information on spoils transport).

Lining Repairs (Lined Tunnel Section)

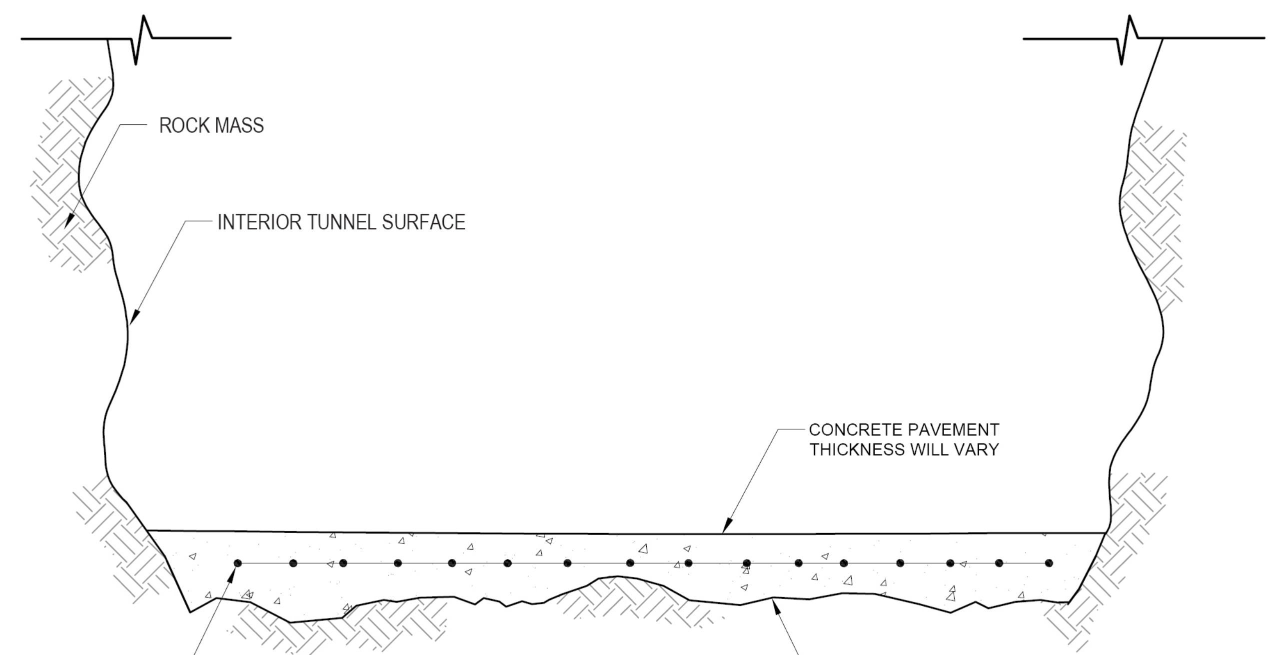
Lining repairs would occur throughout the concrete-lined portion of the tunnel (Station 386+26 to Station 893+20, Figure A-5) to repair defects and eliminate voids in the existing concrete tunnel lining and between the lining and the surrounding rock mass. When water flows through the tunnel at fluctuating rates, these defects and voids can result in increased turbulence and decreased flow rate. Each identified defect in the tunnel lining would be cleaned, the perimeter would be chipped to structurally sound concrete, loose aggregate in the defect would be removed, and the area would be pressure-washed to remove biofilm (i.e., microorganisms that attach to one another in wet environments and adhere to the tunnel walls), dust, and debris. Shotcrete or mortar would then be placed in the defect to match the existing tunnel interior curved surface and create a continuous lining. Prior to the shotcrete placement, wire mesh reinforcement would be placed in areas with larger defects. After the lining has been repaired and exposed surfaces have been smoothed, contact grouting would be performed to ensure that the concrete lining is in contact with the surrounding rock mass. Contact grouting would be performed systematically in the crown (ceiling) and sidewalls along the entire length of this section of the tunnel, to ensure continuous filling of voids between the rock and the final lining. The proposed repair would ensure long-term lining structural performance by distributing the rock mass loads more uniformly along the entire lining structure. Figure A-6 shows how a void in a portion of the tunnel (cross-section) would be repaired. As shown, the defect would be relined using reinforcement and shotcrete. Grout would be pumped into the annular spaces behind the repair to structurally connect the tunnel lining to the rock mass.

Invert Paving (Unlined Tunnel Section)

The upstream, unlined tunnel invert is rough and has pockets of deep water. These conditions affect flow in the tunnel and hinder maintenance activities such as debris removal, because typical vehicles and equipment cannot cross over them with ease. To correct these conditions and allow for drivable access from Adit 5/6, the invert would be paved with concrete. The invert paving work would extend between Adit 5/6 and Station 386+26 (Figures A-4.6 and A-6). Concrete paving thickness would vary between 4 and 15 inches, depending on the size of the invert surface undulations and the tunnel invert elevations between two points.



LINING REPAIR DETAIL



TYPICAL INVERT PAVING FOR UNLINED TUNNEL SECTION

Note: Figure Not to Scale

Source: McMillan Jacobs Associates, 2018

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FIGURE A-6
Tunnel Lining Repair and Invert Paving Typical Sections

Prior to the tunnel invert paving, the unlined invert would be cleaned of debris and loose material. End formwork and screed rails[18] would be used in placement and leveling, and reinforcing would be installed. Concrete would be pumped through the adit for placement, consolidation, and finishing. Any formwork would be removed after the required cure period, and the area would be cleaned before the tunnel is returned to service.

Figure A-6 provides a typical cross-section of a proposed invert paving section in the unlined tunnel. As shown, reinforced concrete would be placed above the rough invert surface.

Localized Steel Lining

Increasing internal operating pressures (by regulating flows and keeping the tunnel full during operations) may cause the tunnel to exfiltrate in areas of low rock cover (i.e., to leak water out of the tunnel where the internal pressure is greater than the exterior pressure from the surrounding rock). This may occur at locations where the tunnel is surrounded by less confining material, or in tunnel locations within a highly permeable rock mass. To address this issue, a watertight steel pipe lining would be installed at areas susceptible to exfiltration near adits and Priest Portal. Additionally, the fractured rock zone could lead to excessive water infiltration (e.g., at the South Fork area fractured rock zone, where river water enters the tunnel), and would need steel pipe lining as well. Figure A-5 shows the tunnel segments proposed for localized steel lining; other areas may be identified upon further design.

Cylindrical steel segments would be transported through the adits into the tunnel with specialized pipe carriers and welded together to form a continuous lining. Upon completion of a continuous steel lining, backfill grouting would be injected to provide continuous contact between the steel lining and the formerly exposed tunnel surface, and a polyurethane coating would be applied to the surface inside the tunnel to protect the steel lining from corrosion. The maximum length of an individual steel segment would be 40 feet, given the size of the adits. Shorter steel segments may be needed to install the steel lining at bends near Priest Portal and to enter through Adits 5/6 and 8/9. In areas of lower pressure or where ground cover is almost adequate, a heavily reinforced concrete lining may be placed in lieu of welded steel pipe.

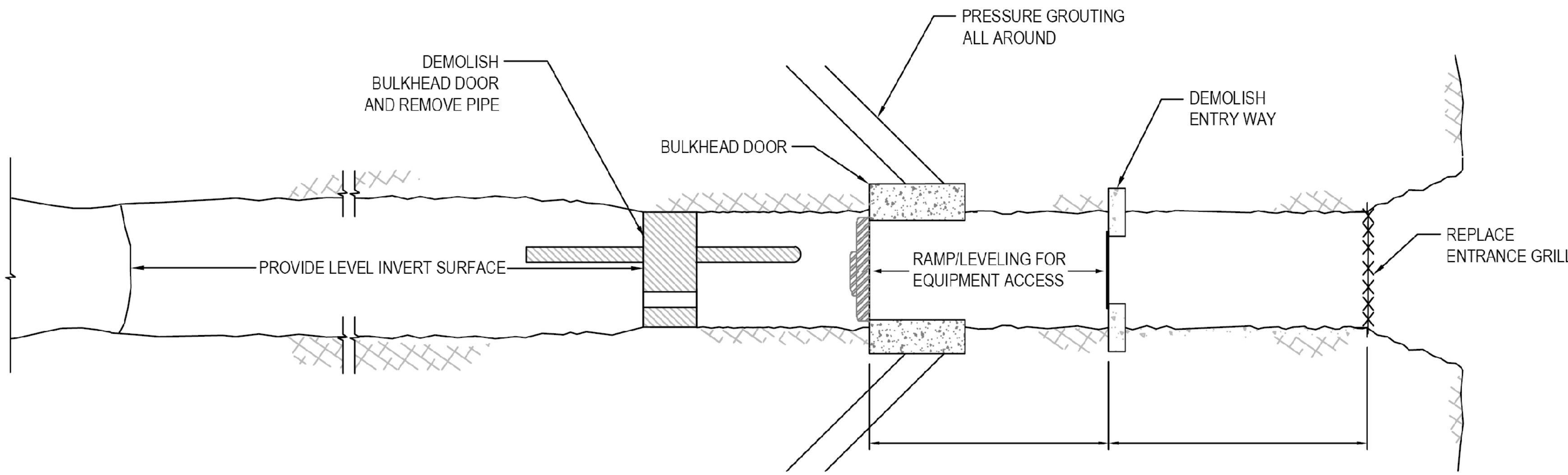
Pressure Grouting

Initial contact grouting would be completed for the entire lined portion of the tunnel. Areas that continue to seep groundwater into the tunnel beyond acceptable limits would be redrilled and regrouted with finer cement grouts.

A.5.3 Early Intake Improvements

To allow for equipment entry into the upstream portion of the Mountain Tunnel, the man-access bulkhead at the Early Intake Adit would be demolished and replaced with a new, larger equipment-entry bulkhead similar to those installed as part of the 2017 improvements at Adits 5/6 and 8/9. Figure A-7 shows existing features to be demolished and new features to be constructed at the Early Intake Adit. This new bulkhead would provide a minimum clear opening of 8 feet by 8 feet. A steel bulkhead door would be secured in the opening, and a concrete plug would be installed with pressure grouting injected

[18] A screed rail is a strip of wood, plaster, or metal placed as a guide for the even application of concrete.



Note: Figure Not to Scale

Source: McMillan Jacobs Associates, 2018

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FIGURE A-7
Early Intake Adit Improvements

into the surrounding rock mass both to support the new bulkhead and to minimize water leakage around the concrete plug. The concrete plug would be approximately 5 feet thick. The adit improvements would allow for regular removal of debris accumulation and quick access in the event of an emergency.

Other Early Intake Adit improvements would include:

- Removal of the existing entrance grill and entryway (outer gate valve, box, and nonfunctioning steel door)
- Installation of a new larger entrance grill to accommodate equipment access, including associated rock excavation
- Installation of new piping and gate valves outside the new bulkhead to drain water from the tunnel, including associated trenching
- Installation of new piping inside the new bulkhead to serve as a tunnel drain
- Leveling of the invert gaps at the intersection of the Early Intake Adit and the Mountain Tunnel
- Installation of a concrete ramp to transition between the existing adit invert grade and the lip of the new concrete bulkhead to facilitate equipment access

The maximum excavation for the new bulkhead, piping, and valves would be approximately 4 feet below ground surface. Demolition of the outer portions of the existing adit entryway components and construction of the new components (bulkhead and associated door, gate valves, piping, and entrance grill) would be conducted while the tunnel is in service. During a planned shutdown of the tunnel, the inner components of the existing adit (e.g., concrete bulkhead and associated features) would be removed, and minor removal of materials and backfilling of an existing trench in the tunnel would occur to allow drivable access. Demolition and rock excavation would be performed using conventional methods;[19] depending on the concrete thickness, which could include chipping or use of pneumatic hammers to break up existing concrete elements in the adit, or controlled detonation (refer to Section A.6.3, Construction Equipment and Controlled Detonation, for additional information on controlled detonation methods).

In addition to the Early Intake Adit improvements, additional work would be performed in the Early Intake area at the Kirkwood Powerhouse/Kirkwood Bypass. Activities at this location would include work on the existing control panel and taps on the pipeline. This work would be performed from existing work areas, and there would be no work in the bed or bank of the river. The SFPUC may also perform remedial slope stabilization across from the Early Intake Switchyard.

A.5.4 South Fork Siphon Extension and South Fork Crossing

The portion of the tunnel that is east of the South Fork Siphon adjacent to the South Fork of the Tuolumne River crosses a fractured rock zone[20] and has been subject to significant infiltration of water from the river. This infiltration can increase the turbidity of the tunnel water. In 2009, a temporary manifold system was installed to collect the infiltrating water and divert it from the tunnel. The system was rehabilitated during 2017 and 2019. The system has operated successfully but is only temporary. The

[19] Conventional methods refer to types of excavation not involving a tunnel boring machine. Instead, these methods include excavation involving drilling and controlled detonation, and/or mechanized excavation by roadheader or other types of rock collection and removal equipment.

[20] The fractured rock zone is an area where fractures in the rock mass were opened due to the original construction methods of drill and blast. These fractures have resulted in an area of high water infiltration due to the low cover of the tunnel at this location and proximity to the Tuolumne River.

proposed permanent solution to infiltration is the installation of a new 750-foot-long siphon segment that would extend the existing siphon and bypass the fractured rock zone (Figure A-8).

In addition to the construction of the 750-foot-long siphon extension, the following work would occur in the vicinity of the South Fork Crossing:

- Installation of a new construction access shaft and connecting adit with bulkhead
- Installation of a new rock trap at the intersection of the access shaft and the new bypass to capture debris
- Installation of a new inclined shaft that would connect the new bypass with the existing tunnel
- Installation of steel lining at the fractured rock zone
- Demolition of the old bulkhead and placement of a new bulkhead farther into the existing tunnel
- Placement of a new security gate at the adit entrance
- Placement of a concrete plug in the crown of the existing siphon, at the start of the old inclined shaft to the existing tunnel
- Placement of backfill in the abandoned old inclined shaft
- Installation of new air vents on the eastern end of the new siphon to allow the siphon to release trapped internal air or intake outside air during high or low tunnel flows
- Extension of the existing air vents on the western end of the new siphon to allow the siphon to release trapped internal air or intake outside air during high or low tunnel flows
- Retrofit of the existing South Fork siphon west access bulkhead

Construction would involve excavation, using conventional rock excavation methods (including drilling, controlled detonation, and mechanical excavation equipment), of a 105-foot-deep by approximately 20-foot-diameter vertical access shaft in the South Fork staging area at the base of the access road above the stairway leading to the adit. A sump pump would be installed inside the new South Fork shaft. During inspection and maintenance, SFPUC staff would power this sump pump using a portable 20-horsepower generator; no permanent generator would be located on site. Water collected from the sump pump would be raw groundwater and discharged in accordance with the SFPUC's State Water Resources Control Board Order WQ 2014-0194-DWQ General Order No. CAG140001 (Statewide National Pollutant Discharge Elimination System Permit for Drinking Water System Discharges to Waters of the United States).

Other underground work activities would include excavation for the siphon extension, installation of a new bulkhead connecting to the siphon extension, installation of a rock trap, and installation of steel lining across the fractured rock zone. The siphon extension, which would also be constructed using conventional rock excavation methods (e.g., controlled detonation), would be constructed while the tunnel is in service. Connection between the siphon extension and the existing tunnel would be completed during a planned shutdown, including placement of a concrete plug and construction of a new bulkhead. Construction of the shaft, siphon extension, and related improvements would occur underground and north of the South Fork of the Tuolumne River. An existing plug on the western side of the proposed siphon extension would also be retrofitted.

In addition, vent outlets connecting to the existing tunnel on the western side of the South Fork Siphon would need to be raised so that the revised operating pressures do not cause tunnel water to spill over the tops of the existing vent outlets and onto the hillside. The eastern vent outlets are in a section of the existing tunnel to be abandoned and would be left in place. Because the existing siphon would be extended to the east, new air vents would be required. Up to three new eastern vents would be installed and up to three western vents would be extended at the siphon extension termini above the new hydraulic grade line. The new eastern vents would be drilled from within the existing tunnel, during an outage, using a small drill

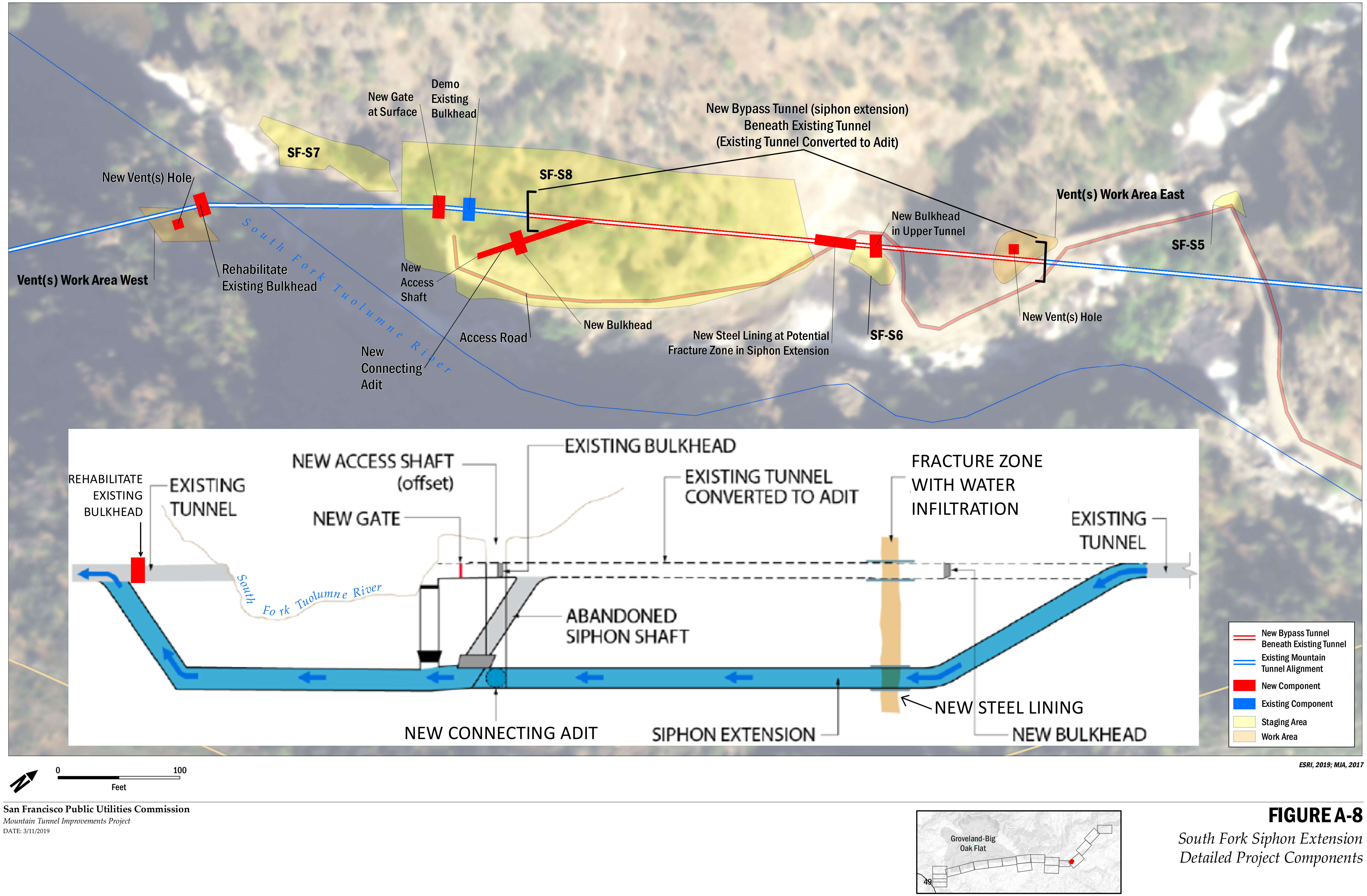

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FIGURE A-8
South Fork Siphon Extension
Detailed Project Components

rig. Minimal work would be required from the hillslopes above the tunnel and access road to prepare the slopes for daylighting of the vent holes. Workers would rappel to the daylighting location to develop and anchor a small working plywood platform (approximately 5 by 10 feet). Because the daylighting point is above the existing access road and on a rock slope that is less steep, it may be possible to access the daylighting vent hole(s) with a boom truck or telescoping aerial lift instead of using rock climbers and harnesses. From there, workers would chip out a small alcove to house a vent cap for the air vent(s), and subsequently connect the cap to a pre-assembled high-density polyethylene vent pipe(s) that would be pulled/jacked through the new vent hole(s). As an alternative to chipping out an alcove, bollards could be placed around the vent caps to protect the vent from damage, such as from rockfalls.

The existing air vents at the western end of the siphon would remain in place; however, the top elevation of these vents would need to be increased due to pressure increases created by the new flow control facility. To increase the western vent elevations, the existing air vents would be extended through approximately 35 feet of piping attached to the ground surface to a higher elevation. The extended piping would be secured in place with rock anchor bolts and covered with plating for protection from rock falls and to eliminate exposure to the elements. Unused existing air vents at the western end would be sealed and backfilled. This work would be completed by two or three workers who would access the site from above the work area. Workers would rappel to the vent locations to develop and anchor a small working plywood platform (approximately 5 by 10 feet).

It is expected that all construction debris from the drilling and chipping processes at the eastern and western vent areas would fall into the vent hole(s) and would be collected from within the tunnel. The platforms would provide additional assurance that unexpected, fallen construction debris would be caught by the platforms rather than falling directly into the river.

A.5.5 Second Garrote Shaft Improvements

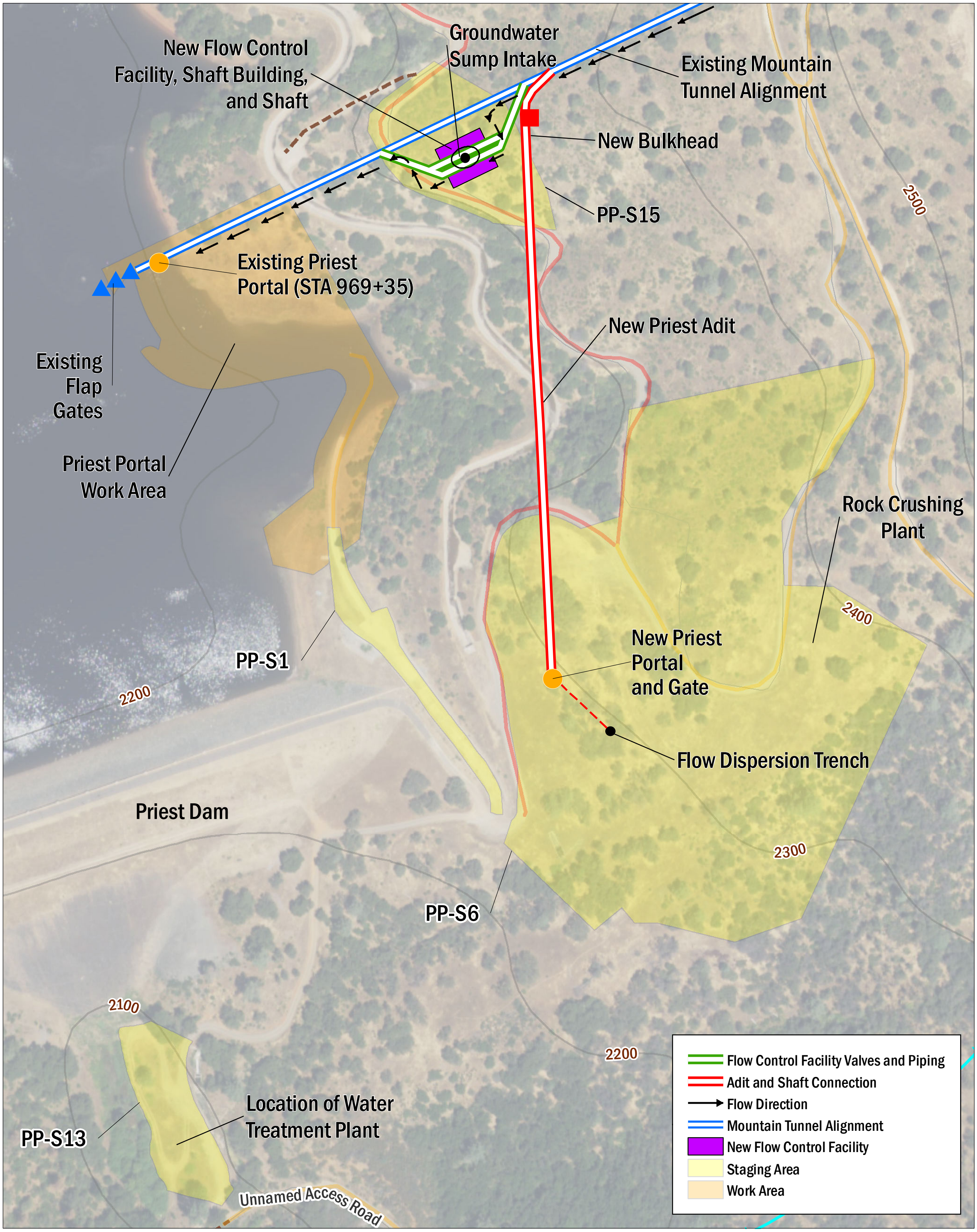
To prevent stormwater from entering Second Garrote Shaft from the surface, the shaft would be surrounded by a nonpermeable membrane. The nonpermeable membrane would be approximately 38 feet long by 16 feet wide. The area enclosed by existing security fencing around Second Garrote Shaft may be expanded slightly, depending on the exact configuration of the membrane. Excavation for installation of the membrane and security fence would be a maximum of 3 feet below the ground surface. Surface drainage improvements (minor grading to redirect water away from the shaft) would also be performed around the upper shaft and membrane to prevent stormwater from entering the shaft.

Pressure grouting adjacent to the shaft would be needed to cut off water infiltration at depth (approximately 500 to 600 feet below ground surface). This would involve drilling multiple, small (3-inch-diameter) boreholes to that depth and injecting grout into the void. Drilling activities would occur during the daytime only, potentially during a shutdown period. Drilling would occur for approximately two weeks, followed by up to 15 days of pressure grouting, using the same equipment as used for contact grouting.

A.5.6 New Flow Control Facility at Priest Reservoir

The flow control facility would be installed underground on city-owned property near Priest Reservoir to maintain the tunnel in full flow (pressurized) conditions during normal tunnel operations (Figure A-9). This improvement would protect the concrete lining from erosive effects of turbulence and surge during transitions from low flow to high flow by maintaining the tunnel full of water. The flow control facility would make it possible to:

- Isolate and perform maintenance on the flow control valves while continuing use of the tunnel for water delivery



ESRI, 2019; MJA, 2019

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FIGURE A-9

Priest Portal Detailed Project Components

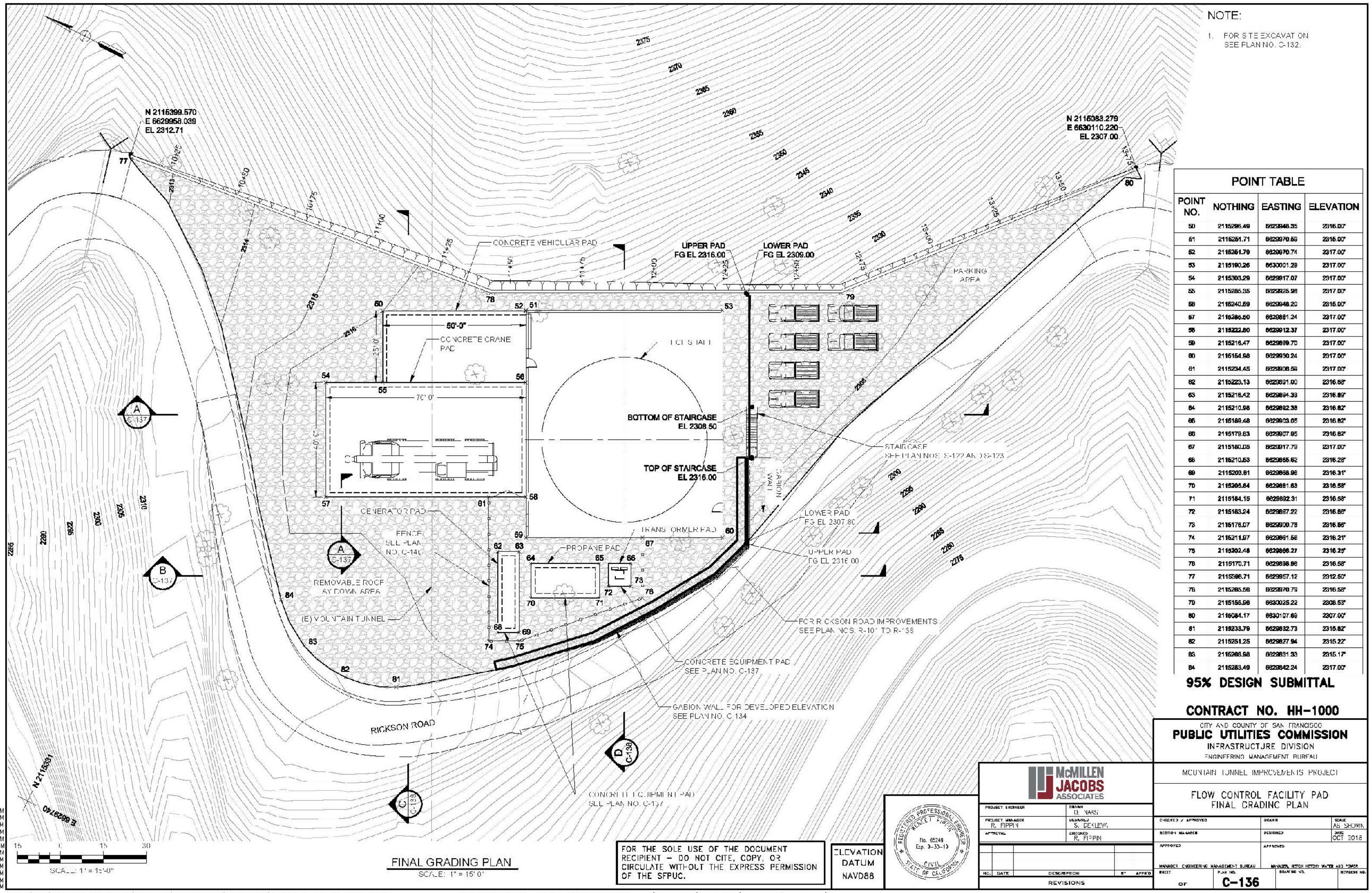
- Isolate Priest Reservoir from the tunnel, allowing tunnel shutdowns and entry without lowering Priest Reservoir, thus providing additional water storage for Moccasin Camp and Moccasin Creek Fish Hatchery operations during long shutdowns and unexpected events

Figure A-9 shows the location of the flow control facility. The flow control facility would match the same stained, split-faced concrete masonry block of the Substation and Sampler Control Building; it would include two control valves, two dewatering pumps, and two small sump pumps, housed in a deep shaft on the shore of Priest Reservoir. The facility would also house two isolation valves for each valve line. The shaft would extend approximately 160 feet below the excavated pad elevation at Staging Area PP-S15. The shaft would be approximately 55 feet in finished (internal) diameter, with a 55-foot by 66-foot finished bottom bell. A permanent structure would be constructed above the shaft to protect the facility and provide safe operations and maintenance access (Figure A-10). The excavated pad at PP-S15 would be covered in crushed rock or aggregate base both for the construction phase and for permanent use. In the excavated pad area, a permanent reinforced concrete crane pad would be provided for future maintenance needs. The portion of the pad where travel into and out of the building would occur may be paved with asphalt. The top of the shaft structure would include a building with hoisting capabilities for servicing the valves. The structure would be approximately 85 feet by 85 feet and 30 feet tall and would have a removable roof for removal of the large flow control valves and isolation valves. A temporary large crane setup would be necessary for valve maintenance and component replacement. A smaller (3-ton) bridge crane would be installed in the structure for lifting lighter equipment.

A permanent power source would be required for the flow control facility at Priest Reservoir. The power would be drawn from existing Hetch Hetchy Water and Power lines north of Priest Reservoir, and a new overhead line and poles would be installed over a distance of about 3,200 feet. Approximate pole locations are displayed on Figures A-4.17 and A-11. New power poles would have a height of approximately 40 feet, similar to existing poles around Priest Reservoir. The depth of the excavation for the poles would be approximately 10 feet. A 30-foot-wide corridor cleared of vegetation around the power line (15 feet on each side of the power line centerline) would be provided to avoid fire hazards; except at pole locations, where a 50-foot radius would be cleared for fire abatement purposes and to allow for structural support (guy lines). To install proper structural support, six of the power poles (P7, P12, P14, P21, P25, and P27) would require a larger clearance zone (Figure A-11), due to the site topography and the need to maintain a clearance height of 25 feet over Rickson Road; the expanded area (typically a 100-foot radius) would also be cleared for fire hazard abatement purposes.

Backup power to the flow control facility would be supplied by a new permanent propane generator maintained onsite. Power to operate the flow control facility's dewatering pumps would be supplied by a permanent 250-kilowatt diesel generator. The diesel generator would be operated every three months for less than a day to exercise the pumps and once every 20 years for three days to dewater the tunnel prior to planned outages. Both the propane generator and the diesel generator would be placed on concrete equipment pads.

Construction of the flow control facility (including construction of the staging area, shaft, and bypass pipeline, and installation of valves) would be performed using conventional rock excavation methods (e.g., drilling or controlled detonation) while the tunnel is in service. However, the upper 50 to 75 feet of the material may be excavated using mechanized means (i.e., using excavators and backhoes or other equipment to mechanically break rock). Excavation of the remaining bypass pipelines that connect to the existing tunnel (and associated connections), installation of the plug closing off the existing tunnel, and



POINT TABLE

POINT NO.	NOTHING	EASTING	ELEVATION
50	2115296.49	6629948.35	2316.00'
51	2115251.71	6629970.59	2316.00'
52	2115251.79	6629970.74	2317.00'
53	2115190.26	6630001.29	2317.00'
54	2115303.29	6629917.07	2317.00'
55	2115285.35	6629925.98	2317.00'
56	2115240.59	6629948.20	2316.00'
57	2115286.50	6629881.24	2317.00'
58	2115222.60	6629912.37	2317.00'
59	2115216.47	6629899.70	2317.00'
60	2115154.98	6629930.24	2317.00'
61	2115234.45	6629906.59	2317.00'
62	2115223.13	6629891.00	2316.66'
63	2115216.42	6629894.33	2316.69'
64	2115210.98	6629892.38	2316.62'
65	2115189.48	6629903.05	2316.62'
66	2115179.63	6629907.95	2316.62'
67	2115180.05	6629917.79	2317.00'
68	2115210.53	6629865.62	2316.28'
69	2115203.61	6629868.96	2316.31'
70	2115205.64	6629881.63	2316.58'
71	2115184.15	6629892.31	2316.58'
72	2115183.24	6629887.22	2316.66'
73	2115176.07	6629900.79	2316.66'
74	2115211.97	6629861.56	2316.21'
75	2115202.48	6629866.27	2316.25'
76	2115170.71	6629898.96	2316.58'
77	2115398.71	6629957.12	2312.50'
78	2115265.56	6629970.79	2316.58'
79	2115155.98	6630025.22	2308.53'
80	2115084.17	6630107.69	2307.00'
81	2115233.79	6629832.73	2315.62'
82	2115251.25	6629827.94	2315.22'
83	2115268.98	6629831.33	2315.17'
84	2115283.49	6629842.24	2317.00'

Source: McMillan Jacobs Associates, 2019

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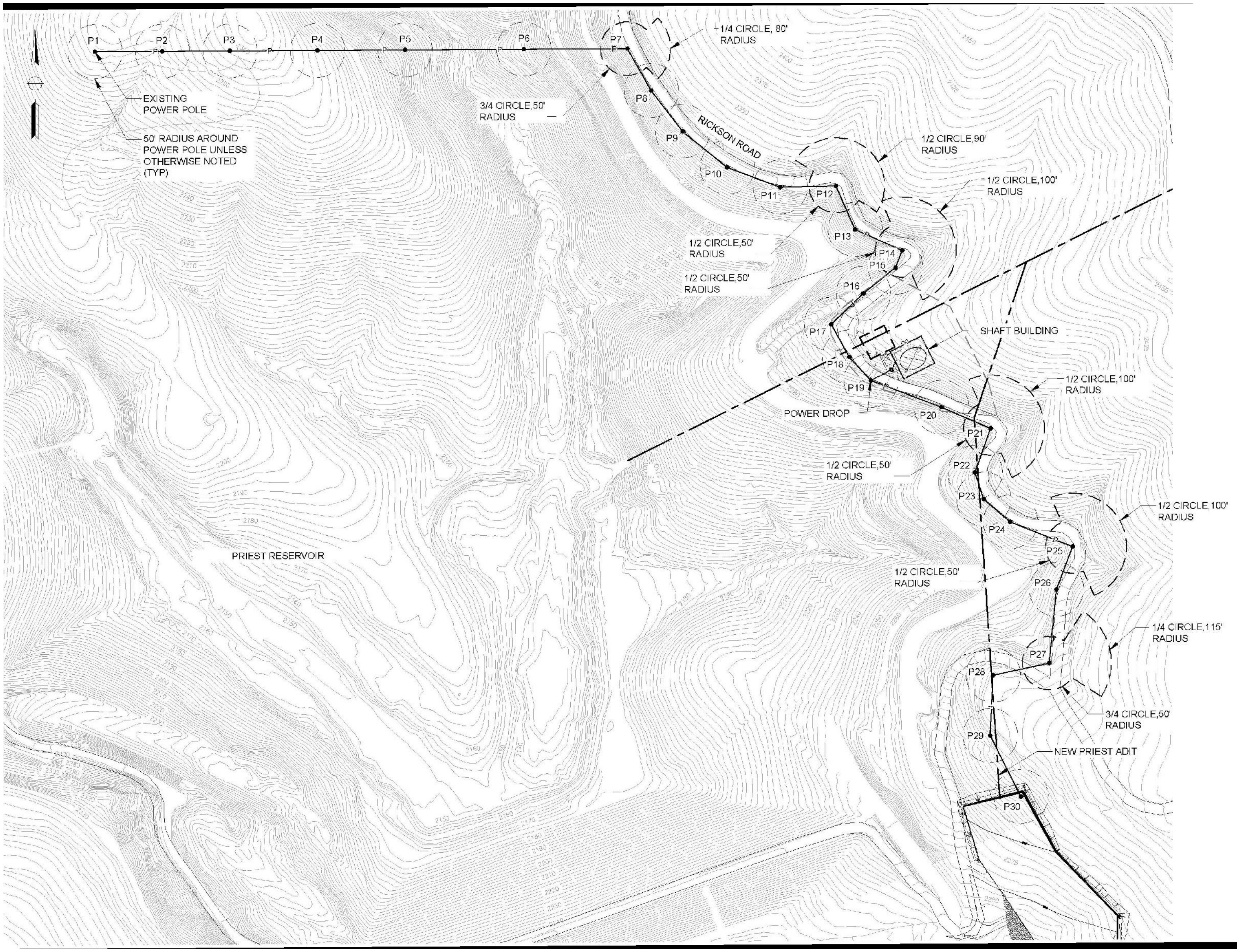
FIGURE A-10
Flow Control Facility Conceptual Layout



Source: McMillan Jacobs Associates, 2018

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FIGURE A-11
Power Line for Flow Control Facility

installation of the steel tunnel lining and backfill grouting would occur during the first 60-day shutdown. Once completed, the flow control facility would allow subsequent shutdowns during construction to extend to 100 days, using the full Priest Reservoir as a water supply source during the shutdown.

A.5.7 New Priest Portal and Adit

A new Priest Adit is proposed to allow access to the Mountain Tunnel while Priest Reservoir is full, and to facilitate installation of up to 1,500 linear feet of steel tunnel lining in locations where tunnel retrofitting for pressurization is necessary (described in Section A.5.2, above).

To facilitate construction of a new Priest Adit, a new Priest Portal would be constructed to serve as an access point to the tunnel in the Priest Adit area (Figures A-4.17 and A-9). The portal would be constructed from a staging area (PP-S6) on the southeastern end of Priest Reservoir. In this staging area, crushed rock, asphalt, or concrete would be used to create a working pad of approximately 1.2 acres. A permanent security gate would be installed at the outer end of the adit.

The new adit would be 1,250 feet long and would range in depth from the excavated, finished ground surface at the new portal to about 250 feet below the ground surface at the tunnel tie-in. This adit would be excavated using conventional mining methods (e.g., drilling or controlled detonation) toward the tie-in location with the Mountain Tunnel. Excavation would be terminated south of the in-service existing Mountain Tunnel, and a new bulkhead would be constructed. This bulkhead would have an 11-foot by 12-foot minimum watertight steel bulkhead door. Similar to the existing adits, the new adit would be generally 14 feet wide and horseshoe-shaped. The tie-in to the existing tunnel would form an enlarged Y-shape (Figure A-9).

A new rock trap would be constructed in the tunnel, downstream of the tunnel's intersection with the new Priest Adit. The trap would be designed to capture debris prior to the debris reaching the flow control facility.

The new portal, most of the adit, and the bulkhead (including the plug and door) would be constructed using conventional rock excavation methods while the tunnel is in service. During the first shutdown, the remaining portion of the adit would be constructed and connected to the existing tunnel.

A.5.8 Drainage Improvements Outside Adits 5/6 and 8/9

The entrance roads to Adit 5/6 and Adit 8/9 are both crossed by ephemeral drainages at the entrances to the adits that drain the hillsides. To improve access to the adits during wet weather, culverts would be installed immediately in front of the entrances to these adits to collect, protect, and direct these ephemeral drainages underground as they pass in front of the adit entrances. The 36-inch culverts would be installed by open cut trenching (approximately 5 feet below ground surface) and backfilling with soil or crushed rock.

A.5.9 Tunnel Access Roadway and Other Drainage Improvements

Tunnel access roadway widening and other improvements would be required to accommodate heavy truck and construction equipment during construction. Road widening, slope stabilization/rebuilding, and drainage improvements are needed to reduce stormwater erosion on the roads and make them safer during the critical winter shutdown periods associated with construction. In addition, these access improvements are needed at Early Intake, eastern and western access points at South Fork Crossing, Adit 5/6, Adit 8/9, and the new Priest Portal for operations, including security, regular collection of monitoring data and water sampling, and routine maintenance. The following proposed access road improvements address long-term tunnel serviceability and construction needs in areas prone to slides and rockfalls. In addition, primary or secondary unpaved roads used for construction access would be graveled as needed if rutting occurs during construction. In general, proposed roadway improvements would likely occur in the first two years of the construction period.

South Fork Access Road

Improvements to the South Fork Access Road (Figure A-4.4) would include improving drainage conditions, reducing slope hazards (rockfall and downslope stability), and localized widening of the road to provide periodic turnouts. To provide safe, short-term construction access as well as long-term access to the South Fork Crossing eastern access point, the following improvements are proposed. Access for construction activities is described in Section A.6.4, Site Access.

- Place concrete paving along the southern 2,510-foot gravel portion of the road.
- Construct additional drainage features (approximately 10) to provide cross drainage at approximately 200-foot intervals along the southern portion of the road. These. cross-drainage features would be concrete water bars[21] constructed at the ground surface and incorporated into the paving.
- Repair approximately 400 linear feet of failed outboard road shoulders, and locally widen the road to increase safety and/or provide periodic turnouts by installing rock-filled gabion baskets (wire-reinforced baskets filled with rocks) or concrete infill.
- Construct six turnouts to improve temporary construction traffic movements and safety.
- Install upslope protection structures along stretches where slope stability and rockfall hazards exist. The improvements would be discontinuous. The maximum extent of upslope protection measures would be approximately 2,050 linear feet. Protection measures would include drilled and grouted rock dowels in key blocks, draped mesh,[22] post-mounted cable net, flexible barrier, or anchored mesh. These structures typically involve some slope preparation, such as scaling loose rock from the slope and eliminating topographic overhangs.
- Stabilize 10 existing downslope rock walls. This would include adding drilled and grouted lateral anchors through the walls and applying a permanent facing, such as shotcrete or rockfall mesh. The facing would be colored with natural hues to blend with the surrounding ground surface and vegetation.
- Repair concrete pavement along approximately 55 linear feet of roadway.
- Repair the gaps between the edges of pavement and edges of walls that have been infilled with vegetation, by removing the vegetation and cleaning, sealing and filling the gaps with a flexible joint sealer[23] (along approximately 950 continuous linear feet of roadway).
- Near the river end of the South Fork Access Road, extend the existing retaining wall/roadway curb that is along the river side of the road and above the river bank, and increase the height of

[21] A water bar is a road construction feature that is used to prevent erosion by reducing flow length. It is a channel across the road that diverts surface water into a stable drain way. By constructing a series of water bars at intervals along a road, the volume of water flowing down the road is reduced.

[22] A draped mesh is an engineered woven steel wire used as a drapery system to prevent rocks and debris from falling down a slope.

[23] The function of a joint sealer is to block the passage of fluids through the openings in the road and rock.

the retaining wall to 5 feet above the paved road to ensure that no construction equipment or supplies would accidentally roll or fall into the river.

Forest Service Road 1S01/Adit 5/6 Access Road and Forest Service Road 1N10 (Lumsden Road)/Adit 8/9 Access Road

Figures A-4.6 and A-4.7 show the location of potential road improvements along Forest Service Road 1S01/Adit 5/6 Access Road, and Figure A-4.9 shows the location of potential road improvements along Forest Service Road 1N10 (Lumsden Road)/Adit 8/9 Access Road. The primary roadway improvement is widening to maintain a minimum roadway width of 12 feet. The road surface would consist of gravel. The entire lengths of each road would be subject to new gravel placement within the existing road limits as needed during construction. The proposed improvements to facilitate construction and long-term access are summarized for each roadway below. Access for construction activities is described in Section A.6.4, Site Access.

Forest Service Road 1S01/Adit 5/6 Access Road

- Widen the existing road for approximately 4,580 linear feet to maintain a minimum, consistent roadway width of 12 feet (plus 2-foot-wide ditch on the inboard[24] side). The widening work would include approximately 3,750 linear feet of the Adit 5/6 Access Road, consisting of installation of gabions to strengthen the soft shoulders and prevent erosion on the outboard[25] edge of the road. The widening work would require up to 1,350 feet of upslope cuts.
- Install approximately 20 concrete water bars at approximately 200-foot intervals along the 4,580 feet of improved roadway.
- In addition to the new 36-inch-diameter culvert at the Adit 5/6 entrance, replace the existing culvert along the access road with a new 30-inch-diameter culvert.
- Construct up to seven new turnouts, varying between 100 feet and 300 feet long, to allow safer vehicle passage. Approximately 4,000 feet from Staging Area A5/6-S2, construct an additional approximately 350-foot-long cut slope for a vehicle turnout and temporary laydown area for material storage during active construction.
- Install a concrete deck overhang to support two stretches of the road, totaling approximately 280 feet, to straddle locations where there are active debris chutes and existing sack walls along the outboard side of the road. The cantilever design would require drilling approximately 60 micropiles and/or a combination of inclined anchorage such as soil nails or tiebacks/tiedowns, consisting of 8-inch-diameter grouted holes spaced approximately 6 to 10 feet apart, and approximately 50 feet below ground surface.
- Install slope protection (i.e., draped mesh, post-mounted netting, or shotcrete facing) at eight rock fall hazard zones. These improvements would be discontinuous. The maximum extent would be approximately 1,100 feet. Conduct additional scaling and spot bolting as needed for slope stability along other segments of the roadway.
- Install safety signage at horizontal curves and other potentially hazardous locations.

[24] Inboard is the upslope side of the road.
[25] Outboard is the downslope side of the road.

Forest Service Road 1N10 (Lumsden Road)/Adit 8/9 Access Road

- Widen approximately 2,720 linear feet of the road to maintain a minimum, consistent roadway width of 12 feet. The widening work would include outboard gabions, similar to the Adit 5/6 Access Road, and upslope cuts along up to 300 linear feet of the road. Perform a rock cut on the inboard side of Forest Service Road 1N10/Lumsden Road within the boundaries of Staging Area A8/9-S4 at the hairpin turn from Forest Service Road 1N10/Lumsden Road to the adit access spur road, to create additional flat space for a new laydown area.
- Protect the existing inboard concrete v-ditch with culvert outlets for long-term drainage. The work would include localized reshaping of the road cross section to reestablish consistent drainage into the ditch.
- Provide up to six turnouts, one on the spur road (and not affecting Lumsden Road), and the remaining five on Forest Service Road 1N10/Lumsden Road. The turnout at the hairpin turn, where the spur road would leave Forest Service Road 1N10/Lumsden Road to access the adit, would be approximately 300 linear feet long and vary in width along this segment (the typical road width in this segment would be about 40 feet). The four remaining turnouts would be located along segments of Lumsden Road that are already widened. At these four turnout locations, the existing upslope rock slope would be scaled and rock slope protection would be installed to allow for safe stoppage of vehicles during passing.
- Address rockfall hazard zones with methods such as draped or post-mounted rockfall mesh/ netting (up to 600 feet) and spot bolting/dowels.
- Install safety signage at horizontal curves and other potentially hazardous locations.

Proposed roadway cuts for road improvements on both the Adit 5/6 and Adit 8/9 access roads (e.g., inboard widening or turnouts) would be approximately 20 feet high but no more than 40 feet. Where cuts are made, the horizontal distance into the existing slope would be approximately 20 to 25 feet, and no more than 36 feet. Where roadway fill is needed for road improvements (e.g., outboard widening), fill vertical heights would be generally be less than 10 feet high, but no more than 17 feet.[26] Where fill is proposed, the horizontal distance from edge of road toward the outboard road side would generally range between 5 and 10 feet, but no more than 20 feet.

Second Garrote Road

Geotextile fabric and gravel would be placed on approximately 2,725 linear feet of Second Garrote Road (Figure A-4.13). In addition, an existing, failing culvert, approximately 850 feet south of the intersection with Highway 120, would be replaced to improve drainage and consequently access to the Second Garrote site during the winter months. Work would involve minimal ground disturbance (approximately 950 square feet), consisting of removing the existing culvert, installing a new culvert, and backfilling on top of the new culvert. The maximum depth of excavation is anticipated to be 5 feet, with 1:1 (horizontal and vertical) temporary slope sides.

[26] Fill height is defined as the height between the finish grade at the top back of gabion (roadside) and the finish grade at the bottom toe of gabion wall. The gabion itself is embedded slightly.

Rickson Road (at Priest Reservoir)

Rickson Road is a loop road that encircles Priest Reservoir and is accessed by SFPUC employees via a gate approximately 1,100 linear feet south of Priest-Coulterville Road. The eastern branch of Rickson Road is approximately 6,600 linear feet, starting from a point south of the gate and continuing along the eastern side of Priest Reservoir to the eastern end of Priest Dam. This eastern branch of Rickson Road would be improved for heavy truck and construction vehicle use by widening the existing road by 2.5 feet plus a 1-foot drainage ditch on the inboard side, adding shoulders, and modifying the curves to have a minimum radius to accommodate a large crane. In localized areas such as compound or tight curves, the effective road width would be between 20 and 32 feet wide). The improvements would involve:

- Cut and fill and general grading, with cuts anticipated to be a maximum height of 20 feet, except at horizontal curves, where the maximum height would be 30 feet
- Slope protection at cuts through installation of soil nails and/or rock bolts, with shotcrete facing where necessary
- Fill walls at areas of downslope widening
- Minor clearing and grubbing prior to placement of fill materials behind the wall (e.g., approximately 6 inches to 1 foot of existing material may need to be excavated prior to placement of aggregate)
- Application of aggregate base and asphalt paving
- Graveling or paving widened roads
- Culvert extension(s) as necessary
- Construction of drainage ditches on the upslope side of the roadway where needed

The western branch of Rickson Road is approximately 8,720 linear feet long. It veers south from the eastern branch of the road, continues along the western side of the reservoir, and then turns east across Priest Dam to reconnect with the eastern branch of the road. This western branch would not be widened, and existing drainage facilities would remain as is. The improvements would involve:

- Limited repairs, as needed, to the existing asphalt pavement, such as fixing potholes and alligatored sections, during the first six years of project construction (approximately 500 feet of these limited repairs per year)
- Application of fresh gravel or aggregate base and compaction to the road shoulders if needed (e.g., if the shoulders become rutted from truck traffic)
- Repaving of the road at the end of the project construction period (i.e., in the seventh year), which would be performed by crushing the existing asphalt, compacting it, and then placing the new asphalt on top

A.6 Construction Activities

The following sections present information on the construction schedule and planned construction activities, including proposed staging areas, construction equipment, and methods.

A.6.1 Construction Schedule

Construction would extend from spring 2020 through 2026 (Figure A-12). The tunnel would be shut down for periods of 60 to 100 days each five times between 2022 and 2026 to enable project construction in the tunnel. The first shutdown, planned for winter 2022, would require the drawdown of Priest Reservoir for a 60-day period to connect the proposed flow control facility and new Priest Portal and Adit. These installations would allow the Priest Reservoir water level to remain higher during the subsequent shutdowns and in turn allow them to be longer, 100-day shutdowns for the remaining construction years.

Construction activities would not be continuous through the entire project schedule. Some activities, such as roadway improvements and preparation of staging areas, would occur during the initial phases of the project to prepare for subsequent phases. Some activities would only be conducted during planned shutdowns during winter months, such as internal tunnel repairs and invert paving and connections between new and existing facilities. It is therefore unlikely that simultaneous construction activities at all project improvement locations would occur during any stage of the project. The contractor would elect which year to perform nonshutdown work. In addition, contractor use of staging areas would not be restricted to specific phases of construction, although it is anticipated that the contractor would no longer use the Early Intake or South Fork staging areas after completion of improvements specific to those areas, due to their remote locations. The estimated construction durations for individual project components are presented in Table A-2.

A.6.2 Construction Staging

Construction Staging Areas and Activities

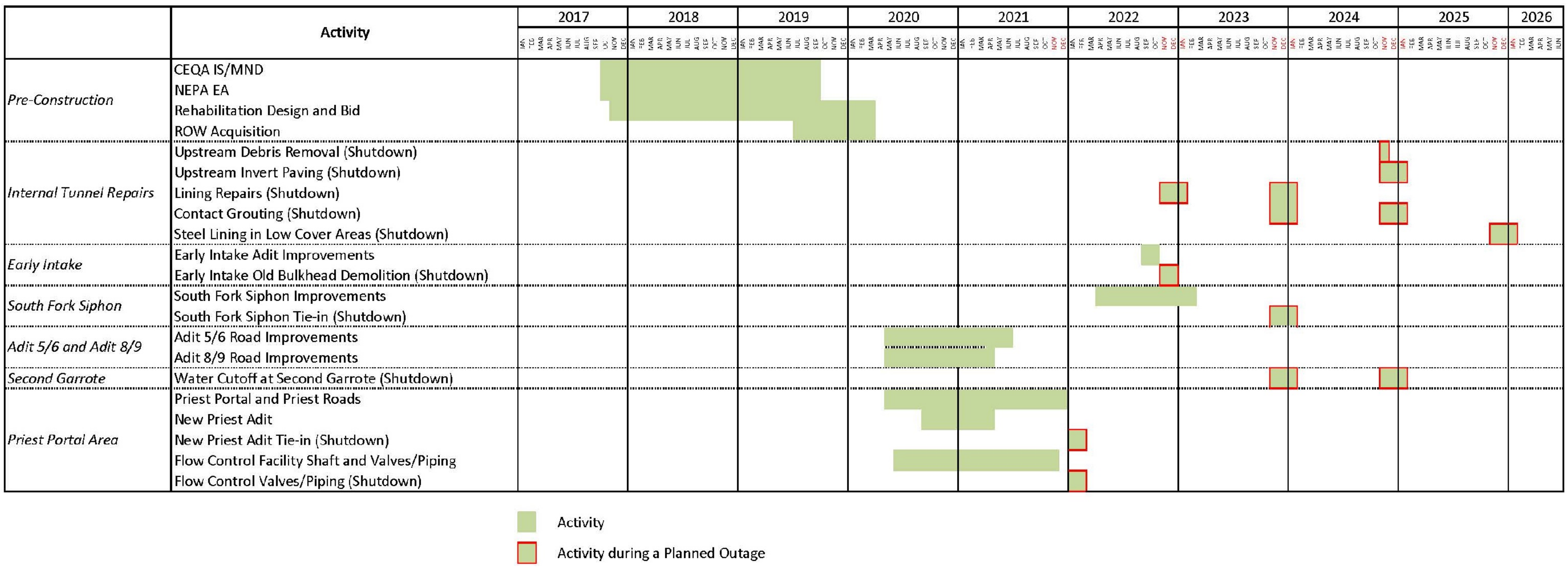
Staging areas have been identified for contractor use for active construction, parking, material storage, spoils storage, trailers, and other uses as described below. Table A-3 lists the location, size, general planned use, and proposed improvements (where applicable), and indicates whether tree and vegetation clearing is anticipated. The boundaries of each staging area (Figures A-4.1 to A-4.18) show the maximum extent of the limits of construction (providing the contractor with adequate space to perform the activities identified for each staging area), and have been located to minimize potential environmental impacts to the extent practicable (e.g., avoid sensitive habitats and archaeological sites).

In general, the new Priest Portal and Adit would be the primary access points for tunnel repairs (e.g., debris removal, lining repairs, contact grouting, and localized steel lining) on the western end of the tunnel. Additional details regarding the Priest Portal Work Area and access to the tunnel for improvements are identified in Table A-3.

Adit 8/9 would be the primary access point for the repairs on the eastern end of the lined section. In addition, contact grouting would be performed from both the Big Creek and Second Garrote shafts. Invert paving would likely occur from Adit 5/6. Pressure grouting would occur from Second Garrote shaft. Construction of the South Fork Siphon extension would occur from near the access points at South Fork Crossing. For these reasons, there are staging areas at each of these locations, as identified in Table A-3.

Tree Removal

To clear construction staging areas, enable construction personnel to perform construction activities, clear areas for the proposed improvements, and avert potentially hazardous conditions from unstable trees, the proposed project includes tree removal. Tree removal areas are generally delineated on Figures A-4.1



Source: AECOM, 2019

FIGURE A-12
Project Schedule

Table A-2
Estimated Duration of Work by Project Component

Work Activity	Duration (Months)[1]	Approximate Laborers for Individual Activities Per Shift
Internal Tunnel Repairs		
Upstream Debris Removal	1	9
Upstream Invert Paving (one shutdown)	3	20
Lining Repairs (one to two shutdowns)	3 to 6[2]	16
Contact Grouting (two shutdowns)	3 to 6[2]	18
Steel Lining in Low Cover Areas (one shutdown)	3	22
Early Intake		
Early Intake Adit Improvements	3 to 6	14
Early Intake Old Bulkhead Demolition (one shutdown)	2	9
South Fork Siphon and Crossing		
South Fork Siphon and Crossing Improvements	8 to 14	15
South Fork Siphon Tie-in (one shutdown)	3[2]	12
Adits 5/6 and 8/9		
Adit 5/6 Road Improvements	14	15
Adit 8/9 Road Improvements	12	15
Second Garrote		
Pressure Grouting (two shutdowns)	3 to 6[2]	9
Priest Portal Area		
New Priest Adit	8	16
New Priest Adit Tie-in (one shutdown)	2	16
Flow Control Facility Shaft and Valves/Piping	12 to 18	16
Flow Control Valves/Piping (one shutdown)	2	16
Priest Portal and Rickson Road	20	20

Source: McMillen Jacobs Associates, 2018.

Note:

1 Demobilization is included in the construction duration specified for each work activity. The final demobilization activities would take six months after the last outage.

2 For those improvements that would occur during a shutdown or outage, a two-month pre-shutdown mobilization would also be added to the construction duration, which would include activities such as setting up trailers, water treatment plants, and dewatering facilities, and importing equipment and materials, but not in-tunnel work.

Table A-3
Staging/Work Area Sizes and Uses

Location	Staging/ Work Area	Acreage	Proposed Activities[1]	Approximate Excavation/Anticipated Vegetation Clearing[4]
Early Intake	EI-S1	0.67	General staging (limited to existing paved areas only). Several parking spaces would be reserved for use by the public, and so would not be used for construction staging.	None
	EI-S2	0.62	General staging (lay down geotextile fabric and gravel as needed on grassy areas). Temporary debris storage.	None
	EI-S3[2]	1.1	Adit access (lay down geotextile fabric and gravel as needed next to the switchyard). Adit improvements (see Section A.5.3).	A 4-foot excavation depth for the bulkhead and a 2.5-foot excavation depth for the trenching for the new piping and gate valves. No excavation outside the adit. Tree and vegetation removal only if sloughing occurs on slopes.
	EI-S4	0.38	General staging.	None
	EI-S7	1.19	General staging. Temporary debris storage.	None
	Kirkwood Bypass	N/A	Work at the existing control panel and taps on the pipeline to be performed via the existing platform. No work in the bed or bank of the river is anticipated.	None
South Fork	SF-S1	0.66	General staging and storage (limited to paved areas only).	None
	SF-S2	0.47	Construction trailer and parking (lay down geotextile fabric and gravel).	None
	SF-S3	0.12	General staging and parking.	None
	SF-S4	0.06	General staging and parking.	None
	SF-S5	0.01	General staging.	No excavation (scaling[5] of upslope rock face for road improvements). Tree and vegetation removal.
	SF-S6	0.02	General staging.	A 4-foot excavation depth for preparing the roadbed for construction of proposed improvements; scaling and spot bolt on the adjacent rock walls. Tree and vegetation removal.

Table A-3
Staging/Work Area Sizes and Uses (Continued)

Location	Staging/ Work Area	Acreage	Proposed Activities[1]	Excavation/Anticipated Vegetation Clearing[4]
	SF-S7[2]	0.07	Adit access. Adit improvements (see Section A.5.4).	A 5-foot excavation of localized rock protrusions. Tree and vegetation removal.
	SF-S8	0.84	Pad development (on the adjacent slope). New South Fork Siphon extension and related activities (see Section A.5.4).	A 105-foot excavation depth for the shaft from the concrete landing; a 5-foot excavation of localized rock protrusions); scaling/spot bolting on rock. Tree and vegetation removal.
	Vent Work Area West	0.03	Extension of existing tunnel vent(s).	Tree and vegetation removal.
	Vent Work Area East	0.03	New tunnel vent(s).	A 130-foot excavation depth from the surface of the hill to the tunnel. Tree and vegetation removal.
Adit 5/6	A5/6-S1	0.85	Construction trailers and storage.	No excavation. Vegetation removal.
	A5/6-S2[2]	0.31	Adit access, a small contractor office, and a small water treatment plant.	A 5-foot excavation depth for culvert installation. Up to a 10-foot excavation depth for the gabion wall. Scaling up to 4 feet into the rock wall. Tree and vegetation removal.
Adit 8/9	A8/9-S1[2]	0.27	Adit access, a small contractor office, and a small water treatment plant.	A 5-foot excavation depth for the culvert installation. Scaling up to 4 feet. Tree and vegetation removal.
	A8/9-S3	0.68	General staging, possible small construction trailer.	No excavation. Tree and vegetation removal.
	A8/9-S4	0.44	General staging, road widening for truck and equipment access.	Up to a 40-foot vertical excavation (height above road level) and up to a 30-foot horizontal excavation into the upslope rock face. Tree and vegetation removal.
	A8/9-S5	0.31	General staging, possible small construction trailer (lay down geotextile fabric and gravel).	None
	A8/9-S6	0.87	General staging, possible small construction trailer (lay down geotextile fabric and gravel).	None
Big Creek Shaft	BC-S2	1.0	Grouting down shaft into tunnel via a grout plant.	None

Table A-3
Staging/Work Area Sizes and Uses (Continued)

Location	Staging/ Work Area	Acreage	Proposed Activities[1]	Excavation/Anticipated Vegetation Clearing[4]
Second Garrote	SG-S1	0.99	Grouting down shaft into tunnel. Grading to direct drainage away from shaft. Install nonpermeable membrane around shaft. Pressure grouting around shaft.	Less than a 1-foot excavation depth for general grading around the shaft; and a 3-foot excavation depth for the new fence.
Priest Reservoir	PP-S1	0.39	General staging, access into the tunnel during first shutdown (see also Priest Work Area West and East).	None
	PP-S4	0.13	General staging.	None
	PP-S5	0.2	General staging.	No excavation.
	PP-S6[2]	9.94	Activities for the new Priest Portal and Adit (see Section A.5.7). Project trailers. Water treatment plant for treatment of construction wastewater (alternate site would be PP-S13). Spoils disposal and stockpiles, and new rock-crushing plant.	Excavation to 49 feet below ground surface for the portal; and 15 feet below ground surface for the spoils disposal area. Tree removal.
	PP-S7	0.28	General staging.	None
	PP-S8	0.17	General staging.	None
	PP-S9	0.33	General staging.	No excavation. Tree removal.
	PP-S13[2]	0.65	Water treatment plant for treatment of construction wastewater (alternate site would be PP-S6).	A 20-foot maximum excavation depth for leveling the site. Vegetation removal.
	PP-S15[2]	1.12	Activities for the new flow control facility (see Section A.5.6).	A 190-foot excavation depth for the shaft pad and shaft (up to approximately 30 feet below ground surface to the shaft pad, plus 160 feet below the shaft pad), 5 feet below ground surface for the flow control facility footings. Tree and vegetation removal.

Table A-3
Staging/Work Area Sizes and Uses (Continued)

Location	Staging/ Work Area	Acreage	Proposed Activities[1]	Excavation/Anticipated Vegetation Clearing[4]
	Priest Work Area West and East	2.7	Drained area for staging activities; plywood bulkhead at existing Priest Portal to provide ventilation, temporary guard house to provide security to the Mountain Tunnel, storage, and parking.[3]	None. Graveling for the parking area.

Source: McMillen Jacobs Associates, 2018.

Notes:

1 "General staging" denotes areas that would serve multiple purposes, such as parking, staging small equipment, and temporary materials storage. Preparation and routine use at all staging areas would result in 1 foot or less of below ground surface disturbance, unless noted that no excavation would occur.

2 Primary work areas.

3 The area PP-S1 is a paved concrete roadway that leads to the existing Priest Portal when the reservoir is drained below the portal invert elevation. The area would be drawn down only for the duration of the first Mountain Tunnel shutdown, which would last 60 days. Drawing down the reservoir below this level exposes flat land surrounding the concrete roadway. This exposed area is referred to as the Priest Work Area West and Priest Work Area East. Work in these areas would be restricted to dry land and be stabilized by gravel/ large crushed rock. These areas would be used for general construction staging, equipment storage, and material storage for entry into and out of the tunnel. In the Priest Work Area West, a plywood bulkhead would be necessary at the existing Priest Portal to facilitate ventilation. A portal security guard would be housed in a guard shack in the Priest Work Area West. Priest Work Area East is generally on higher ground and would be used primarily for shift worker parking, light plants, and general storage. Similar to previous work in the area, temporary staging and work activities would be restricted to dry areas, and no work would occur in the water. Best management practices (e.g., use of oil containment barrier) would be installed in the water in the immediate vicinity of the existing Priest Portal to protect water quality.

4 Vegetation management activities associated with staging areas include tree and vegetation removal within construction clearing limits, roadside clearing and maintenance, and removal of hazard trees.

5 Rock scaling is generally defined as the removal of loose rock from slopes to remove a rockfall hazard. Scaling would require horizontal "excavation" into the face of a slope for a distance of 1 to 4 feet. "Excavation" could also involve removal of trees supported by soils/loose rocks on the slopes.

through A-4.18. As shown in Table A-4, the majority of the estimated 592 trees to be removed are in the Priest Reservoir area (about 384 trees) with smaller, but sizable, numbers along the access roads to the Mountain Tunnel adits. Most of the trees to be removed are oaks (64 percent), except along the access roads, where other species, primarily conifers, are interspersed with the oaks.

Table A-4
Estimated Tree Removal for the Proposed Project by Improvement, Construction, and Staging Area

Work Area	Number of Oaks	Number of Conifers[1]	Total Number of Trees
Early Intake Area			
EI-S3	5	0	5
South Fork Area			
Access Road	12	45	57
Adit 5/6 Area			
A5/6-S2	0	1	1
Access Road	13	107	120
Adit 8/9 Area			
A8/9-S1	2	1	3
A8/9-S4	0	4	4
Access Road	6	12	18
Priest Reservoir Area			
PP-S6	263	3	266
PP-S9	1	0	1
PP-S15	23	11	34
Rickson Road	52	31	83
Totals	**377**	**215**	**592**

Source: Compiled by AECOM and MJA, 2019.

1 The inventories of non-oak trees were not species-specific, but the trees are predominantly conifers; all non-oak trees have been counted as conifers.

Where excavation is proposed as part of the project in the Priest Reservoir area, trees could be mechanically removed using heavy, ground-based equipment (e.g., a bulldozer mounted with a tree cutting blade). Otherwise, manual removal (e.g., a gas-powered chainsaw) would be employed, in which case trees would be cut to the stump to avoid ground disturbance (and movement of soil). Tracked and rubber-tired aerial lifts or a crane truck may be used to reach taller trees for cutting. The type of equipment and methodology used for tree removal would depend on vegetation removal needs, operational feasibility, safety, and cost efficiency.

Trees would also be removed within steep terrain upslope of roadway improvement areas or staging areas for safety purposes (i.e., in case construction activities or weather destabilize their roots over the duration of the project, or where 30 percent or more of a tree's root zone would be removed and/or exposed by excavation or rock scaling). Removal of trees along steep slopes and at staging areas where excavation is not proposed would be done manually, as described above.

Hazard trees on steep, unstable slopes outside of excavation areas but sufficiently close to improvement, construction, and staging areas that may pose a safety risk (i.e., where 50 percent or more of the trees roots are exposed from natural erosion features or where the lean of the tree, decay, or defect or any combination of these factors pose a risk to personnel safety) may also be removed as overhead hazards. Dead trees or dead portions of trees in close proximity may also be removed or correctively pruned.

All removed trees would be cut to standard-length logs (8 to 33 feet) and moved to nearby staging areas (e.g., Adit 5/6-S1, Adit 8/9-S3, Adit 8/9-S5, Adit 8/9-S6, Priest staging areas) for temporary storage and to allow for U.S. Forest Service permitted public collection and SFPUC worker collection in SFPUC-controlled access areas. The hauling of trees for disposal at a green-waste facility may occur as an alternative to provision of logs to the public and SFPUC workers. Other means of disposing the felled trees could include burning and chipping, although the preferred method would be to allow the public and SFPUC workers to collect the wood for their personal use, and the SFPUC would not permit the burning of trees on city-owned lands or city-managed rights-of way.

For mature oak trees greater than 14 inches in diameter and all blue oak (*Quercus kelloggii*) greater than 6 inches in diameter at breast height immediately adjacent to work areas that would not be removed, SFPUC would install protective measures such as temporary fencing (e.g., orange barrier fencing, boulder barriers, or exclusion fencing if appropriate) around the driplines prior to initiating construction, to prevent encroachment by heavy equipment during construction. The fencing would be continuously maintained until all construction activities near the trees are completed. In addition, any necessary tree pruning would be completed by either a certified arborist or by the contractor under the supervision of either an International Society of Arboriculture-qualified arborist, certified arborist, American Society of Consulting Arborists consulting arborist, or a qualified horticulturist. All tree-pruning work would adhere to the "Pruning Guidelines" adopted by the California Department of Forestry and Fire Protection.

A.6.3 Construction Equipment and Controlled Detonation

Construction equipment that would be used for the majority of project improvements includes:

- Excavators
- Front end loaders (track and wheeled)
- Dozers/graders
- Cranes
- Dump trucks
- Multi-passenger all-terrain tunnel utility vehicles
- Drilling equipment
- Concreting equipment for shotcreting, grouting, and pouring (grout plant)
- Air and electric power tools
- Compressors
- Generators
- Water pumps
- Water treatment facilities
- Water trucks

In addition, specialized equipment would be required for specific construction activities, as summarized in the following sections.

Shaft, Adit, and Portal Excavation Equipment

Shaft, adit, and portal excavation would primarily involve drilling and controlled detonation. Equipment required for these activities would include bobcat loaders, wheel loaders, excavators, 30-ton to 225-ton hydraulic cranes, haul trucks (small and large), a drill jumbo, an air-powered track drill, shotcrete pump(s), compressors, generators, lighting, pumps, and ventilation fans. In the Priest Portal area, a rock crushing plant would be used to break down larger rocks and debris for disposal at PP-S6 and reuse along roads. In the Big Creek Shaft and Second Garrote areas, the emergency generators for off-road construction equipment would be sited to avoid impacts to nearby residences: at Big Creek, the generator would be in Staging Area BC-S2, at least 170 feet from the water tank; at Second Garrote, the generator would be in Staging Area SF-S1, at least 100 feet from the water tank.

In-Tunnel Repair Equipment

In-tunnel repair equipment would mainly include air and power tools, compressors, generators, tunnel utility vehicles, lighting, submersible pumps, and ventilation fans. The air and power tools used for demolition generally would include a pressure washer, chipping hammers, spaders, jackleg drills, and a hammer drill. A shotcrete pump would be needed for shotcrete repairs. Grouting would require grout-mixing machines, grout pumps, silos for storing cement and aggregate, water trucks, and ancillary equipment. Invert paving in the upstream portion of the tunnel would require equipment similar to that listed above, in addition to a high-pressure concrete pump for long-distance pumping.

Access Road Equipment

Access road work would require large and small excavators, wheel loaders, dozers, graders, compactors, haul trucks (small and large), a drill jumbo, an air-powered track drill, shotcrete pumps, and compressors. Where paving is to occur, an asphalt paver would be needed. The number of each type of equipment would depend on the contractor’s schedule/overlapping work.

Controlled Detonation

Controlled detonation for rock excavation would be required for construction of both surface and underground components (Early Intake Adit Improvements; South Fork Siphon extension; Priest Portal, adit, and flow control facility; and road improvements). Rock excavation would consist of the following steps:

- Drilling blast holes into the rock using simple drilling equipment (e.g., jack legs with air compressors or a small drill rig)
- Manually load explosives into the holes
- Initiate controlled detonation to fracture the rock
- Remove loose rock using pry-bars
- Clear material (either rock or concrete) from the invert using mechanical equipment (e.g., skip steer)

This process would be repeated until the individual tunnel, shaft, pad, or road cut is completed.

The number of controlled detonations would vary by location and component. Rock excavation would occur during the daytime hours for all sites except along Adit 8/9 Access Road. The underground work inside the existing tunnel or new tunnel-related components at the Priest Reservoir and South Fork areas would occur continuously over the 24-hour period. Table A-5 shows the number of controlled detonations that could occur for each component. Controlled detonations would be completed in compliance with federal, state, and local requirements and would include blast curtains in public areas (e.g., along U.S. Forest Service roads) to ensure public safety downslope of road areas). During controlled detonation events along Forest Service Road 1N10/Lumsden Road, vehicular traffic could be restricted for short periods (approximately two to three hours). The project construction specification would require preparation and implementation of a blasting safety plan(s) by the contractor. The plan(s) would address the proper handling, transporting, storing, securing, and monitoring of blasting supplies; warnings to be implemented prior to and during blasting operations; and procedures for safety prior to, during, and after blasting operations.

A.6.4 Site Access

Primary Access Route to Improvement, Construction, and Staging Areas

Highway 120 is the main highway leading to all construction sites. It would be used as a haul route for materials supplies and spoils disposal, movement of materials and supplies between staging areas, and worker travel. Access roads to each project component are detailed in Section A.4, above.

Access to South Fork Crossing Area

Construction workers and small haul trucks would access the South Fork area from Highway 120 onto Old Big Oak Flat Road, against the one-way traffic for an approximately 300-foot segment of Old Big Oak Flat Road between South Fork Access Road and Staging Areas SF-S3 and SF-S4. Large equipment/ material delivery (e.g., crane) would follow the normal flow of traffic around Rainbow Pool, and deliveries would be completed before 8 a.m., in coordination with the U.S. Forest Service. Traffic control (e.g., flaggers, cones, and signage) would be implemented near the Old Big Oak Flat Road/South Fork Access Road intersection and at the end of the one-way road south of the staging areas (SF-S3 and SF-S4) during the Rainbow Pool open season (April 15 through December 15), to reduce conflicts with recreationists and non-construction-related vehicles. On holidays, and over three-day weekends between April 15 and October 31, SFPUC would restrict work and avoid these days, including the Friday before if the holiday falls on a Monday.

In accordance with its discussions with the U.S. Forest Service, the SFPUC would also provide advance notice of construction activities, so that the U.S. Forest Service can post notices on its website to alert recreationist of upcoming construction work in the area.

During construction of South Fork components, public access would be restricted to ensure safety. Public access would be restricted by signage and controlled by existing construction staff at the site.

Ice-controlling measures, such as sanding or salting of the roadway surface, are also anticipated to be necessary for South Fork Access Road during winter months.

Due to the slope of the road and potential for unsafe driving conditions for large delivery trucks on the South Fork Access Road, as well as the weight of the steel pipe, helicopters would be used to deliver construction material at the South Fork Siphon. Helicopter flights would occur for approximately six days total during the months of September through December. The deliveries would be performed without helicopter landings at the work site.

Table A-5
Planned Controlled Detonations[1]

Location	Above-Ground	Below-Ground	Anticipated Number of Controlled Detonations per Day[2]	Number of Allowed Controlled Detonations per Day[3]	Estimated Total Number of Blasts[4]
Early Intake Area	X		1	3	1
South Fork Area					
South Fork Shaft		X	2	10	20
South Fork Siphon		X	3	10	370
South Fork Access Road	X		5	10	15 to 25
Forest Service Road 1S01/Adit 5/6 Access Road	X		5	10	50 to 75
Forest Service Road 1N10 (Lumsden Road)/ Adit 8/9 Access Road	X		2	10	30 to 50
Priest Reservoir Area					
Flow Control Facility Pad	X		2	2	20 to 30
Priest Portal	X		2	2	30 to 40
Flow Control Facility Shaft		X	2	8	65[5]
Flow Control Facility Bypass Tunnels		X	2 to 4	20	50
Priest Adit		X	3	10	200
Priest Bulkhead		X	2	10	10
Priest Adit Rock Trap		X	2	14	10
Rickson Road	X		2 to 4	10	50 to 70

Notes:

1 The number of controlled detonations shown reflects the worst case scenario and is used in the air quality analysis to provide conservative air quality results. The actual number of detonations would be less than shown in the table.

2 Based on work shift hours and typical practice. The number of controlled detonations in a day is dictated by the ability to drill holes and clear materials after a detonation.

3 As determined based on air quality standards.

4 Based on estimated rock strengths and pounds of explosives for a controlled detonation. The actual maximum number of blasts may vary with rock strength, means, and methods (e.g., quantity of material to be displaced per shift), and restrictions on noise and vibrations.

5 Assumes that the shaft is blasted in half benches. If the shaft is blasted with a full bench, the total number would be halved.

Access to Adit 8/9 Area

Forest Service Road 1N10/Lumsden Road, which is part of the Adit 8/9 Access Road, is publicly accessible and used by recreationists and commercial rafting companies for activities on the Tuolumne River. To minimize impacts on public use of this road during the construction period, the SFPUC coordinated with the U.S. Forest Service to determine a road closure arrangement that would be acceptable to complete the required construction activities while allowing the U.S. Forest Service permittees to use the road during peak recreation periods. As a result of these discussions, the Lumsden Road improvements would be conducted outside the daytime hours during the primary rafting season (May 1 through Labor Day in September). Specifically, in the first year of construction during the primary rafting season, construction work along Lumsden Road would be restricted to between 7 p.m. and 7 a.m. daily from Sunday evening to Friday morning. Construction work on the spur road to Adit 8/9 would still occur during the day or night. During the rafting season, if a holiday falls on a Monday, then SFPUC would also restrict work until 7 p.m. on Monday. After Labor Day through the end of April in the second year of construction, Lumsden Road would be fully closed during construction. Lumsden Road would be fully open to the public during the May 1 through Labor Day period of the second year of construction. Full closure of Lumsden Road may be required after Labor Day through the end of November in the second year of construction to complete work activities if weather delays occur during the prior work periods. To allow access by U.S. Forest Service permittees (as approved by the U.S. Forest Service) on the way to Tuolumne River in April of the second year of construction, road improvements on Forest Service Road 1S01/ Adit 5/6 Access Road would cease for the month so that it could be used as an alternative route to Forest Service Road 1N10/Lumsden Road. During road-closure periods, if emergency access is needed on the roadway, it would be provided as required by contract specifications. In addition, during controlled detonation events along Forest Service Road 1N10/Lumsden Road, vehicular traffic could be restricted for short periods (approximately two to three hours).

In accordance with discussions with the U.S. Forest Service, SFPUC would also provide advance notice of construction activities, so that the U.S. Forest Service can post notices on its website to alert recreationist of upcoming construction work in the area.

Access to Adit 5/6 Area

Construction of the Adit 5/6 Access Road would require full closure of the road to accommodate proposed activities except during April of the first and second years of construction. During that time, the road would be opened for U.S. Forest Service permittees only, because the primary access to the river (Forest Service Road 1N10/Lumsden Road) would be closed. Although Forest Service Road 1S01 is gated and vehicular access is restricted, recreationists currently can use the road at any time. During construction activities, public access would be restricted by signage and existing construction staff at the site to ensure public safety.

A.6.5 Project Workforce, Work Hours, and Construction Vehicle Parking

The estimated project workforce for each activity is provided in Table A-2. Based on the number of workers required for each activity and the schedule for overlapping construction activities, the total personnel working concurrently on any one day at any one time during the full construction duration would range between 30 and 115 workers.

Construction activities outside of planned tunnel shutdowns would typically be completed in 8- to 10-hour workdays, Monday through Friday. Nighttime construction would occur along Forest Service Road 1N10 (Lumsden Road)/Adit 8/9 Access Road, as described in Section A.6.4. In addition, some night work during non-outages in the Priest area may be needed to meet schedule requirements. Because of the time-critical nature of the work occurring during a tunnel shutdown, shutdown and in-tunnel construction activities would be completed in 24-hour workdays (typically two 10- to 12-hour shifts), seven days of the week. To support night work, night lighting would be required for the main staging areas at Early Intake (EI-S3), South Fork (SF-S7 and SF-S8), Adit 5/6 (A5/6-S2), Adit 8/9 (A8/9-S1), and Priest Portal (PP-S6, PP-S13, and PP-S15), BG-S1, and SG-S1, and along Forest Service Road 1N10 (Lumsden Road)/Adit 8/9 Access Road. Night lighting would also likely be required at other locations that support 24-hour construction, at other Priest and South Fork staging areas, A5/6-S1, A8/9-S3, A8/9-S4, and A8/9-S6. Lighting would be shielded and directed away from public vantage locations.

All construction vehicles would park at one of the staging areas specified for the project.

A.6.6 Temporary Power Supply

Most equipment, including ventilation equipment and compressors, would be powered using portable diesel generators placed at the staging areas, due to their remote location. Existing electrical facilities may be used for powering office trailers and other incidental power needs at staging areas at Early Intake, Big Creek Shaft, Second Garrote Shaft, and Priest Portal. Locations being used actively for either work staging or ventilation would have an anticipated total power load of approximately 1,100 kilovolt-amperes for any given activity, which may be powered entirely by diesel generators.

A.6.7 Temporary Grout Plants

Containerized grout plants (grout pumps enclosed in shipping containers) would be sited at the Big Creek Shaft staging area, BC-S2, and Second Garrote staging area, SG-S1, for pumping grout into the tunnel. In general, usage would be confined to planned shutdown periods. Because grouting is anticipated to span two planned shutdowns, the grout plants may remain in place between the shutdown periods.

A.6.8 Excavation, Stockpiling, and Disposal of Spoils

Excavation would take place for certain underground activities, including the new Priest Portal and Adit, the flow control facility shaft and structure, the new South Fork access shaft and the South Fork Siphon extension bypass tunnel, and removal of rock debris from the tunnel invert. No soil or rock material would be placed in the tunnel, but there would be backfill grouting and placement of concrete in certain locations in the tunnel. The total excavation volume, accounting for a bulking factor of 60 percent,[27] from underground activities would be approximately 47,210 cubic yards (Table A-6).

Excavation and fill would occur for road improvements, portal development, and minor activities such as clearing, and fencing or pole installation. The total excavation volume for surface improvements is approximately 101,650 cubic yards (Table A-7).

[27] Bulking is defined as the increase in volume of material when it is excavated from its in situ location. The change in volume is called "bulking" and the measure of the change is the "bulking factor." Soil expands after excavation because of an increase in voids or spaces between individual soil particles. Thus, once excavated, soil expands. For the purposes of this analysis, it is assumed that soil expands by 60 percent.

Table A-6
Approximate Underground Excavation Quantities

General Location	Approximate Excavation Volume (cy)	Reason
Unlined Tunnel	500	Debris removal
Lined Tunnel	200	Tunnel repair demolition
Early Intake Adit	<10	Access bulkhead
South Fork Siphon Extension	8,100	Extension and shaft
Flow Control Facility	23,000	Access shaft/valve chamber
	1,400	Tunneling for piping
Priest Adit	14,000	Adit excavation
Total	**47,210**	

Source: McMillen Jacobs Associates, 2018.
Note:
cy = cubic yards

Table A-7
Approximate Aboveground Excavation/Fill Quantities

General Location	Staging/Work Area (if applicable)	Approximate Excavation Volume (cy)	Fill Volume (cy)	Reason[1]
Early Intake	EI-S3	<100	N/A	General
South Fork	SF-S6 and SF-S7	<100	N/A	General
	Roadways	4,100	1,200	Road improvements
Adit 5/6	A5/6-S2	500	200	Widening
	Roadways	12,200	9,300	Widening and curve improvements
Adit 8/9	A8/9-S1	50	N/A	Widening
	A8/9-S4	4,000	N/A	Widening
	Roadways	2,900	2,400	Widening and curve improvements
Second Garrote	SG-S1(shed footings/fence)	<100	1,000	General
Priest Reservoir	Roadways	12,100	3,000	Widening and curve improvements
	PP-S6	45,000	8,000	Portal developments
	PP-S13	500	500	General
	PP-S15	20,000	1,200	Shaft surface work
Total		**101,650**	**26,800**	

Source: McMillen Jacobs Associates, 2018.
Notes:
1 General is defined as clearing and grubbing. This table identifies a conservative estimate, because not all locations would be cleared and grubbed.
cy = cubic yards
N/A = not applicable

Where possible, spoils generated by project excavations would be used as fill for project improvements. Importing fill is not anticipated except for the gravel/crushed rock/aggregate base needed for roadway improvements or paving. The total excavation quantity for all project activities would be 148,860 cubic yards (including a bulking factor of 40 to 60 percent depending on rock or soil excavation), and the total fill volume would be 26,800 cubic yards. The net disposal amount of spoils after reuse is expected to be approximately 122,060 cubic yards, which includes a bulking factor of 40 to 60 percent. This excavation volume would decrease due to natural compaction once it is conveyed to the disposal site; the final compacted volume would be approximately 90,000 to 97,000 cubic yards.

Spoils from all project sites would be transported to a proposed disposal area at PP-S6 near Priest Reservoir via 16-cubic-yard or similar size trucks. The spoils generated at Early Intake would be transported via 16-cubic-yard trucks. The spoils transported along the adit roads (Adit 5/6, Adit 8/9, and South Fork) would use smaller 3-cubic-yard trucks, because the roads are not capable of accommodating large trucks. Near the Highway 120 intersections, the 3-cubic-yard trucks would transfer spoils to larger trucks that would haul the spoils along Highway 120 to the PP-S6 disposal area. Spoils generated at Priest would be transported to the rock-crushing plant and disposal area at PP-S6 via 8-cubic-yard, larger trucks, or conveyor belts. Truck trips for spoils disposal are provided in Table A-8 and truck trips for imported materials delivery are provided in Table A-9. The maximum number of 16-cubic-yard spoils disposal truck trips per day on any one day at any one time during the total construction duration would be approximately 14. In addition, if the removed trees must be hauled away, then an estimated 195 8-cubic-yard truck trips would be needed to remove the trees from the Priest Reservoir area and an additional 440 3-cubic-yard truck trips would be needed to remove the trees from the other staging areas and access roads. The number of truck trips would be reduced if these loads are transferred to larger 16-cubic-yard trucks for hauling to the disposal facilities.

All of the project spoils would be disposed in PP-S6, with the exception of any spoils that become contaminated during construction such as due to spills or test as contaminated (e.g., isolated higher lead levels were detected near Adit 5/6 portal). Areas of anticipated contaminated soils would be segregated and tested. If results show that they are contaminated, they would be transported to and disposed of at a permitted landfill for contaminated wastes in accordance with local, state, and/or federal requirements. The primary disposal site at PP-S6 encompasses a large area with a total capacity to accommodate a final compacted volume of approximately 100,000 cubic yards. The site is on moderately sloping topography and would require excavation to create a stable base for spoils disposal. Access to the area would be directly available from Rickson Road. A 20,000–square-foot rock-crushing plant, with a capacity to process 20 tons per hour, would be sited in the eastern section of the site, and disposal materials from this facility would be transported to the other sections, particularly the southern section, via a conveyor rather than by trucks along Rickson Road. Spoils would be placed and compacted in layers, and the side slopes of the fill embankment would be a maximum slope ratio (horizontal distance to vertical distance) of 2 to 1.

A.6.9 Water Management

Significant groundwater infiltration along the length of the Mountain Tunnel is anticipated during construction activities. Where possible, clean groundwater would be diverted out of the tunnel before it mixes with construction water. In this way, the volume of construction water to be collected and treated can be reduced.

Table A-8
Estimated Truck Trips for Spoils Disposal

General Location	Activities	Duration (months)	3 cy Small/ Short Haul Total Trips	3 cy Small/Short Haul Trips Per Day	8 cy (10-Wheel Dump Truck) Total Trips	8 cy (10-Wheel Dump Truck) Trips Per Day	16 cy Trucks Total Trips	16 cy Trucks Trips Per Day
Early Intake	Staging Area Preparation	3	N/A	N/A	N/A	N/A	6	1
	Bulkhead Demolition	2					1	0 to 1
South Fork	Shaft/Extension Excavation	8 to 14	2,700	10 to 15	N/A	N/A	506	2
	Staging Area Preparation	2	67	2			1	0 to 1
	Roadways	8	2,000	11			375	2
Adit 5/6	Roadways and Staging Area Preparation	12	7,167	27	N/A	N/A	1,344	5
Adit 8/9	Roadways and Staging Area Preparation	8	3,400	19	N/A	N/A	638	3
Second Garrote	Roadway Preparation	1	N/A	N/A	N/A	N/A	63	3
Priest Reservoir	Portal, Shaft, and Adit Excavation	14 to 17	N/A	N/A	14,675	39 to 48	N/A	N/A
	Roadways	11			1,888	8		

Source: McMillen Jacobs Associates, 2018.

Notes:

cy = cubic yards
N/A = not applicable

Table A-9
Estimated Truck Trips for Imported Materials Delivery

General Location	Activities	Duration (months)	Total Large Truck Deliveries	Small Load Intermediate Trucks/Day (Adit Roads)
Early Intake	Bulkhead Concrete Miscellaneous Materials	3 14	3 616	N/A
South Fork	Miscellaneous Materials	8 to 14	176	3
Adit 5/6	Drill and Blast Supplies for Roadways Shotcrete (for repairs) Water (for repairs) Miscellaneous Materials	6 6 6 21	6 5 3 462	6 3 3 3
Adit 8/9	Drill and Blast Supplies for Roadways Shotcrete (for repairs) Water (for repairs) Miscellaneous Materials	3.5 6 6 16	7 19 12 896	6 3 3 6
Big Creek	Cement (for grouting) Water (for grouting) Miscellaneous Materials	6 6 6	82 59 264	N/A
Second Garrote	Cement (for grouting) Water (for grouting) Miscellaneous Materials	6 6 6	82 59 264	N/A
Priest Reservoir	Drill and Blast Supplies for Portal, Adit, Shaft Concrete for Shaft, Adit, Plug Steel for Shaft, Adit, Plug Valves and Pipe Cellular Grout Shotcrete (for repairs) Water (for repairs) Cement (for grouting) Water (for grouting) Miscellaneous Materials	11 11 2 2 3 6 6 6 6 66 9	458 451 11 95 147 71 47 82 59 2904 504	N/A

Source: McMillen Jacobs Associates, 2018.

Note:

N/A = not applicable

Raw water entering the tunnel through infiltration or through upstream gates[28] is expected to be clean (uncontaminated by construction material or activities). Potential raw water discharge locations, depending on upstream activities, include the eastern access point at South Fork Crossing, Adit 5/6, and Adit 8/9. Adits 5/6 and 8/9 each have blow-off valves to discharge raw water. Raw water from South Fork Siphon would need to be pumped by a sump pump out of the eastern access point at South Fork Crossing and discharged back into the river (over existing bare rock, so that no erosion of the ground surface would occur at this location). No additional erosion control best management practices are needed at Adits 5/6 and 8/9, because the raw water would be discharged from the adits through existing discharge piping into existing dissipation pads previously installed to prevent erosion.

Any water that comes into contact with construction activities or is produced by construction activities (e.g., excavation) is likely to have elevated pH levels and contain dissolved and suspended solids (from sediment and construction materials), and also may contain hydrocarbons. This construction water in the tunnel would mix with groundwater that seeps into the tunnel from the surrounding rock mass. Additionally, natural biofilm may also be present in the tunnel water.

Construction water (i.e., all water that has come into contact with construction activities or materials) may be pumped to and collected at small, temporary treatment facilities along the tunnel (Early Intake, South Fork, Adit 5/6, Adit 8/9) if water volumes are minimal. Treatment facilities (e.g., baker tanks) would be located on nearby staging areas or work areas, depending on space constraints. The precise locations of the discharge points at Early Intake, South Fork, Adit 5/6, and Adit 8/9 have not yet been determined, and would be based on the locations of the treatment facilities. Discharge points would be designed to incorporate best management practices and to ensure compliance with discharge permit requirements.

Larger volumes of construction water would flow downstream inside the tunnel, be collected at the new Priest Portal/Adit, and be pumped to and treated at the main temporary water treatment plant to be installed at either Staging Area PP-S13 or Staging Area PP-S6. The main water treatment system, designed to treat 1,500 gallons per minute of water, would consist of feed points for chemical treatment, a weir tank, feed pumps, and filters to screen and settle material (particle bag, sand, and oil bag filters). Once the construction water has been treated to meet applicable water quality requirements, the treated water would be discharged to nearby waters (i.e., in the culvert/riprapped area of an existing unnamed drainage downstream of the dam that currently conveys seepage water) via a temporary, overland pipeline. The contractor would be required to continuously monitor the Priest water treatment plant during its operation to ensure treatment corrections to maintain compliance with discharge permit requirements (e.g., adding more flocculants to treat increased turbidity).

All surface water originating from within or entering the limits of the staging areas would be managed according to SFPUC's Standard Construction Measures (Section A.6.11).

A.6.10 Surface Restoration and Revegetation

With the exception of the Priest Reservoir area, Second Garrote area, and other road improvement areas where permanent changes to the existing ground surface and vegetation would occur, all staging areas would be restored to their general pre-existing conditions. This would involve regrading each site to its approximate pre-construction contours and restoring the prior surface of the area, such as by covering it with gravel or asphalt, or seeding to restore vegetation.

The areas at Priest Reservoir that would not be restored to pre-existing conditions are the new portal, adit, and spoils disposal site (PP-S6, where approximately 90,000 to 97,000 cubic yards of material would

[28] At Early Intake Diversion Dam.

be permanently stored); the eastern half of Rickson Road; and the flow control facility at PP-S15. Following completion of construction, the appearance of the portal and adit area would be a large cut slope into the hillside including a new flat area accommodating the entrance to the new adit (portal). The appearance of the disposal area, which is north and east of the new cut slope at Staging Area PP-S6, would be similar to that of a rock embankment, which consists of various size rocks on a slope. Although the overall elevation of the spoils disposal site would increase over existing conditions, the side slopes of the fill embankment would be no more than 2:1. The new flow control facility would require the cutting of an existing slope to accommodate the top of a new shaft structure, a new building, and concrete pads for ancillary facilities. For the four shotcrete-covered wall cuts created for building pads for the Priest Portal, Priest Adit, and the flow control facility, the SFPUC would stain the shotcrete to match the earth tones of the surrounding hillsides. In addition, the area along the new power line and around each of the new support poles on the northern and eastern sides of the reservoir would be cleared for maintenance access and to reduce fire risks.

Additionally, the area at the Second Garrote Shaft would not be restored to pre-existing conditions due to the installation of the nonpermeable membrane, security fence, and surface drainage improvements (minor grading to redirect water away from the shaft) that would be installed to reduce stormwater and groundwater infiltration in this area.

A.6.11 SFPUC Standard Construction Measures and Other Avoidance/Minimization Measures Included as Part of the Project

SFPUC Standard Construction Measures

The SFPUC has adopted *standard construction measures* to be implemented during the construction of every SFPUC project and included in all SFPUC construction contracts.[29] The objective of these measures is to avoid and reduce construction-related impacts on the environment. Because they apply to all SFPUC projects, including projects located within San Francisco and other urban areas and projects located in rural and natural areas such as SFPUC watershed lands, the measures are necessarily broad. As such, the measures may be tailored to fit specific projects and some measures may not apply in whole or in part to all projects. The applicability of the standard construction measures to the proposed project is considered below under the related resource topics.

1. SEISMIC AND GEOTECHNICAL STUDIES: All projects will prepare a characterization of the soil types and potential for liquefaction, subsidence, landslide, fault displacement, and other geological hazards at the project site and will be engineered and designed as necessary to minimize risks to safety and reliability due to such hazards. As necessary, geotechnical investigations will be performed.

2. AIR QUALITY: All projects within city limits will comply with the Construction Dust Control Ordinance. All projects outside the city will comply with applicable local and state dust control regulations. All projects within city limits will comply with the Clean Construction Ordinance. Projects outside city limits will comply with San Francisco or other applicable thresholds for health risks. All projects, both within and outside of city limits, will comply with either San Francisco or other applicable thresholds for construction criteria air pollutants.

[29] SFPUC (San Francisco Public Utilities Commission), 2015. SFPUC Standard Construction Measures. Harlan L. Kelly, Jr., General Manager, July 1.

To meet air quality thresholds, all projects (as necessary) will implement air quality controls to be tailored to the project, such as using high tier engines, Verified Diesel Emissions Control Strategies such as diesel particulate filters, customized construction schedules and procedures, and low emissions fuel.

3. WATER QUALITY: All projects will implement erosion and sedimentation controls to be tailored to the project site such as fiber rolls and/or gravel bags around storm drain inlets, installation of silt fences, and other such measures sufficient to prevent discharges of sediment and other pollutants to storm drains and all surface waterways, such as San Francisco Bay, the Pacific Ocean, water supply reservoirs, wetlands, swales, and streams. As required based on project location and size, a Stormwater Control Plan (in most areas of San Francisco) or a Stormwater Pollution Prevention Plan (outside of San Francisco and in certain areas of San Francisco) will be prepared. If uncontaminated groundwater is encountered during excavation activities, it will be discharged in compliance with applicable water quality standards and discharge permit requirements.

4. TRAFFIC: All projects will implement traffic control measures sufficient to maintain traffic and pedestrian circulation on streets affected by construction of the project. Traffic control measures may include, but not be limited to, flaggers and/or construction warning signage of work ahead; scheduling truck trips during non-peak hours to the extent feasible; maintaining access to driveways, private roads, and off-street commercial loading facilities by using steel trench plates or other such method; and coordination with local emergency responders to maintain emergency access. For projects in San Francisco, the measures will also, at a minimum, be consistent with the requirements of San Francisco Municipal Transportation Agency's Blue Book. Any temporary rerouting of transit vehicles or relocation of transit facilities would be coordinated with the applicable transit agency, such as San Francisco Municipal Transportation Agency's Muni Operations in San Francisco. All projects will obtain encroachment permits from the applicable jurisdiction for work in public roadways.

5. NOISE: All projects will comply with local noise ordinances regulating construction noise. The SFPUC shall undertake measures to minimize noise disruption to nearby neighbors and sensitive receptors during construction. These efforts could include using best available noise control technologies on equipment (i.e., mufflers, ducts, and acoustically attenuating shields), locating stationary noise sources (i.e., pumps and generators) away from sensitive receptors, erecting temporary noise barriers, and other such measures.

6. HAZARDOUS MATERIALS: Where there is reason to believe that site soil or groundwater that will be disturbed may contain hazardous materials, the SFPUC shall undertake an assessment of the site in accordance with any applicable local requirements (e.g., Maher Ordinance) or using reasonable commercial standards (e.g., phase I and phase II assessments, as needed). If hazardous materials will be disturbed, the SFPUC shall prepare a plan and implement the plan for treating, containing, or removing the hazardous materials in accordance with any applicable local, state, and federal regulations to avoid any adverse exposure to the material during and after construction. In addition, any unidentified hazardous materials encountered during construction likewise will be characterized and appropriately treated, contained, or removed to avoid any adverse exposure. Measures will also be implemented to prevent the release of hazardous materials used during construction, such as storing them pursuant to manufacturer recommendation, maintaining spill kits onsite, and containing any spills that occur to the extent safe and feasible followed by collection and disposal in accordance with applicable laws. SFPUC will report spills of reportable quantity to applicable agencies (e.g., the Governor's Office of Emergency Services).

7. BIOLOGICAL RESOURCES: All project sites and the immediately surrounding area will be screened to determine whether biological resources may be affected by construction. A qualified biologist will also

carry out a survey of the project site, as appropriate, to note the general resources and identify whether habitat for special-status species and/or migratory birds are present. In the event further investigation is necessary, the SFPUC will comply with all local, state, and federal requirements for surveys, analysis, and protection of biological resources (e.g., Migratory Bird Treaty Act, federal and state Endangered Species Acts, etc.). If necessary, measures will be implemented to protect biological resources, such as installing wildlife exclusion fencing, establishing work buffer zones, installing bird deterrents, monitoring by a qualified biologist, and other such measures. If tree removal is required, the SFPUC would comply with any applicable tree protection ordinance.

8. VISUAL AND AESTHETIC CONSIDERATIONS. PROJECT SITE: All project sites will be maintained in a clean and orderly state. Construction staging areas will be sited away from public view where possible. Nighttime lighting will be directed away from residential areas and have shields to prevent light spillover effects. Upon project completion, project sites on SFPUC-owned lands will be returned to their general pre-project condition, including regrading of the site and revegetation or repaving of disturbed areas to the extent this is consistent with SFPUC's Integrated Vegetation Management Policy.[30] However, where encroachment has occurred on SFPUC-owned lands, the encroaching features may not be restored if inconsistent with the SFPUC policies applicable to management of its property. Project sites on non-SFPUC land will be restored to their general pre-project condition so that the owner may return them to their prior use, unless otherwise arranged with the property owner.

9. CULTURAL RESOURCES: All projects that will alter a building or structure, produce vibrations, or include soil disturbance will be screened to assess whether cultural resources are or may be present and could be affected, as detailed below.

Archeological Resources. No archeological review is required for a project that will not entail ground disturbance. Projects involving ground disturbance will undergo screening for archeological sensitivity as described below and implement, as applicable, SFPUC's Standard Archeological Measures I (Discovery), II (Monitoring) and III (Testing/Data Recovery). Standard Construction Measure I will be implemented on all projects involving ground disturbance, and Standard Archeological Measures II and III will be implemented based on the screening process described below for projects assessed as having the potential to encounter archeological sites and/or if an archeological discovery occurs during construction.

Projects involving ground disturbance will initially be screened to identify whether there is demonstrable evidence of prior ground disturbance in the project site to the maximum vertical and horizontal extent of the current project's planned disturbance. For projects where prior complete ground disturbance has occurred throughout areas of planned work, SFPUC will provide evidence of the previous disturbance in the Categorical Exemption application and no further archeological screening will be required.

For projects that are on previously undisturbed sites or where the depth/extent of prior ground disturbance cannot be documented, or where the planned project-related ground disturbance will extend beyond the depth/extent of prior ground disturbance, additional screening will be carried out as detailed below. The additional screening will be conducted by the SFPUC's qualified archeologist (defined as

[30] The SFPUC's Integrated Vegetation Management Policy was established to manage vegetation on the transmission, distribution, and collection systems within the SFPUC right-of-way so that it does not pose a threat or hazard to the system's integrity and infrastructure or impede utility maintenance and operations. Another objective of this policy is to reduce and eliminate as much as practicable the use of herbicides on vegetation within the right-of-way and to implement integrated pest management. This policy includes woody vegetation management; annual grass and weed management; segments of the right-of-way that are covered by agricultural deed rights; and segments of the right-of-way that are managed and maintained under a lease or license. Further information concerning this policy can be found here: *https://www.sfwater.org/index.aspx?page=431*.

meeting the Secretary of the Interior's Professional Qualifications Standards [36 CFR 61]) and, if a consultant, selected in consultation with the San Francisco Planning Department's Environmental Review Officer and meeting criteria or specialization required for the resource type as identified by the Environmental Review Officer.

1) The SFPUC's qualified archeologist will conduct an archival review for the project site, including review of Environmental Planning's archeological geographical information system data and/or a records search of the California Historical Resources Information System and other archival sources as appropriate. The qualified archeologist will also conduct an archeological field survey of the project site if, in the archeologist's judgment, this is warranted by site conditions. Based on the results, the archeologist will complete and submit to Environmental Planning a Preliminary Archeological Checklist (version dated 4/2015, to be amended in consultation with the Environmental Review Officer as needed). This checklist will include recommendations for the need for archeological testing, additional research and/or treatment measures consistent with Archeological Measures I, II, and III, to be implemented by the project to protect and/or treat significant archeological resources identified as being present within the site and potentially affected by the project.
2) The Environmental Planning Archeologist (for projects within the city) or the Environmental Review Officer's archeological designee (for projects outside the city) will then conduct a Preliminary Archeological Review of the Preliminary Archeological Checklist and other sources as warranted; concur with the checklist's recommendations; and/or amend the checklist in consultation with the SFPUC archeologist or archeological consultant to require additional research, reports, or treatment measures as warranted based on his/her professional opinion.
3) The SFPUC shall implement the Preliminary Archeological Checklist/Preliminary Archeological Review recommendations prior to and/or during project construction consistent with Standard Archeological Measures I, II, and III, and shall consult with the Environmental Planning Archeologist in selecting an archeological consultant, as needed, to implement these measures.
4) Ground-disturbing activities in archeologically sensitive areas, as identified through the above screening, will not begin until required preconstruction archeological measures of the Preliminary Archeological Checklist/Preliminary Archeological Review (e.g., preparation of an Archeological Monitoring Plan, Archeological Treatment Plan, and/or an Archeological Research Design and Data Recovery Plan) have been implemented.

Project-Specific Avoidance and Minimization Measures

Noxious Weeds. Consistent with SFPUC lands management practices, the following noxious weed controls have been incorporated into the project as best management practices pursuant to U.S. Forest Service guidance and policies on invasive species management.[31,32] Specifically, U.S. Forest Service objectives for managing invasive species include prevention, early detection and rapid response, and control and management. To that end, the spread of invasive nonnative plant species shall be avoided or minimized by implementing the following measures:

- Construction equipment shall arrive at the project clean and free of soil, seed, and plant material, to reduce the likelihood of introducing new weed species.

[31] USDA (United States Department of Agriculture, Forest Service), *Stanislaus National Forest. Forest Plan Direction.* Alpine, Calaveras, Mariposa, and Tuolumne Counties, California, March 2017.
[32] Forest Service Manual 2900, December 5, 2011.

- Certified weed-free imported erosion control materials (or rice straw in upland areas) shall be used exclusively.
- Construction vehicles and equipment shall avoid travel through vegetated areas to the greatest extent possible, such as by staying within the roadway and turnouts (i.e., not driving along road shoulders) and by parking or being staged in designated graveled, dirt, and paved staging areas.
- Ground-disturbing activities in areas infested with noxious weeds shall be avoided to the extent feasible. If ground-disturbing activities must occur in areas infested with noxious weeds, the equipment that is exposed to the weeds shall be washed until free of soil or vegetative material in the infestation zone before moving, and washwater shall not enter a drainage feature or travel outside of the infestation area. If washwater cannot be contained in the infestation zone, silt filter bags, silt fence or straw waddles shall be used to filter washwater at a point of concentrated flow. If washing with water is not feasible and conditions are dry, equipment may be cleaned with high-pressure air, and the blown debris shall be contained in the infestation zone to the extent feasible.
- If there is a lapse in use of any staging areas, the area shall be surveyed and cleared of weeds prior to resuming use. Equipment used to perform this work shall be cleaned before being removed from the project.
- The environmental awareness training program for construction personnel shall include orientation regarding the importance of preventing the spread of invasive weeds.

Environmentally Sensitive Areas. In accordance with SFPUC standard construction measures 1, 7, and 9, above, the SFPUC would implement construction best management practices as part of the project at the locations identified in Table A-10 and Table A-11. These practices would protect known sensitive resources and ensure that construction crews do not inadvertently harm these resources or exacerbate hazardous conditions. The choice of barricades, k-rails, fences, or signage (or combinations of) would be determined by the SFPUC with the advice of qualified professionals (as described above in the SFPUC

Table A-10
Environmentally Sensitive Areas along Project Access Roads

Project Road	Environmentally Sensitive Resource	Station Start[1]	Station Stop[1]
South Fork Crossing Access Road	none	n/a	n/a
Adit 5/6 Access Road	yes	63+00 78+00	70+00 99+00
Adit 8/9 Access Road	none		n/a
Second Garrote Access Road	yes	10+00	37+35
Rickson Road	none		n/a
Northern Access Road off Priest-Coulterville Road	none		n/a
Southern Access Road off Priest-Coulterville Road	none		n/a

Note:

1 The station start/stop refers to the stationing on the 65 percent design drawings for the project, October 2018.

Table A-11
Protection of Environmentally Sensitive Areas at Project Staging and Work Areas

Project Component	Protection Measures Required	Geotextiled and/or Graveled	Boulder Barricades	K-Rails	Fencing	Signage
EI-S1	no					
EI-S2	no					
EI-S3	no					
EI-S4	no					
EI-S7	yes					X
SF-S1	yes					X
SF-S2	yes	X	X			X
SF-S3	no					
SF-S4	yes			X		X
SF-S5	no					
SF-S6	no					
SF-S7	no					
SF-S8	no					
Vent Work Area East	no					
Vent Work Area West	no					
A5/6-S1	yes		X		X	X
A5/6-S2	yes				X	X
A8/9-S1	yes				X	X
A8/9-S3	yes	X	Already in place			X
A8/9-S4	no					
A8/9-S5	no					
A8/9-S6	no					
BC-S2	no					
SG-S1	no					
Priest Portal Work Area	no					
PP-S1	no					
PP-S4	yes					X
PP-S5	yes				X	X
PP-S6	yes				X	X
PP-S7	no					
PP-S8	no					
PP-S9	no					
PP-S13	yes					X
PP-S15	no					
Power Distribution Alignment	no					

standard construction measures) in conjunction with the U.S. Forest Service and with the SFPUC's construction contractor. The choice of barrier type and/or signage will vary depending on the terrain, the type and size of construction equipment, and the size of the environmentally sensitive area. The SFPUC would include these environmentally sensitive areas and the applicable type of avoidance and minimization measures on the project drawings and specifications to ensure that the measures are implemented by the project contractors. In addition, SFPUC construction-compliance staff would be responsible for documenting that all avoidance and minimization efforts have been implemented by the contractor. This documentation would include photographs of the installed measures as well as the date of complete installation and of follow-up inspections to ensure compliance.

The proposed project would involve construction in the Priest Reservoir basin that would alter the landscape and introduce new facilities, as described under Section A.6.10, Surface Restoration and Revegetation. The SFPUC routinely prepares photo-documentation of the project setting for its major capital improvements prior to, during, and after construction, and would also do so for this project. The SFPUC would produce photo-documentation to archivally preserve the setting and condition in the Priest Reservoir basin prior to the start of project construction activities. The photographs would illustrate the overall geographic landscape and setting of the Priest Reservoir basin, the character-defining features of eligible historic resources in the basin and their spatial relationships, and the landforms and visual setting of the staging areas and work areas that would not be restored to their existing conditions. This photo-documentation would be prepared in conformance with the *Secretary of the Interior's Standards and Guidelines for Architectural and Engineering Documentation.* The photo-documentation, along with the project Historic Resources Evaluation Addendum,[33] would be held at the Hetch Hetchy Water and Power Records and Archives.

A.7 Operations and Maintenance

A.7.1 Regional Water System and Mountain Tunnel Operations

Mountain Tunnel Operations

During normal water supply operations, water from Hetch Hetchy Reservoir is conveyed through the 10-mile-long Canyon Power Tunnel to Kirkwood Powerhouse (Figure A-13). The water in Canyon Power Tunnel is used to generate hydropower at Kirkwood Powerhouse. From Kirkwood Powerhouse, the water continues in a closed system from Kirkwood Powerhouse into the Early Intake Bypass Pipeline and then into Mountain Tunnel. Mountain Tunnel conveys water to the Priest Reservoir, which serves as a regulating reservoir for operations of the Mountain Tunnel and Moccasin Powerhouse. From Priest Reservoir, water is conveyed through penstocks[34] for power generation at the Moccasin Powerhouse. The water discharged from Moccasin Powerhouse enters Moccasin Reservoir, which serves as a regulating reservoir for operations of the Foothill Tunnel and the San Joaquin Pipelines, which deliver water to the regional water system. In this *water supply operational mode*, only water destined for delivery to the regional water system customers is diverted from Hetch Hetchy Reservoir to Kirkwood and Moccasin powerhouses.

During the snowmelt runoff period (typically March to July) and during (or anticipating) storm events, water in excess of water supply demand is diverted from Hetch Hetchy Reservoir. This operational mode is used in conjunction with valve operations at the O'Shaughnessy Dam (releases directly to the Tuolumne River below the dam) to manage Hetch Hetchy Reservoir at a safe storage level (or elevation).

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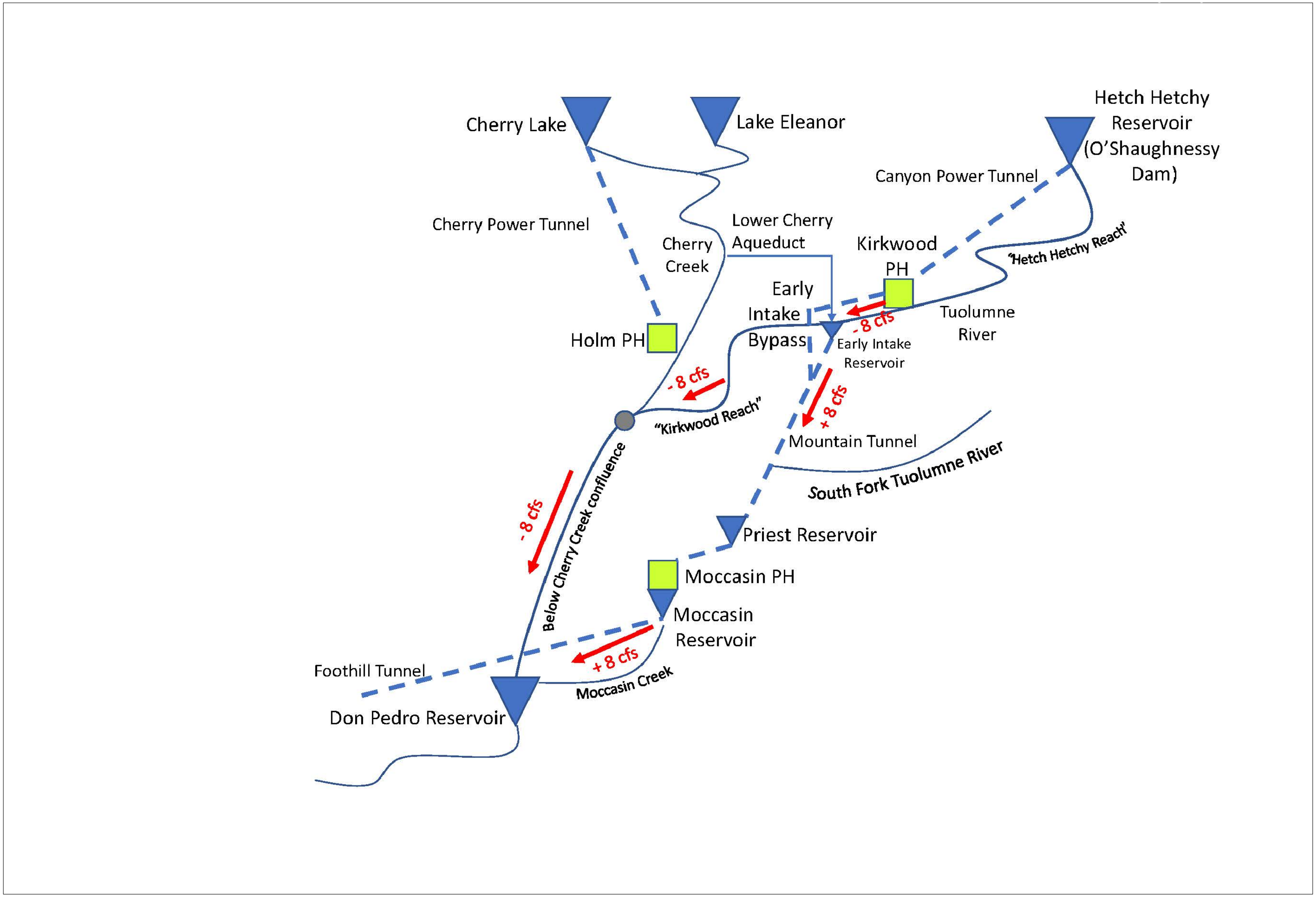
[33] AECOM, *Historic Resources Evaluation Addendum, Mountain Tunnel Improvements Project,* 2019.

[34] A penstock is an enclosed pipe that delivers water to a hydroelectric turbine.



Source: SFPUC, 2019

San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 3/12/2019

FIGURE A-13

Changes to Tuolumne River Flows below Kirkwood Powerhouse from Mountain Tunnel Improvements

In this *reservoir management operational mode*, when flow through Canyon Tunnel and Mountain Tunnel exceeds water supply demand, the excess water is discharged to the Tuolumne River below Kirkwood Powerhouse and below Moccasin Reservoir (Table A-12).

Table A-12
Monthly Flow Volumes (acre-feet) Simulated to Historically Occur Below Kirkwood Powerhouse

Historical Data Set Analyzed (10/1/1970 - 6/30/2017)				
Month	**Mean**	**Minimum**	**Maximum**	**Total Number of Occurrences Mountain Tunnel Capacity Estimated to Have Exceeded Demand and Excess Discharged to the Tuolumne River**
January	14,024	2,380	170,250	9
February	18,397	2,195	76,629	19
March	43,420	2,420	72,301	43
April	43,181	2,373	65,767	42
May	74,819	3,264	362,936	40
June	145,651	4,526	515,860	31
July	55,162	4,531	358,189	19
August	10,308	4,523	100,124	3
September	5,209	3,611	11,337	1
October	4,426	2,162	50,815	1
November	4,488	2,103	40,011	2
December	10,804	2,368	52,979	11

Source: SFPUC, 2019.

The maximum hydraulic flow capacity through the hydrogeneration units at Kirkwood Powerhouse is approximately 1350 cubic feet per second, which exceeds the existing 670-cubic-foot-per-second hydraulic flow capacity of the Mountain Tunnel.[35] When the flow through Kirkwood Powerhouse exceeds the capacity of the Mountain Tunnel, the excess flow (up to 680 cubic feet per second when Kirkwood Powerhouse is operating at capacity) is discharged from the Kirkwood Powerhouse tailrace[36] into the Tuolumne River 1,200 feet upstream of Early Intake Dam. The water remaining in the system continues into the Early Intake Bypass Pipeline and then into Mountain Tunnel, which conveys water to Priest Reservoir and is used again to generate power at Moccasin Powerhouse. Flow through Moccasin Powerhouse that is in excess of water supply demand is released to Moccasin Creek from Moccasin Reservoir and subsequently flows into Don Pedro Reservoir on the Tuolumne River. Currently, there is no physical infrastructure in place that would allow Mountain Tunnel to be "throttled" (control flow in the tunnel). Use of Mountain Tunnel at less than its maximum capacity is generally achieved by reducing the flow to Kirkwood Powerhouse, although operation of Priest Reservoir at a higher elevation can also be used to reduce the hydraulic gradient and slow the flow in the tunnel. Priest Reservoir is operated at

35 McMillen Jacobs Associates and Black & Veatch. 2017. Mountain Tunnel Improvements Project. Revised Table 7.4 from Hydraulic Analysis for Conceptual Improvement Alternatives. August 10.

36 A tailrace is a discharge point for water that has been used to generate hydropower. When the tailrace at Kirkwood Powerhouse is opened, water that has flowed through the hydrogeneration unit can be discharged to the adjacent Tuolumne River.

higher elevations during the summer and winter seasons to provide maximum storage levels and to protect water quality. The reservoir is lowered during the snowmelt runoff period to maximize flow in Mountain Tunnel and power generation at Moccasin Powerhouse. The reservoir may be operated in a daily cycle (gaining and losing elevation) throughout a time period to allow for peaking of power generation to match the peak power demand time periods.

Drinking Water Quality Regulation

The California State Water Resources Control Board has granted the Hetch Hetchy water source a filtration avoidance designation due to its exceptional water quality and effective watershed control program. As a result, the SFPUC is not required to filter water from the Hetch Hetchy Reservoir but must meet all regulatory requirements under the domestic water supply permit issued to the SFPUC and the California Code of Regulations Title 22.[37] The Tuolumne River below the Hetch Hetchy Reservoir does not qualify for this filtration avoidance designation. To comply with the state permit and regulations, water that is conveyed through the Canyon and Mountain Tunnel system must be kept separate and isolated from all other water sources. This means that water discharged into the Tuolumne River from Kirkwood Powerhouse may not subsequently be diverted into the regional water system without losing this filtration avoidance designation.

Mountain Tunnel Operations under Emergency Conditions

The SFPUC has system redundancies in place that ensure the reliability of water delivery, including during emergency operations. One of these redundancies is the ability to divert water directly from the Tuolumne River into the Mountain Tunnel through three head gates at Early Intake Reservoir.[38] Water from Cherry Creek can also be diverted to Early Intake Reservoir via the Lower Cherry Aqueduct. Under normal operating conditions, the Mountain Tunnel head gates at Early Intake Reservoir are closed. In an emergency such as a failure of the Canyon Tunnel or Kirkwood Penstock, the Mountain Tunnel head gates could be opened to supply water from Early Intake Reservoir. This water must be filtered prior to serving customers because it does not qualify for filtration avoidance. This operational configuration cannot meet the regional water system water supply demand for extended periods due to operational restrictions in the SFPUC's Bay Area water supply distribution and treatment system. These restrictions include pumping capacities, treatment plant configurations, and reliability. The project would not change how the system operates under emergency conditions.

Instream Flow Release Requirements on the Tuolumne River

Instream flow release requirements from Hetch Hetchy Reservoir to the Tuolumne River are governed by stipulations approved by the U.S. Fish and Wildlife Service and the U.S. Department of the Interior.[39]

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[37] See 22 CCR §64652.5, Criteria for Avoiding Filtration; and 22 CCR §64665, Watershed Requirements.

[38] "[w]hen Hetch Hetchy Reservoir was originally constructed, water from the face of the dam flowed down the river to Early Intake Reservoir (built in 1924), and from there was diverted to Mountain Tunnel; with the construction of Canyon Power Tunnel and the Early Intake Bypass in the 1960s, the Early Intake Reservoir and Diversion Dam lost much of their functional role in the regional system, and Tuolumne River water flows relatively unimpeded through the spillway adjacent to the diversion dam." San Francisco Planning Department, Final Program Environmental Impact Report for the San Francisco Public Utilities Commission's Water System Improvement Program, October 30, 2008, p. 2-7.

[39] Stipulations 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 (as reported in CCSF 2008).

These stipulations are based on hydrologic year type (wet to normal; dry; or critically dry) and the amount of flow diverted to Canyon Tunnel to generate power at Kirkwood Powerhouse; these stipulations include both minimum instream flow requirements and ramping rates[40] from Hetch Hetchy Reservoir (Table A-13). Any time the flow through the Canyon Tunnel exceeds 920 cubic feet per second, the instream flow release from O'Shaughnessy Dam is required to be increased by an additional 64 cubic feet per second. Required instream flow releases may not be diverted below O'Shaughnessy Dam (i.e., at the Mountain Tunnel head gates in Early Intake Reservoir); the releases must continue to flow down the Tuolumne River, are supplemented by the additional tributary flows, and eventually enter Don Pedro Reservoir. The project would not change the stipulated instream flow release requirements to the Tuolumne River from Hetch Hetchy Reservoir.

Table A-13
Schedule of Average Daily Minimum Required Releases below O'Shaughnessy Dam

	Wet to Normal		Dry		Critically Dry
Month	**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 through 14	100 cfs		80 cfs		75 cfs
September 15 through 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

Source: SFPUC, 2019.

Notes:

[a] Precipitation indicators in inches are cumulative, measured at Hetch Hetchy Reservoir, starting October 1 and the Year Type is defined by the cumulative precipitation (in inches) at the end of the prior month. 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.

[40] Ramping rates are agreed-upon schedules for the timing of flow changes released to rivers to prevent undesirable effects due to rapid changes in flows.

Water Supply and Delivery

The project would not change the amount of Tuolumne River water that is provided to the SFPUC's regional water system customers. As discussed below, the amount of Tuolumne River water that is diverted to the regional water system is controlled by hydrologic conditions and regulatory restrictions and limitations on water supply, and limited by water rights. System operations and the amount of water delivered to customers vary throughout the year based on seasonal demand and operational requirements. The way in which the SFPUC delivers water to the Bay Area is guided by a number of considerations, including local storage of adequate water for emergencies; permitting any necessary shutdowns of portions of the Hetch Hetchy system for maintenance purposes, including the Mountain Tunnel, during the low demand (winter) months; and meeting customer demands, within the limits of the water supply decision (i.e., Resolution No. 08-2000, described below). The overriding operating goal in terms of meeting demand is to ensure that sufficient water is available year-round regardless of hydrologic conditions (i.e., wet, normal or drought year).

The City and County of San Francisco made numerous pre-1914 appropriative water right filings on the Tuolumne River. The water right filings for the Mountain Tunnel point of diversion support a diversion rate of 740 cubic feet per second, or about 478 million gallons per day.[41] The flow capacity of the tunnel has declined over time due to deterioration of the tunnel lining and the replacement of the South Fork pipeline crossing by an inverted siphon tunnel, which increased friction and slightly reduced the hydraulic capacity of the tunnel. The current capacity at Mountain Tunnel is 433 million gallons per day (670 cubic feet per second).[42] With the proposed project (rehabilitation of the tunnel lining), the capacity is expected to be restored to 438 million gallons per day (678 cubic feet per second).

The proposed project would not expand the capacity of other key portions of the regional water system, such as the Foothill Tunnel, San Joaquin Pipelines, or Coast Range Tunnel, or increase the amount of water supplied to customers. The volume of water that is transported to the Bay Area is constrained by the requirements of the water system improvement program water supply decision. The SFPUC approved the Water System Improvement Program on October 30, 2008, in Resolution No. 08--0200. The SFPUC approved a program that was analyzed as the "Phased WSIP Variant" in the Program Environmental Impact Report prepared for the Water System Improvement Program. The SFPUC Commission's approval included full implementation of proposed facility improvements to meet Regional Water System performance objectives for water quality, seismic reliability, and delivery reliability. The approved Water System Improvement Program included average annual water supply delivery of 265 million gallons per day originating from the Tuolumne River, East Bay, and Peninsula watersheds. Of the total 265 million gallons per day, the SFPUC diverts an average annual 223 million gallons per day from the Tuolumne River at the Hetch Hetchy Reservoir. The total 265 million gallons per day allocates 81 million gallons per day for retail customers in San Francisco and 184 million gallons per day for wholesale customers. The approved water system improvement program also included an estimated 20 million gallons per day of conservation, recycled water, and groundwater development in the regional water system service area, allocated equally (10 million gallons per day each) between retail and wholesale customers, to provide adequate supply based on demand projections at the time.

The SFPUC anticipated reevaluation of 2030 water demand projections, regional water system purchase requests, and water supply options by 2018, and a separate SFPUC decision about water supply and

41 State Water Rights Board, *Statement of water Diversion and Use*. June 30, 1967.

42 McMillen Jacobs Associates, *Mountain Tunnel Improvements Project Condition Assessment Report*, 2017.

deliveries after 2018. Under the SFPUC's current demand projections, total demand is not expected to exceed 265 million gallons per day until after the end of the 2040 planning horizon currently used by the SFPUC. However, the water system improvement program's environmental analysis is still pertinent, and in the event that the SFPUC were to supply water in excess of 265 million gallons per day, the SFPUC would implement the mitigation measures adopted in Resolution No. 08-0200 until a new water supply program is approved by the SFPUC Commission following necessary review under CEQA. The Mitigation, Monitoring and Reporting Program included in Resolution No. 08-200 required the SFPUC to implement mitigation measures to reduce impacts to riparian habitat and fishery resources below La Grange Dam on the Tuolumne River. These measures were to be implemented "in proportion to the extent of the exceedance" of deliveries in excess of 265 million gallons per day.

On December 11, 2018, the SFPUC Commission decided to extend the timing of the Water System Improvement Program water supply decision through 2028 in its Resolution No. 18-0212. Accordingly, the limitation on water supply to an average annual delivery of 265 million gallons per day remains in place until 2028, unless the commission separately decides to change that water supply decision prior to that time. As a result, approval of the project would not change the commission's decision to limit the annual average water supply to 265 million gallons per day, and to condition any deliveries in excess of that on the implementation of mitigation measures related to the Tuolumne River.

A.7.2 Mountain Tunnel Maintenance

Following rehabilitation, the Mountain Tunnel would be placed back into long-term service. In accordance with the SFPUC's adopted performance standards for this project, the tunnel would be inspected every 10 years following its rehabilitation (requiring a 10-day minimum planned shutdown), and maintenance activities (requiring a 100-day planned shutdown) would take place every 20 years. Typical tunnel maintenance during the 100-day shutdown would include:

- Regular inspections
- Removal of debris (rock and sand) along the entire length of the tunnel and siphon
- Repair of future lining defects

Maintenance along SFPUC-managed access roadways would be required to ensure access to each of the adits and project components, including removal of small rock debris from netting or roadways, repair of roadway locations that may be damaged by fires or inclement weather, drainage ditch and culvert cleaning, and removal of hazard trees. Road maintenance would be an ongoing task addressed annually or on an as-needed basis.

A.7.3 Flow Control Facility Operations and Maintenance

In addition to inspections and maintenance in the Mountain Tunnel, inspections and maintenance of the flow control facility would be required.

The typical flow control facility maintenance schedule would include:

- Daily visual inspections
- Monthly maintenance

These activities would be conducted by existing SFPUC staff that are onsite inspecting other existing SFPUC equipment in the Priest Reservoir area.

The typical valve maintenance schedule would include:

- Inspection and remediation of new equipment one year after startup

- Annual external inspection of valves, operating actuators, controls, and supporting equipment
- Five-year internal inspection and replacement of worn components of control valves and partial inspection of isolation valves, requiring one flow line of the flow control facility to be out of service
- Five-year internal inspection of isolation valves requiring reservoir and/or tunnel shutdown, including replacement of worn components
- Forty-year replacement of all worn removal parts subject to wear and complete assessment of casings and structural components

During inspections and maintenance of the large flow control and isolation valves, a 275- to 350-ton crane would be required at the flow control facility to lift valves from inside the shaft onto a flatbed trailer at ground level (or directly onto the ground surface). The valves would either be maintained onsite from the trailer or driven to another facility for maintenance. A 250-kilowatt diesel generator would be necessary to operate the dewatering pumps needed to drain the tunnel beyond what can be drained by gravity. The draining operation would take up to three days to complete.

During a maintenance outage, the new Priest Adit would be used for entrance into the Mountain Tunnel. Depending on maintenance activities, up to 1,500 gallons per minute of water (flow rate estimate is based on recent tunnel projects) would be discharged out of the new adit. If there were no construction, this water would be clean and disposed of accordingly. If construction were underway, this water would be pumped to a temporary water treatment facility for treatment prior to discharge.

During normal operations, the flow control facility shaft is expected to collect a clean groundwater inflow of around 5 gallons per minute. When valves are shut, this inflow is expected to temporarily increase to around 40 gallons per minute. The clean groundwater inflows in the new Priest Adit are anticipated to be between 10 and 20 gallons per minute during normal operations. When valves are shut, this inflow is expected to temporarily increase to around 30 gallons per minute. This groundwater inflow would be collected by pumping it to the surface and discharging it in catch basins and flow dispersion trenches at the top of the flow control facility shaft and Priest Portal Adit outlet, respectively. To avoid erosion, the water flow would be dissipated by discharging through the dispersion trenches overland onto the graded surface (overlain with crushed gravel).

Surface and road drainage features would be designed in accordance with California Department of Transportation (Caltrans) Highway Design Manual standards.[43] The drainage system capacities would be based on the pumping rates presented above, combined with the estimated runoff associated with the 100-year precipitation event for this area. Based on Caltrans guidelines, roadside drainage capacities are estimated for the 10-year to 25-year storm, so the proposal to use the estimated runoff associated with the 100-year storm for the design criteria would be conservative.

The approximate sump pump discharge location is shown in Figure A-9.

[43] Caltrans Highway Design Manual, California State Department of Transportation, Sixth Edition, 2018.

B. Project Setting

B.1 Regional and Local Setting

The Mountain Tunnel is in southern Tuolumne County near the town of Groveland, California, in the central Sierra Nevada Mountain Range. The Mountain Tunnel begins at Early Intake Reservoir on the Tuolumne River and extends approximately 19 miles west to Priest Reservoir, near the town of Groveland. All proposed improvement, construction, and staging areas are in Tuolumne County, except for one proposed staging area near the town of Buck Meadows in Mariposa County.

The proposed improvements and the associated areas for construction staging and access are mostly within rights-of-way granted to the City and County of San Francisco pursuant to the 1913 Raker Act; on lands owned in fee by the city; or that are within the Stanislaus National Forest, which is managed by the U.S. Forest Service and adjoins Yosemite National Park to the east. Small portions of the Mountain Tunnel Improvement Project cross or are near privately-owned properties and lands under the jurisdiction of the Bureau of Land Management; the project does not encompass any Bureau of Land Management properties outside the city's Raker Act rights-of-way.

The project area is approximately 140 miles east of San Francisco, is predominantly undeveloped, and lies within the Tuolumne River watershed. Lands along and near the Mountain Tunnel are primarily designated for "Public" and "Agricultural" uses, in accordance with the Tuolumne County General Plan,[44] and reflect the rural, undeveloped nature of the project area. A majority of the project lies within the Stanislaus National Forest (see Figure A-2). The U.S. Forest Service Forest Plan Direction for the Stanislaus National Forest identifies 12 distinct management areas, based on the resources of and uses for the area. The project lies within two such management areas: "Wild and Scenic Rivers," which recognizes and seeks to protect the wild and scenic features of the Tuolumne River near the Mountain Tunnel; and "Near Natural," which recognizes the lower Tuolumne River Canyon for its natural-appearing landscape in a nonmotorized setting, and seeks to protect the high-quality visual setting and to limit land-altering practices.[45] Portions of the wild and scenic management area relevant to the project area are those national forest lands within 0.25 mile of the Tuolumne River. In addition, the Forest Plan Direction proposes the wild and scenic management designation for a 2-mile segment of the South Fork Tuolumne River, from its confluence with the Middle Fork Tuolumne to its confluence with the main Tuolumne River. It also includes all lands within 0.25 mile of the segment. The topography of the project area is characterized by gently to moderately sloping foothills and basins, the steep ridges and drainages of the Rim of the World, and the extremely steep canyon walls of the Tuolumne River. The project area ranges in elevation from approximately 4,000 feet near the edge of the Tuolumne River canyon to 2,170 feet at Priest Reservoir at the western end of the project area.

Cumulative Project Setting

Table B-1 lists the projects in the project vicinity that could contribute to significant cumulative impacts in combination with impacts of the proposed project. A discussion of potential cumulative impacts is included in the individual environmental resource area subsections in Section E, Evaluation of Environmental Effects.

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[44] Tuolumne County, General Plan Land Use Designation Map (GIS Database), 2018, *http://gis.co.tuolumne.ca.us:8093/flexviewers/General%20Plan%20And%20Zoning/*, accessed August 2, 2018.

[45] U.S. Forest Service, Stanislaus National Forest, Forest Plan Direction, March 2017, *https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd535378.pdf*, accessed September 25, 2018.

Table B-1
Projects Considered in the Cumulative Impact Analysis

Project No.	Project Name (Jurisdiction)	Project Description	Estimated Construction Schedule
1	Rim Range Infrastructure Phase II Project (USFS)	Fence construction (approximately 3.5 miles), water development (two troughs or guzzlers), cattle guard installation (five cattle guards), and new corral construction (three corrals).	Developing Proposal
2	Ferretti Nonmotorized Trails Project (USFS)	Construction of 3.5 miles of nonmotorized multi-use (pedestrian, equestrian, and bicycle) and 15 miles of nonmotorized bicycle-only national forest system trails.	Under Analysis
3	Rim Fire Reforestation Project (USFS)	Treatment of about 48,000 acres of national forest system lands within the 2013 Rim Fire zone, including deer habitat enhancement, natural regeneration, noxious weed eradication, reforestation, and thinning existing plantation forests.	2016 - 2029
4	Early Intake Dam Rehabilitation Project (SFPUC)	Rehabilitation of the Early Intake Dam includes the installation of a Carpi liner to extend the serviceable life of the dam.	2026
5	Canyon Tunnel Rehabilitation (SFPUC)	Installation of a new reinforced concrete plug downstream of the existing plug to reduce leakage and increase reliability of the system.	2021 - 2022
6	Early Intake Bridge Replacement Project (SFPUC)	Replacement of the existing bridge at a higher elevation to meet the high river flows. Improving the roads to match the new bridge.	2024 - 2026
7	Transmission Line Clearance Mitigation Project (SFPUC)	A 15-year-long regulatory project, addressing the 2010 North American Electric Reliability Corporation's Alert, to correct deficiencies in transmission conductor clearances by modifying 54 towers on lines 5 and 6 between Intake Switchyard and Warnerville Substation and 18 towers on lines 3 and 4 between Moccasin Switchyard and Newark Substation. All improvements are modifications to existing towers and conductors, except for 10 sites proposed for grading in the wire zone.	2015 - 2030

Table B-1
Projects Considered in the Cumulative Impact Analysis (Continued)

Project No.	Project Name (Jurisdiction)	Project Description	Estimated Construction Schedule
8	Reliable Power Project (SFPUC)	Transmission vegetation management program to minimize the risk of power outages and fires from vegetation contact with transmission lines on or near the right-of-way for electrical transmission lines; to repair and replace culverts associated with transmission line access roads; and to construct a sand storage shed to stockpile sand for winter road treatments needed for access during winter months.	Ongoing implementation of Transmission Vegetation Management Program; schedule for sand shed and culverts improvements to be determined
9	Kirkwood Penstock Project (SFPUC)	The Kirkwood penstock has experienced significant movement of the foundation materials, resulting in the penstock detaching from one fixed saddle directly below one of the anchor blocks. Plans include repairs to the lining, recoating, extensive foundation treatment, and rock protection at selective locations.	2026 - 2028
10	Intake Switchyard Slope Stabilization (SFPUC)	The Rim Fire caused severe burning of the slopes adjacent to the Intake switchyard which has increased the slope instability hazards, resulting in risks to health and safety, damage to property, and potential loss of operations. This project would mitigate these hazards by slope grading (flattening) with netting, sheet metal skirting along the fence to protect the switchyard, and surface water diversions.	2020
11	Hazard Tree Settlement Sale (Caltrans)	Removal of hazard trees along Highway 120.	2018 - 2021

Notes:

Caltrans = California Department of Transportation
SFPUC = San Francisco Public Utilities Commission
USFS = United States Forest Service

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C. Compatibility with Existing Zoning and Plans

	Applicable	*Not Applicable*
Discuss any variances, special authorizations, or changes proposed to the Planning Code or Zoning Map, if applicable.	☐	☒
Discuss any conflicts with any adopted plans and goals of the city or region, if applicable.	☒	☐
Discuss any approvals and/or permits from city departments other than the Planning Department or the Department of Building Inspection, or from regional, state, or federal agencies.	☒	☐

This section identifies potential conflicts between the project and the applicable land use plans. The focus of this section is on City and County of San Francisco land use plans and policies, and other local plans that apply to the project.

The proposed project is in the central Sierra Nevada Mountain Range in northern California, near the town of Groveland in Tuolumne County. With the exception of one proposed staging area near the town of Buck Meadows in Mariposa County, the proposed project's improvements, construction, and staging areas are all in Tuolumne County. Because the SFPUC, as the project sponsor, is an agency of the City and County of San Francisco, the project is under the jurisdiction of the city's plans and policies, where applicable.

C.1 Proposed Changes to the Planning Code or Zoning Map

Because the proposed project lies outside the San Francisco city limits, the city planning code and zoning maps would not apply, and there would be no variances or changes proposed to these regulatory instruments that define use, height, bulk, and other development regulations; therefore, the proposed project would not require variances, special authorizations, or changes to the Planning Code or Zoning Map and these issues are not applicable to the proposed project.

Because the proposed project would involve use of national forest system lands, it would need to secure special use authorizations from the U.S. Forest Service. These authorizations are generally not required where the proposed project lies within Raker Act boundaries, but Raker Act section 4 requires payment to the U.S. Forest Service for merchantable timber cut on and off the right-of-way for project-related purposes. The 1913 Raker Act granted right-of-way to the city over national park, national forest, and unclassified public lands for SFPUC project facilities, including the Mountain Tunnel. The removal of merchantable timber within and outside of Raker Act right-of-way boundaries require negotiation with and payment to the U.S. Forest Service under Raker Act section 4 and the stipulations approved by the Department of Agriculture for the Mountain Tunnel right-of-way traversing national forest system lands.

C.2 Conflicts with Adopted City and Regional Plans

The SFPUC is a department of the City and County of San Francisco; accordingly, the San Francisco General Plan, which sets forth the city's comprehensive, long-term land use policy, is a relevant adopted plan for consideration in this section. The city has authority over the management, use, and control of land it owns outside of the City of San Francisco, subject to the SFPUC's exclusive responsibility for the construction, management, use, and control of the city's water supplies and utilities.[46] For this project, other relevant adopted plans addressed in this section are those of Tuolumne and Mariposa counties, where the proposed project is located.

C.2.1 San Francisco General Plan

A general plan, as mandated by the state government code, defines a blueprint for a municipality's future development and resource management direction. This blueprint is presented through "elements" that address land use, circulation, housing, conservation, open space, noise, and safety.[47] The policies and implementation strategies in these elements chart the direction and mechanisms by which the municipality will work toward its visions and goals. The elements included in the San Francisco General Plan are housing, commerce and industry, recreation and open space, transportation, urban design, environmental protection, community facilities, community safety, arts, and air quality. These elements provide direction for community development, resource management, safety, and public improvements within the city. As such, the proposed project in Tuolumne and Mariposa counties would not conflict with goals or policies affecting city development. The only identified policies that are relevant to the proposed project are in the Community Safety Element and the Environmental Protection Element, both of which describe the importance of protecting the city's infrastructure and critical lifelines. The proposed project, which would improve the city's water supply system, would not conflict with these policies; rather, it would be consistent with and supportive of them.

Furthermore, any conflict between the proposed project and policies that relate to physical environmental issues are discussed in Section E, Evaluation of Environmental Effects. The compatibility of the proposed project with 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.

C.2.2 Proposition M – The Accountable Planning Initiative

In November 1986, the voters of San Francisco approved Proposition M, the Accountable Planning Initiative, which added section 101.1 to the San Francisco Planning Code and established eight *priority policies*. These policies, and the topics in Section E, Evaluation of Environmental Effects that address the environmental issues associated with these policies, are: (1) preservation and enhancement of neighborhood-serving retail uses; (2) protection of neighborhood character; (3) preservation and enhancement of affordable housing (Question 3b, Population and Housing, regarding housing supply and displacement issues); (4) discouragement of commuter automobiles (Questions 4a, 4b, and 4f, Transportation and Circulation); (5) protection of industrial and service land uses from commercial office development and enhancement of resident employment and business ownership; (6) maximization of earthquake preparedness (Questions 13a through 13d, Geology and Soils); (7) landmark and historic building preservation (Question 4a, Cultural Resources); and (8) protection of open space (Questions 9a and 9b, Wind and Shadow, and Questions 10a and 10c, Recreation). The analyses in Section E, Evaluation of Environmental Effects, that correspond to these questions do not identify any significant environmental impacts that could result from conflicts with the priority policies.

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46 San Francisco Charter, sections 4.112 and 8B.121.

47 City (City and County of San Francisco), San Francisco General Plan: San Francisco Planning Department, 1988, *http://generalplan.sfplanning.org/index.htm*, accessed July 26, 2018.

Prior to issuing a permit for any project that requires an initial study under CEQA; issuing a permit for any demolition, conversion, or change of use; and taking any action that requires a finding of consistency with the general plan, the city is required to find that the proposed project or legislation would be consistent with the priority policies. As noted above, the compatibility of the proposed project with general plan objectives and policies that do not relate to physical environmental issues will be considered by city decision-makers as part of their decision whether to approve or disapprove the proposed project. Any potential conflicts identified as part of that process would not alter the physical environmental effects of the proposed project.

C.2.3 Tuolumne County and Mariposa County Land Use Plans and Policies

This section describes the local land use policies of Tuolumne County and Mariposa County that are applicable to the project. California Government Code section 53090 et seq. mutually exempts cities and counties from complying with each other's building code and zoning ordinances. The SFPUC, which is part of the city, is therefore exempt from complying with the building and zoning ordinances of other cities and counties. Although the SFPUC is not legally bound by the land use plans and policies of other jurisdictions, non-city land use plans are discussed in this section to the extent that they provide land use planning information for the jurisdictions in which the project is located.

Determinations of project consistency with local general plans would be made by the pertinent land use jurisdictions, following notification by the SFPUC pursuant to state law. In addition, this initial study/ mitigated negative declaration addresses environmental impacts of conflicts with local land use plans if the project would meet any of the following conditions:

- Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., conflict with policies promoting bus turnouts or bicycle racks), 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 E.5, 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 E.6, Noise)
- Is in 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), and would expose people residing or working in the project area to excessive noise levels (analyzed in Section E.1, Land Use, and Section E.6, Noise)
- Conflict with local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance (analyzed in Section E.13, 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 E.13, Biological Resources)
- 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 E.17, Mineral and Energy Resources)
- Conflict with existing zoning for agricultural use or a Williamson Act contract (analyzed in Section E.18, Agricultural and Forest Resources)

The project would not result in any change of land use in the vicinity of the project, and therefore would not conflict with adopted county plans and goals. This initial study/mitigated negative declaration systematically identifies the potential environmental impacts associated with implementation of the proposed project, as well as feasible measures to avoid or substantially lessen such effects. The criteria used in the impact analysis of this initial study/mitigated negative declaration support the intent of general plan goals and policies related to protection of the environment. As detailed throughout Section E, Evaluation of Environmental Effects, most of the environmental impacts attributable to the proposed project are associated with construction activities, and these impacts would be reduced to less-than-significant levels through implementation of proposed mitigation measures. Therefore, the proposed project would be consistent with the local general plans and would not conflict with local land use policies of Tuolumne or Mariposa counties.

C.2.4 Other Tuolumne County Plans

Other relevant plans adopted by Tuolumne County include the Tuolumne County Airport Land Use Compatibility Plan and the Tuolumne County Water Quality Plan. The Tuolumne County Airport Land Use Compatibility Plan discusses Columbia Airport, 18 miles northwest of Priest Reservoir; and Pine Mountain Lake Airport, 2.7 miles northwest of the Big Creek Shaft Staging Area BC-S2. Relevant projects and land uses are those in the "vicinity" of the airports, defined as land within 2 miles of the public airports.[48] None of the proposed project improvement, construction, or staging areas is within 2 miles of these public airports, and therefore would not be included in or conflict with the Airport Land Use Compatibility Plan.

The Tuolumne County Water Quality Plan was adopted to address water quality concerns in the county. This water quality plan considers surface water quality, factors affecting surface water quality, and mechanisms for maintaining and improving surface water quality.[49] The water quality plan is also intended to assist CALFED (a department of the government of California, administered under the California Resources Agency) by protecting major sources of drinking water for the Sacramento-San Joaquin Delta and the San Francisco Bay.[50] The Tuolumne County Water Quality Plan was developed to implement best management practices, as well as a watershed-based planning framework that includes measurable goals to evaluate effectiveness in protecting water quality over a 20-year timeframe.[51] The proposed project includes drainage improvements and slope stabilization measures that would minimize operational erosion, sedimentation, and water quality impacts, as described in Section A.5.8, Drainage Improvements Outside Adits 5/6 and 8/9, and Section A.5.9, Tunnel Access Roadway and Other Drainage Improvements. Additionally, Section A.6.10, Surface Restoration and Revegetation, and Section A.6.11, SFPUC Standard Construction Measures and Other Avoidance/Minimization Measures Included as Part of the Project, identify avoidance and minimization measures that would be implemented during the construction period and would be consistent with the best management practices of the Tuolumne County Water Quality Plan. In particular, SFPUC's standard hydrologic construction measure states that all projects will implement erosion and sedimentation controls to be tailored to the project site, such as fiber rolls and/or gravel bags around storm drain inlets, installation of silt fences, and other such measures sufficient to prevent discharges of sediment and other pollutants to storm drains and all surface

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[48] Shutt Moen Associates, Tuolumne County Airport Land Use Compatibility Plan, January 22, 2003. *https://www.tuolumnecounty.ca.gov/DocumentCenter/View/1150/Airport-Land-Use-Plan?bidId=*, accessed September 29, 2018.

[49] Tuolumne County, Tuolumne County County Plans, 2018d, *https://www.tuolumnecounty.ca.gov/184/County-Plans*, accessed September 29, 2018.

[50] Tuolumne County, Tuolumne County Final Water Quality Plan, February 2007, *https://www.tuolumnecounty.ca.gov/DocumentCenter/View/7570/Tuolumne-County-Water-Quality-Plan?bidId=*, accessed September 29, 2018.

[51] Tuolumne County, Tuolumne County Final Water Quality Plan, February 2007, *https://www.tuolumnecounty.ca.gov/DocumentCenter/View/7570/Tuolumne-County-Water-Quality-Plan?bidId=*, accessed September 29, 2018.

waterways. As a result, the proposed project would not conflict with the goals and objectives of the Tuolumne County Water Quality Plan.

C.2.5 Stanislaus National Forest, Forest Plan Direction

The U.S. Forest Service completed the Stanislaus National Forest Land and Resource Management Plan (Forest Plan) and Environmental Impact Statement in October of 1991. The Stanislaus National Forest "Forest Plan Direction" presents the current Forest Plan management directives.[52] The Forest Plan Direction aims to manage the Forest's land and resources in combination with present day environmental and economic challenges and opportunities. This plan includes forest goals, forest objectives, management goals and strategies, management practices, forest-wide standards and guidelines, management area direction, and land allocations.[53] One of the objectives of the proposed project is to be consistent with the management objectives of the Stanislaus National Forest. This would include adhering to and implementing management goals and strategies of the Forest Plan Direction in Tuolumne and Mariposa counties for all improvement, construction, and staging areas on national forest system lands. As a result, the project would not conflict with the Forest Plan Direction. The project would not interfere with or impede the broad management goals and strategies listed in the Forest Plan Direction that work to enhance old forest ecosystems and associated species; aquatic, riparian, and meadow ecosystems and associated species; fire and fuels management; noxious weeds; and lower west side hardwood ecosystems.[54] The Forest Plan Direction's goal for Lands contains the following directions: "Consider special uses of the National Forest where public needs cannot be met on private lands and where such uses conform to management direction for the area." To meet the Forest Plan Direction, the U.S. Forest Service would need to provide special use authorizations related to the construction of the Mountain Tunnel improvements. These authorizations are not required where proposed project work lies within Raker Act right-of-way boundaries. The SFPUC has submitted a special use permit application to the U.S. Forest Service for use of national forest system lands outside of Raker Act right-of-way boundaries.

C.3 Project Approvals

The anticipated approval actions required for the proposed project include:

City and County of San Francisco

- San Francisco Planning Commission General Plan Consistency Determination
- SFPUC adoption of the final mitigated negative declaration and the mitigation monitoring and reporting program
- SFPUC approval of the Mountain Tunnel Improvements Project

State Agency Approvals

- California Department of Fish and Wildlife section 1602 Lake or Streambed Alteration Agreement

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[52] U.S. Forest Service, Stanislaus National Forest, Forest Plan Direction, March 2017, *https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd535378.pdf*, accessed August 1, 2018.

[53] U.S. Forest Service, Stanislaus National Forest, Forest Plan Direction, Table of Contents, March 2017, *https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd535378.pdf*, accessed August 29, 2018.

[54] U.S. Forest Service, Stanislaus National Forest, Forest Plan Direction, Table of Contents, March 2017, *https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd535378.pdf*, accessed October 2, 2018.

- Central Valley Regional Water Quality Control Board Clean Water Act section 401 Water Quality Certification
- State Historic Preservation Office section 106 consultation under the National Historic Preservation Act

Federal Agency Approvals

- U.S. Forest Service special use authorization
- U.S. Army Corps of Engineers Clean Water Act section 404 permit

The SFPUC action on the Mountain Tunnel Improvements Project constitutes the *approval action* for the project. The approval action date establishes the start of the 30-day appeal period for this mitigated negative declaration to the San Francisco Board of Supervisors pursuant to section 31.04(h) of the San Francisco Administrative Code.

D. Summary of Environmental Effects

The proposed project could potentially affect the environmental factor(s) checked below. The following pages present a more detailed checklist and discussion of each environmental factor.

☐ Land Use and Planning	☒ Air Quality	☒ Biological Resources
☐ Aesthetics	☐ Greenhouse Gas Emissions	☐ Geology and Soils
☐ Population and Housing	☐ Wind and Shadow	☐ Hydrology and Water Quality
☒ Cultural Resources	☐ Recreation	☐ Hazards and Hazardous Materials
☐ Transportation and Circulation	☐ Utilities and Service Systems	☐ Mineral and Energy Resources
☒ Noise	☐ Public Services	☒ Agricultural and Forest Resources
		☒ Mandatory Findings of Significance

This initial study/mitigated negative declaration examines the project to identify potential effects on the environment. For each item on the initial study checklist, the evaluation has considered the impacts of the project both individually and cumulatively (i.e., combined with other reasonably foreseeable future projects). If an item on the initial study checklist has been checked "Less than Significant with Mitigation Incorporated," "Less than Significant Impact," "No Impact," or "Not Applicable" it indicates that, upon evaluation, staff has determined that the project would not have a significant adverse environmental impact related to that issue. A full discussion is included for all items checked "Less than Significant with Mitigation Incorporated" or "Less than Significant Impact," and a brief discussion is included for items checked "No Impact" or "Not Applicable." The items checked in Section D, Summary of Environmental Effects (above), have been determined to be "Less than Significant with Mitigation Incorporated." A determination of "Potentially Significant" applies where a project component could result in a significant impact for which mitigation would not be expected to reduce the impact to a less-than-significant level. As discussed in detail in Section E, Evaluation of Environmental Effects, implementation of the proposed project would not be expected to cause any "Potentially Significant" impacts.

The State Office of Planning and Research issued new CEQA Guidelines, including the Appendix G environmental checklist form, effective on December 28, 2018. The refinements and updates make efficiency, substantive, and technical improvements, and take into account CEQA legislation, case law, other state environmental laws and regulations, and feedback from public agencies, business and environmental groups, and other stakeholders. Substantive changes include provisions to implement Senate Bill 743 of 2013 and to focus transportation analysis on vehicle miles traveled (rather than intersection and roadway level of service); the addition of new Appendix G environmental topics on energy and wildfires; updated exemptions for transit-centered residential and mixed-use development; use of regulatory standards as thresholds of significance; and allowing the use of other baselines to describe existing conditions when supported by appropriate evidence. The CEQA checklist revisions focus primarily on the scope of the analysis and do not substantively expand it, other than the new wildfire questions. The new energy questions are similar to the previous Appendix F, which concerned energy conservation and the avoidance of inefficient, wasteful, and unnecessary consumption of energy.

This initial study/preliminary mitigated negative declaration uses the prior CEQA Guidelines and Appendix G to evaluate the impacts of the proposed project. The City Planning Department recognized that a number of environmental documents were in various stages of review and determined that those that had completed, or had reasonably advanced towards, the second administrative draft could use the prior CEQA Guidelines. Although the City has allowed the use of the earlier Appendix G, the analysis in this CEQA document does consider substantive changes included in the new guidelines. For example, the analysis focuses on the effects of the project on the existing physical environment (rather than the impacts of the environment on the project, as clarified in California Building Industry Association v. Bay Area Air Quality Management District [2015] 62 Cal.4th 369); addresses wildfire hazards given the high potential for forest fires in the project area (presented in the Hazards and Hazardous Materials section); and uses a model to derive simulated baseline conditions for flows in the Tuolumne River basin (rather than using a snapshot of flows when the environmental document was initiated).

E. Evaluation of Environmental Effects

This section includes an analysis of the potential environmental effects of the proposed project. For each resource area, there is a brief discussion of the existing setting, an analysis of the potential impacts, and a determination of significance. Where the analysis finds that mitigation measures would be required, identified mitigation measures are also described.

E.1 Land Use and Planning

Topics:	*Potentially Significant Impact*	*Less than Significant with Mitigation Incorporated*	*Less-than-Significant Impact*	*No Impact*	*Not Applicable*
1. LAND USE AND PLANNING					
Would the project:					
a) Physically divide an established community?	☐	☐	☐	☒	☐
b) 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?	☐	☐	☒	☐	☐

Impact LU-1. The project would not physically divide an established community. (No Impact)

The project is in the central Sierra Nevada Mountain Range in northern California on undeveloped lands and is not in an established community. The town of Groveland is 2 miles northwest from the Second Garrote Staging Area SG-S1 (the nearest work area), and the proposed project would not include development in Groveland or otherwise physically divide this community. The proposed project includes one staging area near the town of Buck Meadows in Mariposa County (Staging Area A5/6-S1), but due to the temporary use of this small area for staging and its location at the far eastern end of Buck Meadows, the project would not divide the community.

A majority of the project's improvements would be underground. The few aboveground project components—the building above the flow control facility, the power line, the spoil disposal area at Staging Area PP-S6, and appurtenant features—are near Priest Reservoir, where there is no established community. The project would include improvements to existing access roads that connect Highway 120 to the project components; however, these roads traverse steep mountain terrain, and none pass through existing communities. Therefore, the proposed project would have *no impact* related to dividing an established community.

Impact LU-2. The project would not 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. (Less than Significant)

As described in Section C, Compatibility with Existing Zoning and Plans, the project would not conflict with applicable land use plans, policies, and regulations. The project would not conflict with the Stanislaus National Forest Plan Direction, because the project would not interfere with the forest goals that are listed in the plan. Goals pertaining to air quality, community stability, cultural resources, economic, fish and wildlife, forest pests, geology and minerals, lands, range, recreation, sensitive plants, soils, special areas, timber, transportation and facilities, urban interface, visual resources, water, wild and scenic rivers, and wilderness would still be obtainable with implementation of the project.[55] The project would not conflict with the broad management goals and strategies that work to enhance old forest ecosystems and associated species; aquatic, riparian, and meadow ecosystems and associated species; fire and fuels management; noxious weeds; and lower west side hardwood ecosystems, such that the project would result in a significant physical environment impact. For further details on the project's effect on these resource topics, see Section E.13, Biological Resources; Section E.16, Hazards and Hazardous Materials; and Section E.18, Agriculture and Forest Resources.[56]

The Tuolumne County General Plan designates the majority of the project site for public use. The Public designation identifies lands that are owned by public agencies, and recognizes that these lands are exempt from county land use regulations; this designation allows for all types of public use, such as utilities, government offices, schools, airports, libraries, recreational facilities, and resource management and utilization.[57] Consistent with this land use designation, all project staging areas, with the exception of Staging Areas PP-S6 (at Priest Reservoir) and SG-S1 (at Second Garrote), are zoned as "P," public.[58] Permitted uses in the public district include public utility distribution facilities and accessory uses and structures appurtenant to permitted uses.[59] The public zoning district does not have development regulations, such as minimum parcel sizes or building intensity limitations. As a result, the project components within the public land use designation and the public zoning district would not conflict with the purpose of these land use and zoning areas.

Staging Areas PP-S6 and SG-S1 have a general plan designation of "AG" for agricultural, which allows crop production, orchards and vineyards, grazing, pasture and rangeland, recreational farming, resource extraction activities, and facilities that directly support agricultural operations and public facilities.[60,61] Consistent with this general plan designation, the staging areas are partially in zoning district AE-37, Exclusive Agricultural District. This district has a 37-acre minimum lot size and is applied to areas for agricultural and resource production where commercial agricultural uses can exist without encroachment of incompatible uses.[62] Although the main objective of this district is to provide land for agricultural purposes, public use distribution facilities are permitted uses pursuant to section 17.52.060 of the Tuolumne County zoning ordinance, and none of the project improvement, construction, or staging areas are currently in agricultural use. California Government Code section 53090 et seq. mutually exempts cities and counties from complying with each other's building code and zoning ordinances. The SFPUC, a

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55 U.S. Forest Service, Stanislaus National Forest, Forest Plan Direction, March 2017, *https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd535378.pdf*, accessed September 28, 2018.

56 U.S. Forest Service, Stanislaus National Forest, Forest Plan Direction, March 2017, *https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd535378.pdf*, accessed September 28, 2018.

57 Tuolumne County, Tuolumne County General Plan Update, Summary of Land Use Designations, 2018c, *https://www.tuolumnecounty.ca.gov/DocumentCenter/View/10269/Summary-of-Land-Use-Designations?bidId=*, accessed September 29, 2018.

58 Tuolumne County, General Plan Land Use Designation Map (GIS Database), 2018a, *http://gis.co.tuolumne.ca.us:8093/flexviewers/General%20Plan%20And%20Zoning/*, accessed August 28, 2018.

59 Tuolumne County, Tuolumne County Zoning Ordinance Code, Title 17, 2018b. *https://www.tuolumnecounty.ca.gov/DocumentCenter/View/444/Chapter-1741---Public-District-or-P-District?bidId=*, accessed August 1, 2018.

60 Tuolumne County, Tuolumne County General Plan Update, Summary of Land Use Designations, 2018c, *https://www.tuolumnecounty.ca.gov/DocumentCenter/View/10269/Summary-of-Land-Use-Designations?bidId=*, accessed September 29, 2018.

61 Tuolumne County, General Plan Land Use Designation Map (GIS Database), 2018a, *http://gis.co.tuolumne.ca.us:8093/flexviewers/General%20Plan%20And%20Zoning/*, accessed August 28, 2018.

62 Tuolumne County, Tuolumne County Zoning Ordinance Code, Title 17, 2018b. *https://www.tuolumnecounty.ca.gov/DocumentCenter/View/444/Chapter-1741---Public-District-or-P-District?bidId=*, accessed August 1, 2018.

department of the City and County of San Francisco, is therefore exempt from complying with the building and zoning ordinances of other cities and counties. The project would not conflict with the intent of the agricultural land use designation and zoning district.

The Mariposa County land use diagram designates Staging Area A5/6-S1 as agriculture/working landscape.[63] This land use designation is applied to recognize that agriculture is an economic use and not a holding classification for open space.[64] The Mariposa County General Plan also notes that public facilities and sites are to be considered in all land use classifications to accommodate existing and proposed public facilities and sites in the county.[65] Staging Area A5/6-S1 is zoned "PDZ," public domain zone,[66] applicable to lands under public ownership, primarily by the U.S. Forest Service or Bureau of Land Management. Primary uses include sustained yield timber management, harvesting, and associated activities; grazing and other agricultural uses; mining and mineral processing; noncommercial recreation; and hydroelectric generation and other similar uses.[67] Located in the Stanislaus National Forest, Staging Area A5/6 would require a special use authorization from the U.S. Forest Service. The proposed staging area would not conflict with the Mariposa County agricultural land use designation or zoning district.

The proposed project would include new, permanent above-ground facilities: a building over the flow control facility, a supporting power line, spoils disposal, and appurtenant features, all in the Priest Reservoir area. These areas are designated Public in the general plan and zoning map of Tuolumne County, and the proposed project components would be permitted uses in this land use designation and zoning district. As a result, these improvements would not conflict with land use regulations governing the respective improvement sites. Other project components that are underground, such as the new adits, the tunnel repairs, the new shafts, and the Priest Portal, occur within the Raker Act right-of-way and are on lands within the public land use designation and zoning district. As explained above, these uses are permitted pursuant to section 17.52.060 of the Tuolumne County zoning ordinance, and the public zoning district does not include any development regulations such as minimum lot sizes or building intensities. Staging areas would be temporary uses during construction between 2020 and 2026. As a result, these project components would also not conflict with adopted land use plans, policies, or regulations of Tuolumne and Mariposa counties.

In summary, the proposed project would not substantially conflict with any applicable land use plans, policies, regulations, or zoning, and its impact would therefore be *less than significant*.

Impact C-LU. The proposed project, in combination with reasonably foreseeable future projects in the vicinity of the project sites, would not result in a significant cumulative impact related to land use. (Less than Significant)

The geographic scope of the cumulative impacts analysis for land use consists of the project site and the immediate vicinity. As stated above in Impact LU-1, the proposed project would have no impact

[63] Mariposa County, General Plan Land Use Diagram, December 2012, *http://www.mariposacounty.org/DocumentCenter/View/39698*, accessed September 29, 2018.

[64] Mariposa County, County of Mariposa General Plan, Volume I, Countywide General Plan, December 18, 2006, *https://www.mariposacounty.org/DocumentCenter/Home/View/6354*, accessed September 29, 2018.

[65] Mariposa County, County of Mariposa General Plan, Volume I, Countywide General Plan, December 18, 2006, *https://www.mariposacounty.org/DocumentCenter/Home/View/6354*, accessed September 29, 2018.

[66] Conway, Sean, Assistant Planner, Mariposa Planning, Mariposa County, phone correspondence with Bridget Freitas, Environmental Planner, AECOM, October 4, 2018 and October 16, 2018.

[67] Mariposa County, County Code, Title 17 Zoning, 17.52 Public Domain Zone (PDZ), 2018, *http://mariposa.municipalcodeonline.com/book?type=ordinances#name=Title_17_Zoning*, accessed October 16, 2018.

regarding physically dividing an established community. Therefore, there would be no cumulative impact regarding dividing an established community.

With respect to conflicts with applicable land use plans, the cumulative projects identified in Table B-1 are all by public agencies and involve improvements to existing water and power facilities; fire management and risk reduction programs; and nonmotorized travel improvements. Because these projects would not change the existing uses—but would restore, improve, or replace existing facilities or lessen fire hazards—they would not conflict with the general plan designations and zoning districts of Tuolumne and Mariposa counties or the management area goals of the U.S. Forest Service. As a result, these cumulative projects would not conflict with applicable land use plans, policies, and regulations that have been adopted for the purpose of avoiding or mitigating environmental effects. Therefore, no significant cumulative impact related to compliance with applicable land use plans, policies or regulations would result.

E.2 Aesthetics

Topics:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Not Applicable
2. AESTHETICS					
Would the project:					
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☒	☐	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒	☐
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☒	☐	☐
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☒	☐	☐

Approach to Analysis

Aesthetics impacts are generally defined in terms of a project's physical characteristics and potential visibility, and the extent to which the presence of a proposed project would change the perceived visual character and quality of the physical environment in which it would be located. The aesthetic quality of an area is a function of the relationships between its features, their composition, and their visibility from publicly accessible vantage points.

Viewer sensitivity depends on the number and type of viewers and the frequency and duration of views. Visual sensitivity is also affected by viewer activity, awareness, and expectations, in combination with the number of viewers and the duration of the view. The viewer's distance from landscape elements plays an important role in the determination of an area's visual quality. Generally, the closer a visual or scenic resource is to the viewer, the more dominant, and therefore visually important, it is to the viewer. In general, as a viewer group, people engaged in recreational activities have a heightened awareness of their surroundings, are familiar with the scenic resources in the area, and are seeking an experience in a natural setting. This analysis focuses on changes to the existing visual setting from the viewpoint of recreationists at Stanislaus National Forest recreational facilities, and recreationists traveling to and from designated recreational areas on local roadways and Highway 120 (i.e., publicly accessible vantage points).

Aerial photos, topography, and site visits were used to identify proposed project improvement, construction, and staging areas that would be visible from scenic vista points, publicly accessible vantage points such as trailheads and campgrounds, and roadways; Table E.2-1 identifies those project components that are evaluated in this section. Existing and proposed facilities at Early Intake, South Fork, Adit 5/6, Adit 8/9, and Priest Reservoir that are visible from publicly accessible vantage points are discussed below and shown on Figures E.2-1 through E.2-6. The proposed improvement, construction, and staging areas at the Big Creek and Second Garrote shafts are not discussed further in this section for the reasons identified in Table E.2-1.

Table E.2-1
Visibility of Project Improvement, Construction, and Staging Areas

Location	Improvement, Construction, Staging Area	Nearby Publicly Accessible Vantage Point	Described and Evaluated in this Aesthetic Assessment?
Early Intake	EI-S1	Cherry Lake Road (FSR 1N07), Preston Falls trailhead	Yes
	EI-S2		Yes
	EI-S3		Yes
	EI-S4		Yes
	EI-S7		Yes
South Fork	SF-S1	Highway 120, Cherry Lake Road (FSR 1N07)	Yes
	SF-S2	Highway 120, Cherry Lake Road (FSR 1N07), Old Big Oak Flat Road, Sweetwater Campground	Yes
	SF-S3	Highway 120, Old Big Oak Flat Road	Yes
	SF-S4	Highway 120, Old Big Oak Flat Road	Yes
	SF-S5	South Fork Access Road	Yes
	SF-S6	South Fork Access Road	Yes
	SF-S7	South Fork Access Road	Yes
	SF-S8	South Fork Access Road	Yes
	Siphon, Adit, Vent Construction Areas	South Fork Access Road	Yes
	Construction Access Road: Old Big Oak Flat Road	Highway 120, Old Big Oak Flat Road, Rainbow Pool	Yes
	South Fork Access Road	South Fork Access Road	Yes

Table E.2-1
Visibility of Project Improvement, Construction, and Staging Areas (Continued)

Location	Improvement, Construction, Staging Area	Nearby Publicly Accessible Vantage Point	Described and Evaluated in this Aesthetic Assessment?
Adit 5/6	A5/6-S1	Highway 120, Lost Claim Campground	Yes
	A5/6-S2	Tuolumne wild and scenic river reaches, Lumsden and South Fork Campgrounds	No; distant public vantage points are along the river but screened by trees
	Adit 5/6 Access Road	Highway 120, Rim of the World Vista, Lost Claim Campground, Adit 5/6 Access Road	Yes; limited visibility from distant vantage points, screened by terrain and trees; proximate to Lost Claim Campground
Adit 8/9	A8/9-S1	Lumsden Road (FSR 1N10), Tuolumne wild and scenic river reaches	No; not visible from road or river because of intervening terrain and trees
	A8/9-S3	Ferretti Road	No; not visible from road because of intervening terrain
	A8/9-S4	Lumsden Road (FSR 1N10)	Yes
	A8/9-S5	Highway 120, Ferretti Road, Casa Loma Road	Yes
	A8/9-S6	Highway 120, Ferretti Road, Casa Loma Road	Yes
	Construction Areas, Adit 8/9 Access Road	Lumsden Road (FSR 1N10)	Yes
Big Creek Shaft	BC-S2	Big Creek Shaft Road	No; public road serves local residents and utility employees, minimal number of viewers, and setting is defined by a water tank, utilities, overhead transmission lines, and a storage/maintenance yard
Second Garrote	SG-S1	Second Garrote Road	No; public road serves local residents and utility employees, minimal number of viewers, and setting is defined by a water tower, industrial buildings, equipment and maintenance sheds, storage yard, and overhead power lines

Table E.2-1
Visibility of Project Improvement, Construction, and Staging Areas (Continued)

Location	Improvement, Construction, Staging Area	Nearby Publicly Accessible Vantage Point	Described and Evaluated in this Aesthetic Assessment?
Priest Reservoir	PP-S1	Priest-Coulterville Road, canyon rim in vicinity of Priest Station	No; less than 0.5 mile from publicly accessible vantage point but screened by terrain and trees
	PP-S4		No; more than 0.5 mile from publicly accessible vantage point and screened by terrain and trees
	PP-S5		Yes
	PP-S6		No; less than 0.5 mile from publicly accessible vantage point but screened by terrain and trees
	PP-S7		No; more than 0.5 mile from publicly accessible vantage point and screened by terrain and trees
	PP-S8		No; more than 0.5 mile from publicly accessible vantage point and screened by terrain and trees
	PP-S9		Yes
	PP-S13		No; less than 0.5 mile from publicly accessible vantage point but screened by terrain and trees
	PP-S15		No; less than 0.5 mile from publicly accessible vantage point but screened by terrain and trees
	Priest Improvement and Construction Areas		No; less than 0.5 mile from publicly accessible vantage point and screened by terrain and trees

Note:
FSR = Forest Service Road

N

0 500
Feet

NAIP Imagery, 2016; MJA, 2017; USFS, 2018

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Mountain Tunnel Improvements Project
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USFS Road
Trail
Staging Area
Tuolumne River Wild and Scenic River Designation
Recreational
Wild

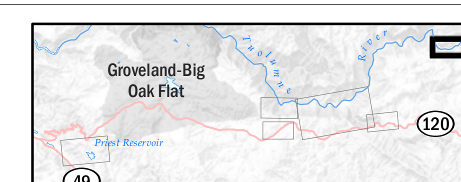
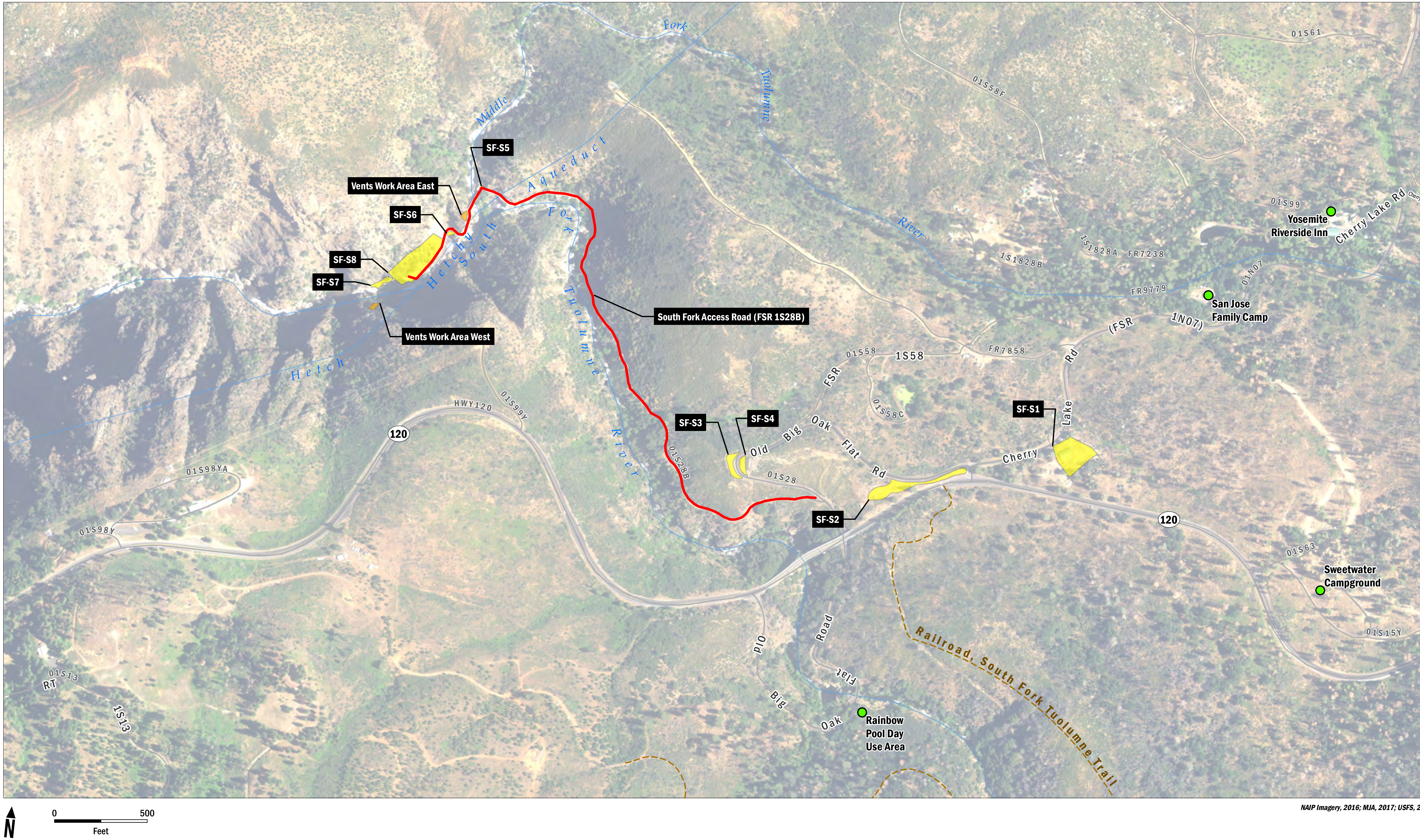


FIGURE E.2-1
Public Vantage Points
Early Intake Area



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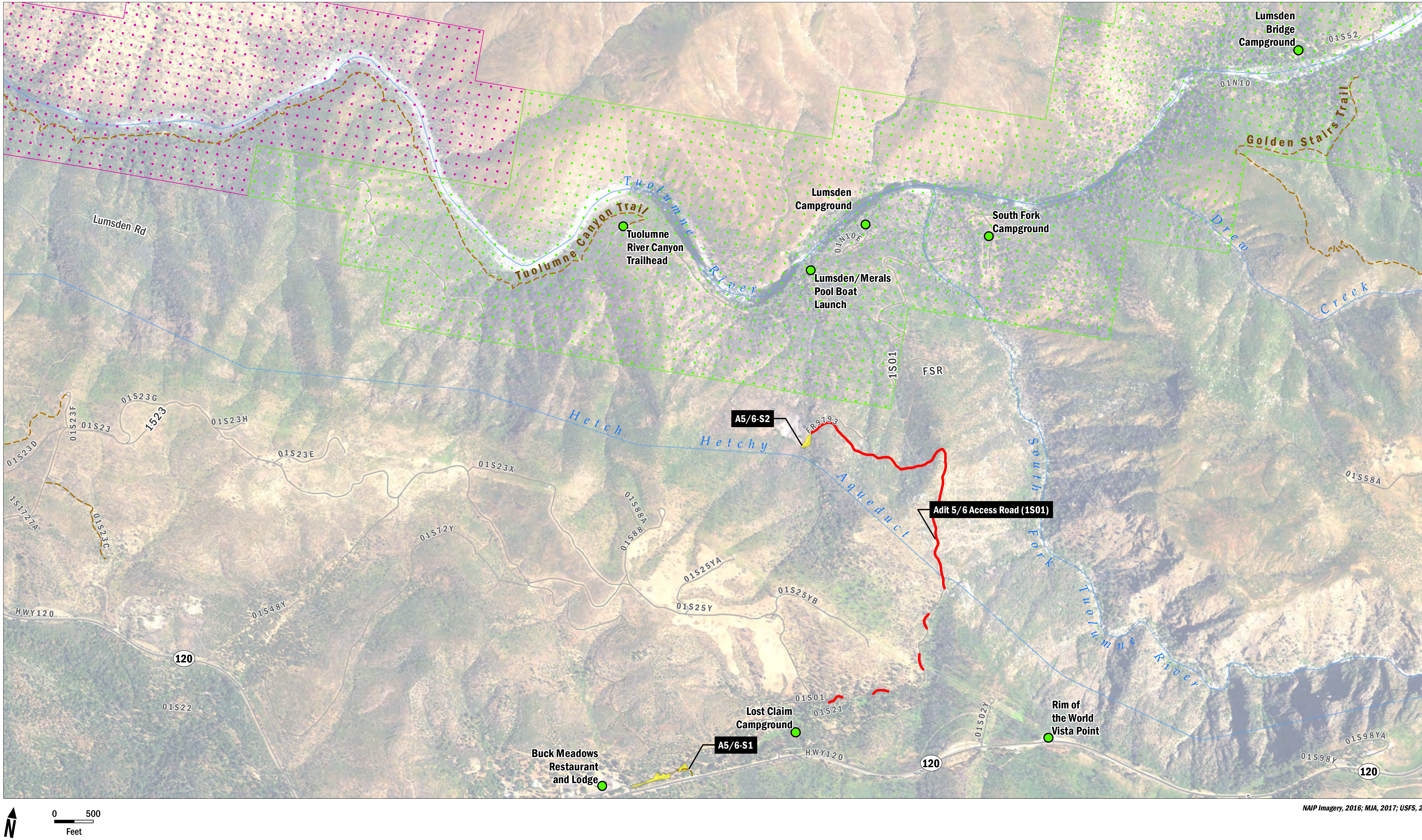
USFS Road
Trail
Proposed Road and Drainage Improvement
Staging Area
Work Area

FIGURE E.2-2
Public Vantage Points
South Fork Siphon Area



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DATE: 2/5/2019

USFS Road
Trail
Proposed Road and Drainage Improvement
Staging Area

Tuolumne River Wild and Scenic River Designation
Scenic
Wild

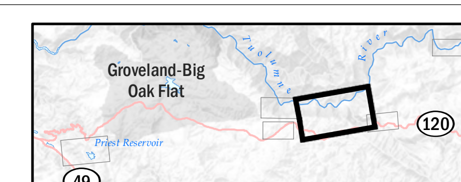
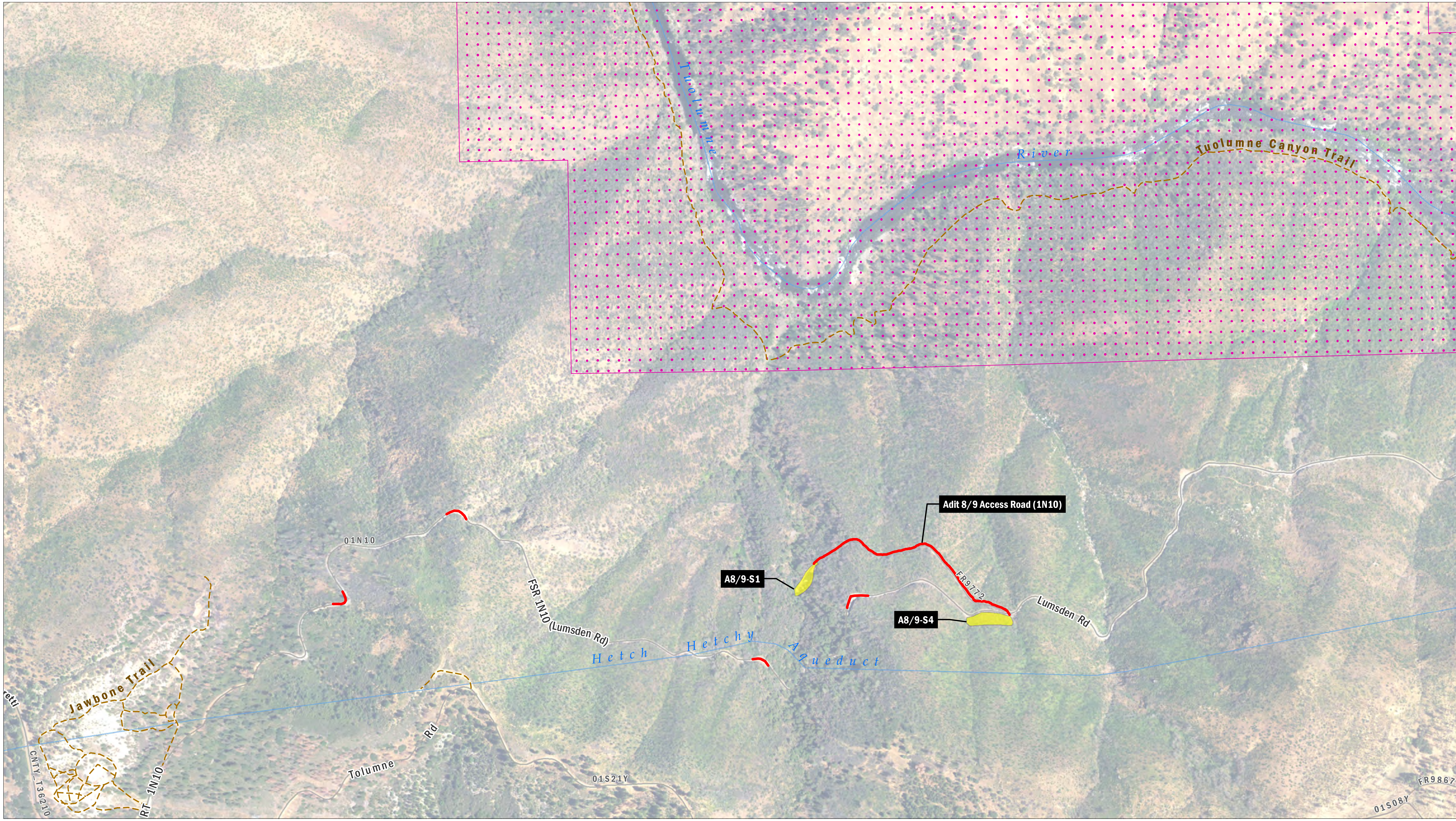


FIGURE E.2-3
Public Vantage Points
Adit 5/6 Area



San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 2/5/2019

USFS Road
Trail
Proposed Road and Drainage Improvement
Staging Area

Tuolumne River Wild and Scenic River Designation
Wild

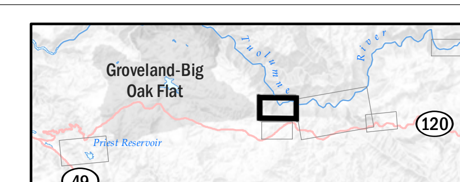


FIGURE E.2-4
Public Vantage Points
Adit 8/9 Area

NAIP Imagery, 2016; MJA, 2017; USFS, 2018

N

0 500

Feet

San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 5/20/2019

Publicly Accessible Vantage Points
- Viewpoints
- Trail
- Publicly Accessible Road

Project Features
- Staging Area

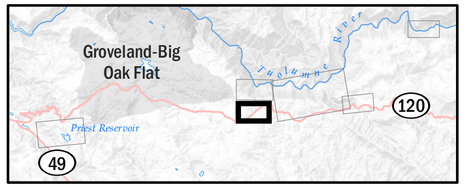
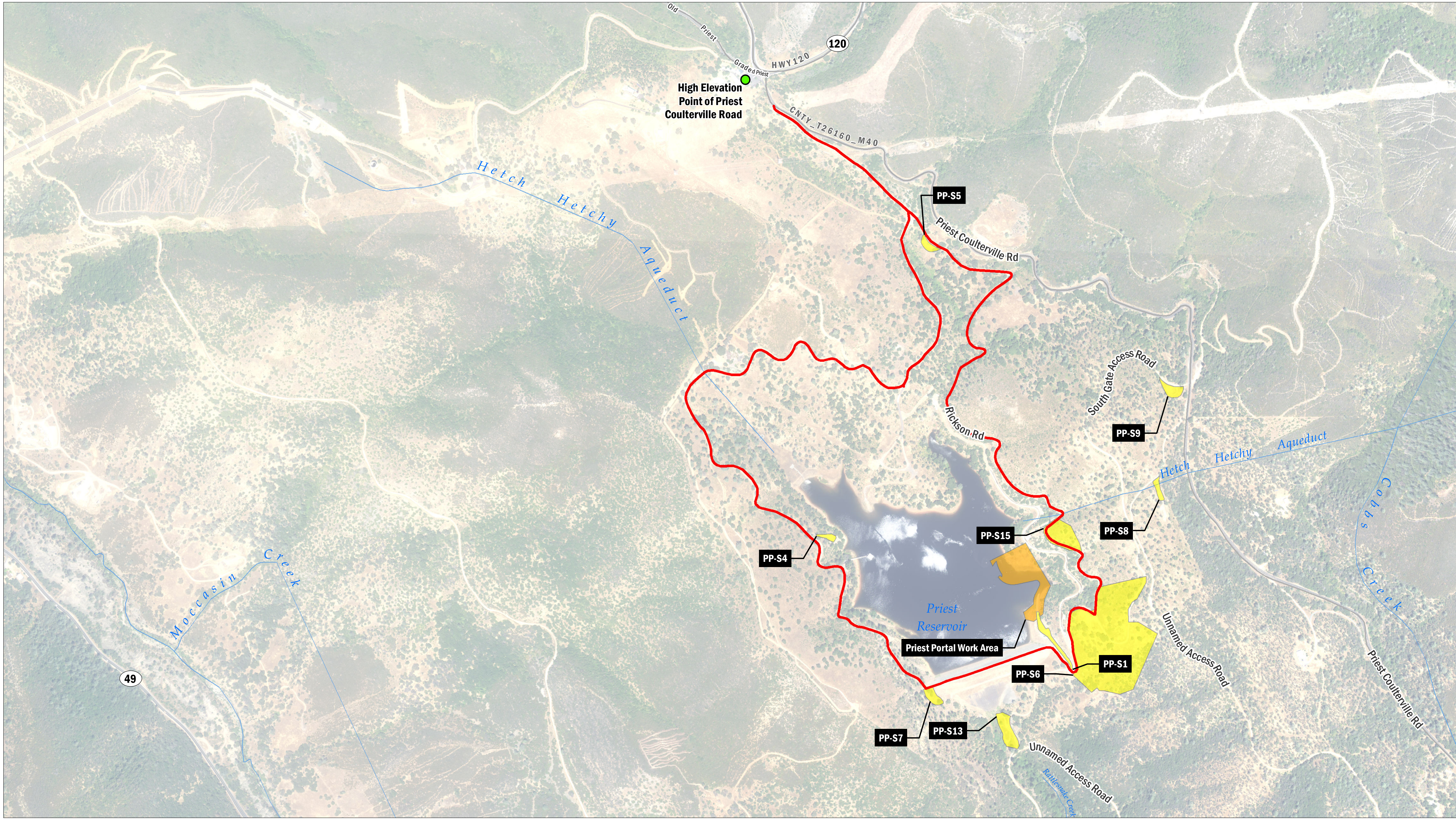


FIGURE E.2-5
Public Vantage Points
Adit 8/9 Area (cont.)



NAIP Imagery, 2016; MJA, 2017; USFS, 2018

N

0 500
Feet

San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 5/22/2019

Publicly Accessible Vantage Points
- Viewpoints
- Publicly Accessible Road

Proposed Project Components
- Proposed Road and Drainage Improvement

Project Features
- Staging Area
- Work Area

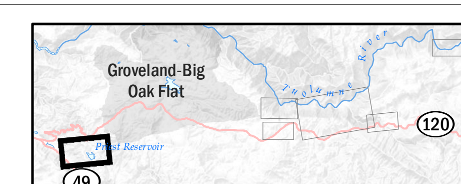


FIGURE E.2-6
Public Vantage Points
Priest Reservoir Area

Environmental Setting

Representative photographs of the existing visual character of the project areas identified in Table E.2-1 are presented below. Photographs were selected based on the proximity of project-related improvement, construction, and staging areas to publicly accessible vantage points.

Early Intake Area

Facilities at the Early Intake area are accessed by and visible from Cherry Lake Road (Forest Service Road 1N07), which is a narrow, curvilinear, paved roadway that provides access to various Stanislaus National Forest recreational facilities. The Early Intake area includes tunnel operation and hydroelectric power generation facilities, including a dam and diversion facility; powerhouse; aboveground pipeline and concrete bridge across the Tuolumne River; SFPUC and Yosemite National Park Service employee housing; bunkhouse building; electrical switchyard; wood power poles and metal transmission towers with overhead power lines; and paved and graveled roads and parking areas. The proposed improvement, construction, and staging areas in the Early Intake area are adjacent to these facilities and the Tuolumne River in a narrow, steep-sided canyon approximately 2,000 feet below the surrounding ridgelines. The northern side of the canyon is sparsely vegetated because of the 2013 Rim Fire[68] and other historical fires. The land coverage consists primarily of annual and perennial grasses with exposed rock and scattered low-growing shrubs. In contrast, a portion of the southern side of the canyon is heavily vegetated with brush and tall trees, including deciduous varieties that are brown and barren in winter, and conifers that are green year-round.

Staging Area EI-S1 (shown in Viewpoint 1) would be at the Stanislaus National Forest Preston Falls Trailhead, which is the start of the Preston Falls Trail (see Figure E.2-1). The trailhead includes a parking area and restroom facilities and is approximately 70 feet above the Tuolumne River. The trailhead area includes natural features such as grass, boulders, and scattered trees, along with man-made recreational features such as signs, gates, restrooms, and a paved parking area. The trailhead facility has been designed to blend in with the natural landscape, using green and brown colors, native boulders, and a small-scale brown vault toilet building.

Staging Areas EI-S2, EI-S4, and EI-S7 consist of existing man-made structures and hydroelectric and tunnel maintenance facilities. The grey and brown colors of the man-made features are similar to the colors of the natural features; however, the form, line, and texture of the man-made features contrast strongly with the river and vegetation. As shown on Figure E.2-1, the proposed improvement, construction, and staging areas in the Early Intake area are outside the designated Wild and Scenic River corridor, which is east and west of the Early Intake area.[69]

[68] The Rim Fire burned 257,314 acres from August 17, 2013, primarily through October 2013. Due to a lack of winter rainfall, some areas continued to smolder, and the fire was not declared officially extinguished until November 4, 2014. The fire was named for its proximity to the Stanislaus National Forest's Rim of the World vista point (which is discussed further throughout this section). Approximately 90 percent of the fire was in the Tuolumne River watershed. The Early Intake, South Fork, Adit 5/6, and Adit 8/9 work areas are in the Rim Fire burn area.

[69] Stanislaus National Forest, Decision Memorandum, Tuolumne Wild and Scenic River Management Plan Revisions, Maps 1 and 2, 1988, *https://www.rivers.gov/documents/plans/tuolumne-plan.pdf*.

Viewpoint 1
Staging Area EI-S1, Looking Southwest from the Preston Falls Trailhead Parking Area

South Fork Area

Recreationists traveling on Highway 120 have panoramic views of the steep slopes and rugged terrain surrounding the South Fork Tuolumne River canyon, with the Tuolumne River canyon in the background (see Viewpoint 2). Water in the river is visible, along with the high, steep-sided canyon walls, which display areas of exposed rocks and barren brown soil. Low-growing green shrubs and grasses are also present, along with scattered stands of live trees. Brown silhouettes of dead trees from the Rim Fire are visible throughout the viewshed. The horizontal lines and vegetative cuts for Old Big Oak Flat Road and the gated access road area descending into the South Fork canyon contrast with the vertical lines of trees in the middleground and distance. Staging Areas SF-S3 and SF-S4, which consist of adjacent wide, flat benches cut into the ridgeline above the South Fork canyon, are visible from Highway 120 (see Viewpoint 2 and Figure E.2-2). Both have a flat gravel surface and have been previously cleared and used as staging areas.

Rainbow Pool is a popular Stanislaus National Forest day-use recreational area south of Highway 120 and the southeastern end of the proposed South Fork Access Road (Forest Service Road 1S28B) improvements and Staging Areas SF-S3 and SF-S4. Rainbow Pool is accessed from Highway 120 via Old Big Oak Flat Road; the road curves around Rainbow Pool and the associated recreational facilities before traveling back underneath Highway 120, where the South Fork Access Road splits off to the west (see Figure E.2-2). Old Big Oak Flat Road would be used to transport large equipment (e.g., crane) to the South Fork area during project construction. Old Big Oak Flat Road is cut into a steep slope, and in the vicinity of Rainbow Pool it is surrounded by grasses, low-growing shrubs, and heavy forest cover, including both deciduous and evergreen trees (see Viewpoint 3).

Viewpoint 2
South Fork Access Road (red arrows), Old Big Oak Flat Road (orange arrows), South Fork Tuolumne River, and Staging Areas SF-S2 (yellow arrow), SF-S3 (black arrow), and SF-S4 (blue arrow), Looking East from Highway 120

Viewpoint 3
Old Big Oak Flat Road, Rainbow Pool, and South Fork Tuolumne River, Looking Southeast from Old Big Oak Flat Road

A paved, day-use parking area, a small brown and tan vault toilet building, and a picnic area with tables and barbeque grills are near Rainbow Pool (see Viewpoints 4a and 4b). The pool itself is approximately 100 feet wide, and an approximately 6-foot-high waterfall pours into the pool over a rock ledge at the eastern end. Old Big Oak Flat Road crosses the South Fork Tuolumne River upstream and at an elevation approximately 30 feet higher than Rainbow Pool and traverses the middle of the day use area (see Figure E.2-2).

Viewpoints 4a and 4b
Old Big Oak Flat Road and Day Use Facilities at Rainbow Pool,
Looking Southeast from Forest Service Road 1N07/Lumsden Road

Staging Areas SF-S1 and SF-S2 are situated on a flat bench at the top of the ridgeline, immediately adjacent to Cherry Lake Road (Forest Service Road 1N07) and Highway 120. Cherry Lake Road north of Highway 120 is traveled by recreationists accessing areas along the Middle Fork of the Tuolumne River, including the San Jose Family Camp and the Yosemite Riverside Inn (see Figure E2-2). Staging Area SF-S1 consists of an existing fenced, gated, and graveled vehicle and equipment storage and maintenance yard with an administrative building, and limited nighttime security lighting. Staging Area SF-S2 (see Viewpoint 5) consists of a partially paved and partially dirt, barren, open area that has been used as a staging area in the past.

Staging Areas SF-S5 through SF-S8 and Vents Work Areas East and West are at the end of South Fork Access Road (Forest Service Road 1S28B). This road is not open for public vehicle use but is occasionally used by bicyclists and pedestrians. Views along the road are dominated by steep rock walls that adjoin the road and the South Fork of the Tuolumne River.

Adit 5/6 Area

The existing Adit 5/6 Access Road (a portion of which is also Forest Service Road 1S01) traverses a ridgeline approximately 2,400 feet northwest of the Rim of the World vista point (see Viewpoint 6 and Figure E.2-3). The Stanislaus National Forest's Rim of the World vista is on the northern side of Highway 120. The vista point includes a paved parking area, paved viewing area with interpretive signage, a stacked stone wall, vault toilet, and trash bins. This is a designated scenic vista point, providing expansive views of the south fork and main stem Tuolumne River canyons, along with multiple ridgelines to the north and west stretching into the distance. This area burned in the Rim Fire. Canyon views consist primarily of exposed brown soil and grey rocks, along with scattered low-growing green grasses and shrubs and the brown and blackened silhouettes of burned shrubs and trees.

Viewpoint 5
Staging Area SF-S2, Looking West from Highway 120

Viewpoint 6
Adit 5/6 Access Road (Forest Service Road 1S01), Looking Northwest from Rim of the World Vista Point

The Stanislaus National Forest's Lost Claim Campground is immediately adjacent to and south of a segment of the Adit 5/6 Access Road (Forest Service Road 1S01) near Highway 120 (see Figure E.2-3). The campground and this segment of the adjacent access road are in a partially forested drainage between two low hillsides. Tall, mature conifers that are green throughout the year, along with mixed deciduous trees, are scattered throughout the campground, particularly at the southwestern end. The campground includes brown wood and metal picnic tables; small metal in-ground fire pits with grills; and a small, brown wood vault toilet building. Campsites are composed of grass and dirt. The very narrow, one-lane Adit 5/6 Access Road (Forest Service Road 1S01) is composed of dirt and gravel, and therefore appears visually similar to the existing adjacent campground facilities and campground access road (see Viewpoint 7).

The Adit 5/6 Access Road (Forest Service Road 1S01) is a gated road; access is available only to U.S. Forest Service and SFPUC employees, as well as U.S. Forest Service permittees. The road is occasionally used by bicyclists and pedestrians who experience varying views of the surrounding landscape, as described above and below, while traveling along the road.

Staging Area A5/6-S1 is a long, narrow strip of gravel and dirt, surrounded by grass and pine trees, at the southwestern end of the Adit 5/6 Access Road, adjacent to and north of Highway 120 (Viewpoint 8). This location has been used as a staging area in the past. This staging area is east of the entrance to the Buck Meadows Restaurant and Lodge (see Figure E.2-3), but is not visible from this destination because of its distance (about 0.45 mile) and intervening trees that obstruct views of the staging area.

The Adit 5/6 Access Road (Forest Service Road 1S01) travels east then north through the Stanislaus National Forest, crossing over two ridgelines above the Tuolumne River. The road descends from an elevation of approximately 3,100 feet above mean sea level at Highway 120, to approximately 2,300 feet at Adit 5/6. The road is very narrow and is composed of dirt and gravel. The eastern side of the first 0.5 mile of the access road parallels a drainage and is partially forested. However, the western side of this portion of the access road, and both sides of the remaining approximately 1.2 miles of access road and the surrounding area, are composed of low-growing shrubs and annual and perennial grasses (green in the spring, but brown for most of the year), along with brown and black vertical silhouettes of burned trees from the Rim Fire.

Adit 5/6 and the associated Staging Area A5/6-S2 are on the southern side of the steeply sloping Tuolumne River canyon, at the existing barren spoils pile that was created when the tunnel was first constructed. The adit and the staging area are adjacent to but outside of the Tuolumne River Wild and Scenic River corridor (which has a designation of "Scenic" in this area;[70] see Figure E.2-3), approximately 800 feet above the river. A few small stands of evergreen trees are scattered throughout the canyon, but this area is primarily composed of green low-growing shrubs and annual and perennial grasses, along with brown and black vertical silhouettes of burned trees from the Rim Fire.

Adit 8/9 Area

The Adit 8/9 Access Road, a portion of which is also known as Lumsden Road (Forest Service Road 1N10), travels eastward from Ferretti Road and drops down into the Tuolumne River canyon, in the Rim Fire burn area. This narrow, curvilinear, dirt road provides public access to the Tuolumne Canyon Trail (see Figure E.2-4) and Lumsden Campground (approximately 4.5 miles to the northeast [see

[70] Stanislaus National Forest, Decision Memorandum, Tuolumne Wild and Scenic River Management Plan Revisions, p. 2, 1988, *https://www.rivers.gov/documents/plans/tuolumne-plan.pdf*.

Viewpoint 7
Adit 5/6 Access Road (Forest Service Road 1S01), Looking Northeast from the Northeast End of Lost Claim Campground

Viewpoint 8
Staging Area A5/6-S1, Looking Northwest from Highway 120

Figure E.2-3]) and is also used by rafting companies for Tuolumne River access at the Lumsden/Merals Pool boat launch (immediately west of Lumsden Campground). The first 1.4 miles of Adit 8/9 Access Road descend approximately 600 feet through a heavily forested area. The remaining portion of the access road and surrounding national forest system lands are composed of low-growing shrubs and annual and perennial grasses (green in the spring but brown for most of the year), along with brown and black vertical silhouettes of burned trees from the Rim Fire. A few small stands of evergreen trees are scattered throughout the canyon. Approximately 1.4 miles from Ferretti Road, the gated Adit 8/9 Access Spur Road (also in the Rim Fire burn area) turns westward and switchbacks around the ridge to Adit 8/9 and Staging Area A8/9-S1. Adit 8/9 and Staging Area A8/9-S1 are approximately 1,000 feet above the Tuolumne River, which is designated as both "Wild" and "Scenic" in this area[71] (see Figure E.2-4). Adit 8/9 and Staging Area A8/9-S1 are in a steeply sloping drainage, most of which is forested.

Staging Area A8/9-S4 is on the southern side of Forest Service Road 1N10, where the gated portion of Adit 8/9 Access Spur Road takes off to the west (see Viewpoint 9) and Forest Service Road 1N10 continues toward the river (see Figure E.2-4). This staging area is approximately 1,200 feet above the river. This area is composed of green low-growing shrubs and annual and perennial grasses, along with brown and black vertical silhouettes of burned trees from the Rim Fire. A few small stands of evergreen trees are scattered throughout the canyon. The staging area slopes upward steeply into the adjacent rocky hillside on the southern side.

Staging Area A8/9-S3 is on the western side of Ferretti Road and approximately 0.35 mile from Highway 120 (see Viewpoint 10 and Figure E.2-5). Staging Area A8/9-S3 consists of an open dirt and grass area that has been used for staging/parking in the past and is bordered by a line of large boulders on the eastern side. Staging Area A8/9-S3 is surrounded by shrubs and trees.

Staging Areas A8/9-S5 and A8/9-S6 are immediately adjacent to and north of Highway 120 at the intersection with Casa Loma Road. Both staging areas are generally open and are composed of dirt and grass. Staging Area A8/9-S5 is open to and clearly visible from Highway 120 and Ferretti Road (see Viewpoint 11 and Figure E.2-5) and is used as an overflow parking area for rafters at the adjacent ARTA River Trips office. Staging Area A8/9-S6 is owned and used by Caltrans periodically for staging of its materials and equipment; it is surrounded by mixed deciduous and evergreen shrubs and trees and is visible from Highway 120 during the winter months (see Viewpoint 12).

Priest Reservoir Area

Priest Reservoir and its associated facilities are City and County of San Francisco-owned water and power facilities; the access roads are gated, and public entry or use is not permitted. The area is mountainous, and is composed of multiple narrow, elongated drainages sandwiched between higher ridgelines. The Priest Reservoir area is largely undeveloped, consisting of heavy forest cover (grasses, shrubs, and a mix of tall deciduous and evergreen trees), with only a handful of widely scattered private rural residences in the vicinity. In addition to Highway 49, some recreationists, along with local residents, travel on Priest-Coulterville Road, northeast of the Priest Reservoir area, to access the Stanislaus National Forest recreational areas further east. Staging Area PP-S9 would be situated at the eastern terminus of the existing South Gate Access Road, at its intersection with Priest-Coulterville Road (see Figure E.2-6). Staging Area PP-S9 consists of a flat, open grassy field bordered by brush, oak trees, and conifers (see Viewpoint 13).

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[71] Stanislaus National Forest, Decision Memorandum, Tuolumne Wild and Scenic River Management Plan Revisions, p. 2, 1988, *https://www.rivers.gov/documents/plans/tuolumne-plan.pdf*.

Viewpoint 9
Staging Area A8/9-S4, Looking West from Forest Service Road 1N10

Viewpoint 10
Entrance to Staging Area A8/9-S3, Looking Southwest from Ferretti Road

Viewpoint 11
Staging Area A8/9-S5, Looking Northwest from Highway 120

Viewpoint 12
Staging Area A8/9-S6, Looking Northwest from Highway 120

Viewpoint 13
Staging Area PP-S9, Looking Southwest from Priest Coulterville Road

Staging Area PP-S5 consists of a small graveled area, approximately 150 feet southwest and approximately 40 feet below Priest Coulterville Road (see Viewpoint 14 and Figure E.2-6). The slope between Priest Coulterville Road and the staging area consists of grass. On the other three sides, the staging area is surrounded by trees and shrubs. Both of these areas have been used as staging areas and repositories for spoils piles in the past. Rickson Road (see Figure E.2-6) is gated and used by SFPUC employees; public access is not permitted. From Priest-Coulterville Road, the viewshed looking toward Rickson Road is a typical lower-elevation oak woodland ecosystem, with large open grassy areas and scattered oak trees. Tall, thick brush is present along the southwestern side of Priest-Coulterville Road.

Scenic Vistas

There is one designated scenic vista in the vicinity of the project area that offers views of the project area: the Stanislaus National Forest's Rim of the World vista. The Tuolumne River is designated as a Wild and Scenic River near the project area and holds this designation in part due to the scenic views of the river canyon.

Tuolumne Wild and Scenic River

The California Wild and Scenic Rivers Act was established in 1972 (California Public Resources Code sections 5093.50–5093.70) to protect designated rivers that possess extraordinary scenic, recreation, fishery, or wildlife values. The Tuolumne River was designated as wild and scenic in 1984 with the passage of the California Wilderness Act (Public Law 98-425). The Tuolumne River also has a federal Wild and Scenic River designation. In all, 83 miles of the main stem were designated, from the river's

Viewpoint 14
Staging Area PP-S5, Looking Southwest from Priest Coulterville Road

source inside Yosemite National Park downstream to New Don Pedro Reservoir. The designated wild and scenic river corridor extends for a distance of 0.25 mile on both sides of the river. The California Wild and Scenic Rivers Act includes three potential river designations, as defined below:[72]

- **Wild rivers—**Those rivers or segments of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted.
- **Scenic rivers—**Those rivers or segments of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.
- **Recreational rivers—**Those rivers or segments of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

For a river or river segment to receive a “scenic” designation under the California Wild and Scenic Rivers Act, it must be found to have “extraordinary scenic values” following preparation of a report submitted to the Governor and the California State Legislature on the suitability or unsuitability of a river or river segments for addition to the wild and scenic river system.[73] The wild and scenic river designations in the vicinity of the project are shown on Figures E.2-1 through E.2-4.

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[72] Public Resources Code section 5093.53.
[73] Public Resources Code sections 5093.50 and 5093.547.

Rim of the World Vista

The Stanislaus National Forest's Rim of the World vista is on the northern side of Highway 120, east of the start of the Adit 5/6 Access Road (Forest Service Road 1S01) (see Figure E.2-3). As shown in Viewpoint 6, the area around the access road as seen from the vista consists primarily of exposed brown/tan soil and grey/black rock faces, along with scattered low-growing green shrubs and the brown and blackened silhouettes of burned trees. This vista offers expansive, panoramic views of the mountainous and forested terrain that provide the visual context for the project area and beyond.

Impact AE-1. The project would not have a substantial adverse effect on a scenic vista. (Less than Significant)

Scenic Vistas along the Tuolumne River

From the Tuolumne River, there are views of portions of the project around the Early Intake area, Adit 5/6 Access Road (Forest Service Road 1S01), and Adit 8/9 Access Road (Lumsden Road/Forest Service Road 1N10) areas.

The Tuolumne River in the Early Intake area is not included in the wild and scenic river designation.[74] As shown on Figure E.2-1, there are nearby reaches identified as wild and recreational, but recreationists in these reaches do not have views of the proposed improvement, construction, or staging areas in the Early Intake area, because of bends in the river. Therefore, the proposed project in the Early Intake area would have *no impact* on scenic vistas from the Tuolumne River.

The proposed Adit 5/6 Access Road improvement, construction, and staging areas are in the vicinity of the wild and scenic river corridor but are not within the corridor. As shown on Figure E.2-3, the wild and scenic river designation in the vicinity of Adit 5/6 (i.e., the Lumsden Campground area) is "Scenic" (see Figure E.2-3).[75] Proposed work along the Adit A5/6 Access Road (Forest Service Road 1S01) would include installation of slope protection measures (e.g., netting or shotcrete facing), road graveling and widening, and drainage improvements. In addition, approximately 120 trees may be removed along the Adit 5/6 Access Road (Forest Service Road 1S01). These improvements would occur along the length of the access road and would not introduce new vertical visual elements that would contrast with or substantially alter the existing landform. Although some of the improvement, construction, and staging areas are visible from the Tuolumne River, recreationists on the river would be 800 feet below and approximately 1,900 feet away at their closest point to the access road. Because of the distance from the scenic reaches of the Tuolumne River and the presence of deciduous and evergreen trees along the southern side of the river that screen some views from the river, the temporary construction activities, roadway modifications (including tree removal), and slope stabilization measures would be barely noticeable from the river below, if at all. Therefore, the impact on scenic vistas from the Tuolumne River due to improvement, construction, and staging areas of the Adit 5/6 Access Road area would be *less than significant.*

In the vicinity of the Adit 8/9 Access Road, which includes Lumsden Road (Forest Service Road 1N10 and a short spur road that provides access to the adit from Lumsden Road), the Tuolumne River is designated

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[74] Stanislaus National Forest, Decision Memorandum, Tuolumne Wild and Scenic River Management Plan Revisions, pp. 21 and 25, and Maps 1 and 2, 1988, *https://www.rivers.gov/documents/plans/tuolumne-plan.pdf*.

[75] Stanislaus National Forest, Decision Memorandum, Tuolumne Wild and Scenic River Management Plan Revisions, p. 2, 1988, *https://www.rivers.gov/documents/plans/tuolumne-plan.pdf*.

"Wild" (see Figure E.2-4).[76] The Tuolumne River Canyon Trail follows the southern side of the river along this reach of the river. Improvements along the access road are similar to those described above for the Adit 5/6 Access Road (Forest Service Road 1S01)—small staging areas, minor tree (about 25 trees) and vegetation removal, road graveling and widening, retaining walls, turnouts, and culverts. The river and Tuolumne River Canyon Trail are approximately 1,100 feet away at their closest point to, and about 1,000 feet below, the Adit 8/9 Access Road improvement, construction, and staging areas. Given the distance to the river and trail and the existing tree cover along the canyon walls, the temporary construction activities and the permanent road improvements set into the steep canyon wall high above the river would be barely noticeable, if at all, by recreationists on the river or the Tuolumne River Canyon Trail. Therefore, the impact on scenic vistas from the Tuolumne River due to improvement, construction, and staging areas of the Adit 8/9 Access Road area would be *less than significant.*

Rim of the World Vista Point

The Stanislaus National Forest's Rim of the World vista is on the northern side of Highway 120, east of the Adit 5/6 Access Road (Forest Service Road 1S01) (see Figure E.2-3). As shown in Viewpoint 6, views from the vista consist of panoramic views of the mountainous terrain, marked by exposed brown/tan soil and grey/black rock faces, along with scattered low-growing green shrubs and the brown and blackened silhouettes of burned trees. The Adit 5/6 Access Road (Forest Service Road 1S01) is visible as a horizontal line cut into a steep slope.

The proposed project includes road graveling and widening, and installation of retaining walls, turnouts, drainage improvements, and cantilevered concrete road overhangs along the Adit 5/6 Access Road (Forest Service Road 1S01). In addition, minor vegetation removal is proposed along the roadway, where necessary to widen the road. Most of these improvements would be flat along the existing road bed and would not introduce a vertical visual element that would contrast with the existing road or landform. The retaining walls, other slope stabilization improvements, and tree removal would alter the landform and remove some of the existing tree cover; however, most of the existing Adit 5/6 Access Road (Forest Service Road 1S01) is blocked from the Rim of the World vista due to the intervening topography. Approximately 0.25 mile of the access road along a ridgeline would be visible, approximately 2,400 feet (at the closest point) northwest of and approximately 500 feet lower in elevation from the viewpoint (see Viewpoint 6 and Figure E.2-3).

Because road improvements would proceed in a sequential fashion, construction equipment and personnel would only be visible from the vista temporarily and for a much shorter duration than the entire project. At the completion of construction, most of the permanent Adit 5/6 Access Road (Forest Service Road 1S01) improvements would appear visually similar to existing roads throughout the Stanislaus National Forest. From the Rim of the World vista, approximately 280 feet of suspended concrete deck would be visible in middle ground views at two locations along the access road, approximately 3,000 feet northwest of the vista point (at the closest point). Sections of gabion wall (large rocks enclosed with metal mesh to form a retaining wall) and shotcrete (concrete sprayed over metal mesh that is held in place with rebar) would also be installed along this segment of the access road. The shotcrete walls would be colored tan or brown to blend in with the surrounding landscape and contoured to follow the existing hillside (see Section A.5.9, Tunnel Access Roadway and Other Drainage Improvements). As shown in Viewpoint 6, this segment of the access road is surrounded by large open

[76] Stanislaus National Forest, Decision Memorandum, Tuolumne Wild and Scenic River Management Plan Revisions, p. 2, 1988, *https://www.rivers.gov/documents/plans/tuolumne-plan.pdf*.

areas of tan soil; tan, brown, and grey rocks; and scattered green shrubs. Because of the distance to this road segment from the vista, and the SFPUC proposal to blend the gabion and shotcrete walls with the landform and colors, the proposed permanent road improvements would not stand out in the landscape to such a degree that the scenic view from the vista would be substantially affected. Therefore, this impact on views from the Rim of the World vista would be *less than significant*.

Impact AE-2. The project would not affect scenic resources associated with a designated scenic highway. (No Impact)

Project-related facilities and work areas would be approximately 8.5 miles west of the federally designated Tioga Road/Big Oak Flat National Scenic Byway, the western end of which begins at the Yosemite National Park Big Oak Flat entrance station.[77] Due to the intervening distance and topography, project-related facilities and construction work would not be visible from this national scenic byway.

State scenic highways are designated by Caltrans. There are no state-designated scenic highways in Tuolumne County, although Highway 49, and the portion of Highway 120 between Chinese Camp and Moccasin Creek, are listed as eligible.[78,79] Highway 140 is a state-designated scenic highway extending from the border of Yosemite National Park to the community of Mariposa in Mariposa County. [80]

Project improvement, construction, and staging areas at Priest Reservoir (the closest location to Highway 49/ Highway 120 at approximately 1 mile east) would not be visible from Highway 49/Highway 120 due to the intervening hilly topography; Highway 49/Highway 120 west of Priest Reservoir travels through a narrow, steep-sided canyon. Priest Reservoir is approximately 1,500 feet above Highway 49/Highway 120 in the bowl of an adjacent drainage. Project-related construction work in Mariposa County near Buck Meadows would be approximately 12.5 miles north of Highway 140; due to the intervening distance and topography, project-related facilities and construction work would not be visible from Highway 140.

Mariposa County does not have any locally designated scenic routes.[81] The Tuolumne County General Plan[82] indicates that Highway 49 is a locally designated scenic route from the Mariposa County line to Highway 120 near Moccasin Creek, and from Highway 120 at Chinese Camp to the Calaveras County line, exclusive of the City of Sonora. Tuolumne County has also designated Highway 120 from Chinese Camp southeastward to Moccasin Creek as a locally designated scenic route. Project-related construction activities and new facilities around Priest Reservoir would be approximately 1 mile east of the locally designated scenic routes near Moccasin Creek. However, as described above, project improvement, construction, and staging areas at the Priest Reservoir area would not be visible from Highway 49/ Highway 120 due to the intervening hilly topography.

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77 Federal Highway Administration, America's Byways, Tioga Road/Big Oak Flat Road, 2018, *https://www.fhwa.dot.gov/byways/byways/2302/maps*.

78 Caltrans (California Department of Transportation), List of Eligible and Official Designated State Scenic Highways, 2017, *http://www.dot.ca.gov/design/lap/livability/scenic-highways/*.

79 The status of a state scenic highway changes from eligible to officially designated when the local jurisdiction adopts a scenic corridor protection program, applies to Caltrans for scenic highway approval, and receives notification from Caltrans that the highway has been designated as a Scenic Highway.

80 Caltrans (California Department of Transportation), List of Eligible and Official Designated State Scenic Highways, 2017, *http://www.dot.ca.gov/design/lap/livability/scenic-highways/*.

81 Mariposa County, County of Mariposa General Plan, December 18, 2006, *http://ca-mariposacounty.civicplus.com/index.aspx?NID=1142*.

82 Tuolumne County, Tuolumne County General Plan, Chapter 2: Circulation Element, pp. 2-22, 1996, *https://www.tuolumnecounty.ca.gov/185/General-Plan-Policy*.

For these reasons, the project would have *no impact* on scenic resources associated with a designated scenic highway.

Impact AE-3. The project would not substantially degrade the existing visual character or quality of the site and its surroundings. (Less than Significant)

Most of the project-related work would be conducted underground, and therefore would not be visible to the public following completion of construction. Potential project-related impacts from construction work and long-term impacts at visible, aboveground features are evaluated below. For those areas affected by temporary construction and staging, excluding those areas in the Priest Reservoir area and along road improvement areas where permanent changes are proposed, SFPUC would restore the affected areas to their pre-existing conditions as part of the proposed project (see Section A.6.10, Surface Restoration and Revegetation). As a result, temporary construction impacts to the visual character or quality of the construction and staging areas would be reduced as part of the project, as described more fully below.

Early Intake Area

As shown on Figure E.2-1 and reported in Table E.2-1, all of the Early Intake area improvement, construction, and staging areas are directly visible from roads that access the Preston Falls Trailhead. Staging Area EI-S1 in the Preston Falls Trailhead parking area would be used on a temporary basis for storage of construction equipment and parking for construction personnel. Recreationists using the Preston Falls Trail would pass by or through the staging area at the trailhead and would have clear close-up views of construction equipment and personnel. Construction equipment and personnel staged at the Preston Falls Trailhead (EI-S1) would not be visually compatible with a natural, undisturbed recreational area and the trailhead facilities that were designed to blend with the natural surroundings. However, construction staging would be temporary, the staging area would not be visible once on the trail, and the trailhead area would be returned to pre-project conditions at the conclusion of construction activities, as discussed in the project description (see Section A.6.10, Surface Restoration and Revegetation) and as required by the U.S. Forest Service.

Staging Areas EI-S2 and EI-S7 are immediately adjacent to the access road to the Preston Falls Trailhead and would be visible to recreationists traveling to the trailhead. Construction equipment and personnel would not detract from the visual character or quality of these areas, because this activity would be temporary. Moreover, the visual setting of these two staging areas is largely defined by existing man-made hydroelectric and tunnel maintenance facilities, so that their visual character would not be impaired or substantially affected by temporary construction activities and materials storage.

Staging Areas EI-S3 and EI-S4 are adjacent to one another and form a semicircle around the existing Early Intake Switchyard and Adit. Views of construction equipment and personnel in most of these two staging areas would be blocked by the existing electrical equipment, except at the southeastern end of Staging Area EI-S3 and the northwestern end of Staging Area EI-S4, which would be clearly visible to recreationists traveling on Cherry Lake Road (Forest Service Road 1N07). Construction equipment and personnel would not be visually incompatible with the adjacent hydroelectric power equipment and fencing, due to its existing developed/industrialized visual character. The removal of approximately five trees at EI-S3 as part of the project would not substantially alter the visual setting of the area, which is heavily forested upslope and around this staging area.

In summary, the Early Intake area is developed with existing facilities related to operation of the tunnel and the generation of hydroelectric power, including a dam and diversion facility, powerhouse, aboveground pipeline and concrete bridge across the river, SFPUC employee housing, bunkhouse building, electrical switchyard, wood power poles and metal transmission towers with overhead power lines, and paved roads and large paved parking areas. The temporary presence of construction equipment and personnel throughout the Early Intake area, along with the proposed permanent improvements to the existing Early Intake adit and tunnel access, would not be visually incompatible with the existing developed facilities and would not substantially degrade the area's existing visual character for the reasons described above. Therefore, the impact of the project on the visual character of the Early Intake area would be *less than significant.*

South Fork Area

The proposed South Fork Access Road (Forest Service Road 1S28B) improvements (including minor tree removal at the northeastern end), and Staging Areas SF-S3 and SF-S4 would be visible to recreationists and other motorists traveling along Highway 120. Due to the narrow, steep South Fork river canyon and the meandering river (which result in intervening ridgelines), along with tall trees that are present in the river corridor around the pool, views of the South Fork Access Road (Forest Service Road 1S28B) and Staging Areas SF-S3 and SF-S4 from the Rainbow Pool day use area would be obscured. However, these areas would be visible for recreationists traveling from Rainbow Pool along Big Oak Flat Road where it connects to Highway 120 further east of Rainbow Pool. The proposed South Fork Access Road (Forest Service Road 1S28B) improvements would also be visible to recreationists using this road to access the South Fork Tuolumne River on the northern side of Highway 120, and to pedestrians and bicyclists using South Fork Access Road. However, the improved surface of the South Fork Access Road (Forest Service Road 1S28B), including minor road widening, paving, and slope stabilization (such as shotcrete or rockfall mesh that would be colored with natural hues to blend with the surrounding ground surface and vegetation), would be visually similar to other paved U.S. Forest Service and private roads throughout the area.

The Stanislaus National Forest's Sweetwater Campground is approximately 1,200 feet east of Staging Area SF-S2 (see Figure E.2-2). Most of the area between the campground and the staging area is composed of standing dead trees. The intervening topography and the remaining existing live trees in the campground and on the eastern side of the staging area would screen the views of construction personnel and equipment from recreationists in Sweetwater Campground. Similarly, Staging Areas SF-S1 and SF-S2 would not be visible from the river or from the San Jose Family Camp or the Yosemite Riverside Inn off Cherry Lake Road (Forest Service Road 1N07) due to the intervening topography.

Based on the limited visibility of the above improvement, construction, and staging areas as summarized in Table E.2-1, the discussion below evaluates the change in visual character or quality at Staging Areas SF-3 and SF-4, the Rainbow Pool area, and Staging Areas SF-1 and SF-2.

Staging Areas SF-3 and SF-4 would be visible from Highway 120 and Big Oak Flat Road; however, recreationists' views would be fleeting, while driving past, and the construction-related activities would be temporary. The construction traffic and use of the staging areas would visually contrast with the existing natural visual of hillsides and trees (see Viewpoint 2). However, at the conclusion of project-related construction activities, Staging Areas SF-3 and SF-4 would be returned to pre-project conditions as part of the proposed project (see Section A.6.10, Surface Restoration and Revegetation), and the improved surface of the South Fork Access Road (Forest Service Road 1S28B), including minor road widening, paving, and slope stabilization, would be visually similar to other paved U.S. Forest Service and private roads throughout the area.

In the immediate vicinity of Rainbow Pool, Old Big Oak Flat Road is approximately 30 feet above the pool and most of the road is visible looking north from the pool. Furthermore, the day-use parking and picnic areas flank the road. The road and day-use park and picnic areas are heavily used, so that traffic movement and parking is commonplace and contributes to the visual character of the area. Views of construction-related traffic on Old Big Oak Flat Road would be out of place; however, the project-related traffic would be temporary and limited to the project's construction phase. As a result, although this traffic would alter the visual setting by introducing a different mix of motorized vehicles, it would not permanently affect the natural setting, the picnic area, the pool, or the trees alongside the road, which collectively define the area's visual character (as seen earlier in Viewpoints 3, 4a, and 4b).

Staging Areas SF-1 and SF-2 would be visible to recreationists traveling on Cherry Lake Road (Forest Service Road 1N07) near the intersection with Highway 120 (see Figure E.2-2). Staging Area SF-S1 and the eastern end of Staging Area SF-S2 would also be visible to recreationists traveling on Highway 120. The existing staging areas already visually contrast with the surrounding forest vegetation. Due to the curvature of South Fork Access Road (Forest Service Road 1S28B), Staging Areas SF-S5 through SF-S8 and Vents Work Areas East and West would only be visible to pedestrians and bicyclists near or at the end of the road. The introduction of project-related staging activities and material and equipment storage would contrast with the visual setting. However, as previously explained, these conditions would be temporary during the construction phase. At the conclusion of project-related construction activities, the proposed project includes restoring staging areas to pre-project conditions (see Section A.6.10, Surface Restoration and Revegetation).

In summary, the construction activities and staging areas would temporarily alter the visual character of the South Fork area. The four staging areas that are visible from publicly accessible vantage points would be converted from flat open areas amidst trees and variable terrain to sites for construction equipment and materials storage and construction personnel. Similarly, the appearance and character of the Old Big Oak Flat Road would be altered from a route for visitors/recreationists to one that would also appear to be a construction truck haul route. The visual quality of the Rainbow Pool area itself would not be substantially degraded, because the heavy vegetation, recreational facilities, and natural setting of the pool would remain unchanged. The project-related changes to the visual character of the South Fork area would be temporary during the construction phase. As part of the proposed project, staging areas would be returned to pre-project conditions (see Section A.6.10, Surface Restoration and Revegetation). Therefore, the impact of the project on the visual character of the South Fork area would be *less than significant.*

Adit 5/6 Area

The Adit 5/6 area is part of a wide, panoramic viewshed from the Tuolumne River, campgrounds, and recreational areas to the south and from the Rim of the World vista to the east and southeast. Staging Area A5/6-S2 and the northern portion of the Adit 5/6 Access Road (Forest Service Road 1S01) would be visible in the distance looking up at the canyon wall from the Tuolumne River, the Lumsden/Merals Pool boat launch ramp, Lumsden Campground, and South Fork Campground approximately 1,900 to 2,500 feet away (at the closest points) (see Figure E.2-3). Tall deciduous and evergreen trees along the southern side of the river would block most views of the project improvement, construction, and staging areas. Even if visible, the project improvements to the Adit 5/6 Access Road (Forest Service Road 1S01) would be level with the existing road bed; the slope stabilization area could introduce some visual scarring along the mountainsides that would appear as barren areas but would be treated with natural colors to appear similar to large portions of the existing viewshed (see Section A.5.9, Tunnel Access Roadway and Other Drainage Improvements). Views of the Adit 5/6 area from the Rim of the World vista are described in Impact AE-1. Similar to the discussion above for visible changes in the character of the viewshed and surrounding setting from the Tuolumne River, the Rim of the World vista is distant from the Adit 5/6 area, and the changes to the overall visual setting, landscape, and tree cover are relatively small scale (e.g., roadway turnouts and localized widening; slope protection; and drainage improvements). The limited visibility and change to the visual landscape would not substantially degrade the visual character and quality of the natural, rugged, and forested terrain from either of these public areas.

As summarized in Table E.2-1, the analysis below focuses on changes to the use and improvements along the Adit 5/6 Access Road (Forest Service Road 1S01), as it passes Lost Claim Campground, and at Staging Area A5/6-S1, which stretches along the northern side of Highway 120. The proposed Adit 5/6 Access Road (Forest Service Road 1S01) improvements would also be visible to bicyclists or pedestrians using this road. However, the improvements to this road, including minor road widening, graveling, and slope stabilization (i.e., draped mesh, post-mounted netting, or shotcrete facing), would be visually similar to other paved U.S. Forest Service and private roads throughout the area.

The Lost Claim Campground is adjacent to a short segment of the Adit 5/6 Access Road (Forest Service Road 1S01) (see Figure E.2-3), where only road graveling is proposed. The road would also provide access for construction equipment, trucks, and personnel working on road and drainage improvements further north along the access road. The road improvements in the vicinity of the campground, as well as personnel and equipment traveling on the road during the construction period, would be directly visible by recreationists in the campground both during and after construction activities. Upon completion, the road graveling would be visually similar to existing U.S. Forest Service campground access roads, and the minimal changes to the road bed would not substantially degrade the natural setting depicted in Viewpoint 7. The access road would, however, serve as the only route to carry construction-related equipment and materials to the improvement, construction, and staging areas of the Adit 5/6 area. The introduction of this construction activity would affect the overall visual character and quality of the campground area. However, similar to the earlier discussion of construction traffic by Rainbow Pool, the proposed project would not substantially degrade the rustic setting, the campground facilities, or the tree cover in the area. Project impacts would be noticeable only during the temporary construction phase.

Staging Area A5/6-S1 is visible to recreationists and motorists traveling on Highway 120 (see Figure E.2-3). A small construction trailer would be sited at Staging Area A5/6-S1 to serve as a temporary headquarters for the contractor, and for equipment storage, and would be removed at the conclusion of construction activities. Because this staging area is an existing cleared, partially graveled area (Viewpoint 8) adjacent to the highway, recreationists' views would be fleeting, while driving past; and the construction-related activities would be temporary. The construction traffic and use of the staging areas would visually contrast with the existing natural visual of trees. However, at the conclusion of project-related construction activities, Staging Area A5/6-S1 would be returned to pre-project conditions as part of the proposed project (see Section A.6.10, Surface Restoration and Revegetation).

In summary, the construction activities and the use of Staging Area A5/6-S1 would alter the visual character of the southernmost portion of the Adit 5/6 area. The access road and the staging area would be visible from publicly accessible vantage points, and the visual character would be temporarily converted from limited-use rural roads and flat open areas amidst trees to one with construction equipment and materials storage and construction personnel. The visual quality of the Lost Claim Campground itself would not be substantially degraded, because the heavy vegetation, recreational facilities, and natural setting of the rustic campsites would remain unchanged. The project-related changes to the visual character of this portion of the Adit 5/6 area would be temporary during the construction phase. As part of the proposed project, construction and staging areas would be returned to pre-project conditions (see Section A.6.10, Surface Restoration and Revegetation). Visual changes related to slope stabilization (such as gabion embankments or draped mesh, and shotcrete facing) would be noticeable but would be limited in their application and would not be substantially different from features on other paved U.S. Forest Service and private roads throughout the area. Therefore, the impact of the project on the visual character of the Adit 5/6 area would be *less than significant.*

Adit 8/9 Area

As summarized in Table E.2-1, there are two staging areas at the southern end of the Adit 8/9 area visible from Highway 120 and Casa Loma and Ferretti roads. In addition, the Adit 8/9 Access Road for much of its length follows Lumdsen Road (Forest Service Road 1N10), used by recreationists, including the rafting companies, to access the Tuolumne River to the north. The portions of the Adit 8/9 area that are not evaluated below are Staging Area A8/9-S3, the short spur road that leaves Lumsden Road to provide access to the adit (which is gated and where public access is not permitted), and Staging Area A8/9-S1 at the end of the spur road, none of which is visible from publicly accessible vantage points. Staging Areas A8/9-S5 and A8/9-S6 are along Casa Loma Road immediately north of Highway 120. They are both open, level, cleared areas amidst trees that partially screen views from Highway 120 (Viewpoints 11 and 12). Staging Area 8/9-S5 is periodically used for overflow parking by a nearby commercial rafting company, and Staging Area 8/9-S6 is occasionally used by Caltrans for temporary staging or spoils storage. The proposed project would use these areas for temporary storage of equipment and materials during the construction phase. Because the areas are already cleared, and recreationists driving by would have fleeting glimpses of them, the temporary change to the visual character of these areas would not substantially degrade the visual quality of this southernmost portion of the Adit 8/9 area. Similar to other staging areas, at the conclusion of project-related construction activities, Staging Areas A8/9-S5 and A8/9-S6 would be returned to pre-project conditions as part of the proposed project (see Section A.6.10, Surface Restoration and Revegetation). Consequently, there would be no long-term change to the visual character of these sites.

Lumsden Road (Forest Service Road 1N10) is a narrow, winding, one-lane road that is publicly accessible and used by recreationists and commercial recreational outfits traveling to the Tuolumne River, campgrounds, and rafting and kayaking launches. Lumsden Road (Forest Service Road 1N10) would require periodic closure during road-construction activities; construction equipment and personnel would be visible to recreationists traveling along the road (when the road is open) to the Tuolumne River Canyon Trail, Lumsden Campground (approximately 4.5 miles to the northeast), and the Lumsden/ Merals Pool boat launch, where Tuolumne River access is provided. For most of the roadway length, proposed project improvements involve graveling the road bed; however, there are targeted segments where permanent turnouts would be constructed for safety during the operational phase. In addition, portions of the road would be widened, and slope stabilization measures would be installed. At the point where the adit spur road veers from Lumsden Road (Forest Service Road 1N10) to connect to Adit 8/9, a relatively large staging area (approximately 0.4 acre) would be created by cutting into the steep slope. Up to 40 feet of the hillside above the existing roadway would be removed, along with tree and vegetation removal, to create the staging area. Construction equipment and personnel would use the Adit 8/9 Access Road and alter the scenic, visual character of the route. Staging Area A8/9-S4 would also change the visual quality for this stretch of Lumsden Road (Forest Service Road 1N10) during construction and post-construction, because the natural landform would be replaced with a cut slope, stabilized with spot dowels and draped mesh. This segment would be approximately 300 feet in length and more than double the width of the existing Lumsden Road. Because the construction activity would be temporary, and most of the permanent improvements (i.e., the turnouts and drainage features) would be level with the existing road and similar in appearance to other roads throughout the Stanislaus National Forest, the proposed project would not substantially degrade the visual quality along Lumsden Road (Forest Service Road 1N10). By contrast, the slope stabilization measures (i.e., the gabion embankments and draped or post-mounted rockfall mesh on the cut slopes), typically where the turnouts are proposed, would be more visually prominent and alter the landform. Road 1N10) is winding and the turnouts are widely separated (see Figure E.2-4), the changes to the visual setting and character due to the slope modifications are not viewed in combination or for long stretches. Furthermore, slope stabilization measures such as draped mesh are not uncommon in areas with steep slopes. As a result, the changes to the visual quality and character of Lumsden Road (Forest Service Road 1N10) would be noticeable but would not substantially degrade the scenic, winding, natural visual character of the access road with multiple vistas.

In summary, the Adit 8/9 area would experience visible changes along the entire access route, from Highway 120 to Staging Area A8/9-S4. The changes at the southern end near Highway 120 would result from construction staging that would be noticeable during the temporary construction period. As described in the project description, these two areas would be restored to their pre-project condition (see Section A.6.10, Surface Restoration and Revegetation). By contrast, the improvements along the Lumsden Road (Forest Service Road 1N10) segment of the Adit 8/9 Access Road would be permanent. The changes to the visual character as a result of the slope stabilization measures would be evident but would not be out of place along mountainous roadways with steep terrain. In addition, the rockfall protection and cut slope draped mesh would occur at discrete, noncontiguous segments. Neither the temporary staging areas nor the long-term improvements would substantially degrade the visual character of the Adit 8/9 area. Therefore, the proposed project impacts on visual character or quality in the Adit 8/9 area would be *less than significant*.

Priest Reservoir Area

Due to the hilly terrain and heavy vegetative cover, most of the proposed improvement, construction, and staging areas in the Priest Reservoir area would not be visible from public vantage points. The reservoir sits in a bowl-like depression that is rimmed by generally north-south trending ridgelines that are part of the Sierra Nevada mountain range. The north-south trending ridgeline on the eastern side of the reservoir is approximately 300 feet above the water line. The elevation of Priest-Coulterville Road ranges from 50 to 100 feet below the ridgeline to the east. As a result, the new flow control facility, the new power line along the northern and eastern fringes of the reservoir, the spoils disposal area in the southeastern area of the reservoir, and the tree removal in the area would not be visible from publicly accessible vantage points. As summarized in Table E.2-1, only Staging Areas PP-S9 and PP-S5 would be visible from Priest-Coulterville Road, which runs north/south along the eastern side of the Priest Reservoir area.

Staging Area PP-S9 would be at the eastern terminus of the existing South Gate Access Road and would be visible to local residents and recreationists traveling on Priest-Coulterville Road (see Figure E.2-6). Staging Area PP-S5 is smaller than PP-S9, would be a graveled road turnout, and would also be visible to local residents and recreationists traveling on Priest-Coulterville Road (see Figure E.2-6). Both staging areas would be used for general construction equipment storage and require minor vegetation removal. The introduction of construction equipment, materials, and personnel would alter the visual character of these two staging areas, which are flat, open areas, bordered by vegetation and trees (Viewpoints 13 and 14). These changes would, however, be temporary during the construction phase, and passing recreationists and travelers would have fleeting glimpses of these staging areas. Following construction, the proposed project would restore these areas to their pre-project conditions, as described in Section A.6.10, Surface Restoration and Revegetation. Therefore, the proposed project would not substantially degrade the visual character of the Priest Reservoir area, and its visual impacts would be *less than significant.*

Impact Conclusion

In summary, most proposed staging areas that are visible to the public consist of vacant, cleared gravel and/or paved areas that already visually contrast with the surrounding areas. The presence of construction equipment and personnel would be of a temporary nature. The number of trees to be removed is minor, given the abundant tree coverage in the National Forest surrounding the work areas; for this reason, the removal of trees would not substantially degrade the existing visual character at any location that is visible from a publicly accessible vantage point. At Priest Reservoir, which is outside the National Forest, only a small amount of vegetation removal would occur at Staging Areas PP-S9 and PP-S5; these areas, which are visible from publicly accessible vantage points, are already graveled and paved and used periodically for staging activities. Therefore, the tree removal would not substantially alter views or the overall visual landscape. At the conclusion of construction activities, the staging areas (with the exception of PP-S6, which is not visible from a public vantage point) would be returned to pre-project conditions, including regrading of the site and revegetation or repaving of disturbed areas, as part of the proposed project (see Section A.6.10, Surface Restoration and Revegetation). The road improvements would proceed in a sequential fashion, so that construction equipment and personnel would only be visible for a short period of time at any given location. At the conclusion of construction activities, the access road improvements (i.e., road widening, turnouts, graveled or paved surface, drainage improvements, and rockfall and slope protection) would be noticeable and distinct from the surrounding forest vegetation, but they would be visually similar to existing roads throughout the project area. None of the proposed new aboveground facilities would be visible to the public. Therefore, the proposed project would result in a *less-than-significant* impact related to degradation of the existing visual character or quality.

Impact AE-4. The project would not create a new source of substantial light or glare that would adversely affect daytime or nighttime views in the area, or that would substantially affect other people or properties. (Less than Significant)

Because of the time-critical nature of the work occurring during a tunnel shutdown (five shutdowns total), the shutdown and in-tunnel construction activities would be completed in 24-hour workdays (typically two 10- to 12-hour shifts) on all 7 days of each available week. To support night work, night lighting would be required for construction activities at the main staging areas at Early Intake (EI-S3), South Fork (SF-S7), Adit 5/6 (A5/6-S2), Adit 8/9 (A8/9-S1), and Priest Portal (PP-S6, PP-S13, and PP-S15), as well as for nighttime work along the Adit 8/9 Access Road (Lumsden Road/Forest Service Road 1N10). These staging areas would not be visible to nearby residents. Night lighting may be required at other staging areas as well. Some of the staging areas would be visible to motorists on nearby local roadways and to recreationists traveling on Highway 120. However, the nighttime lighting would be temporary. Furthermore, SFPUC would implement best management practices associated with its Standard Construction Measure 8 (refer to Section A.6.11), which requires that nighttime lighting be directed away from residential areas and have shields to prevent light spillover effects. Most of the project-related work would be conducted underground. The new gravel and paved roads, adit and shaft entrances, and the electrical line over Priest Reservoir would not create a new source of light or glare. The existing facilities already have minimal permanent nighttime lighting for security purposes, which would not change as a result of project implementation. Therefore, this impact would be *less than significant.*

Impact C-AE. The project, in combination with reasonably foreseeable future projects in the vicinity, would not result in a significant cumulative aesthetics impact. (Less than Significant)

For a cumulatively significant impact to occur, construction and operation of one or more of the projects considered in this cumulative analysis would have to occur at the same time and affect the same publicly accessible vantage points as the proposed project. Therefore, the cumulative context for aesthetics is limited to projects within one-quarter mile of the project improvement, construction, and staging areas; this includes all of the projects considered in the cumulative analysis, as described in Table B-1.

Substantial Degradation of Scenic Views and Visual Character

The other projects considered in this cumulative analysis would involve minor new barbed wire fencing and cattle corrals, construction of new trails, habitat enhancement and reforestation in the Rim Fire burn area, and rehabilitation and replacement of Early Intake facilities. The approximately 3.5 miles of new cattle fencing and corrals would be consistent with existing cattle fencing and corrals scattered throughout the Stanislaus National Forest and nearby private lands, and these facilities tend to blend in with the existing landscape character. New trails would be designed according to Stanislaus National Forest recreational and visual guidelines, which are specifically designed to avoid degradation of scenic vistas and visual character. The rehabilitated and replaced facilities in the Early Intake area would be visually similar to the existing facilities. Rehabilitation in the Rim Fire burn area would, over time, promote new tree plantings and improve visual conditions in the Stanislaus National Forest, consistent with forest management direction. Therefore, the proposed project, in combination with these other projects, would not combine to result in significant cumulative impacts on scenic views or visual character.

The SFPUC's Early Intake Dam Rehabilitation and Bridge Replacement Projects would include staging and work areas where construction personnel and equipment, along with operation of new facilities, would be visible from public vantage points. However, as with the proposed project, road improvements include graveling, paving, and culvert installation, the end result of which are access roads that appear visually similar to existing roads on public and private land throughout the Stanislaus National Forest. Replacement of the Early Intake Bridge to help avoid flood flows would result in operation of a new bridge that is visually similar to the existing bridge across the Tuolumne River. Operation of the rehabilitated Early Intake Dam and associated facilities would be visually similar in appearance to the existing Early Intake Dam and facilities. Furthermore, these proposed improvements at Early Intake would not occur within the designated Wild and Scenic River corridor.

The Stanislaus National Forest plans to implement a series of projects to conduct approximately 48,000 acres of treatments on national forest system lands in the 2013 Rim Fire burn area. The proposed treatments include wildlife and plant habitat enhancement, natural regeneration, noxious weed eradication, removal of hazard trees, improvement of existing U.S. Forest Service roads for hydrologic function, reforestation, meadow restoration, and installation of water troughs. These treatments would improve scenic vistas, improve the existing visual character and quality, improve the overall viewshed from designated scenic highways, and would not introduce new sources of light and glare.

Most of the work associated with the proposed project would be performed underground, and therefore would not be visible to the public. Although it may be possible for aboveground construction equipment, staging areas, road improvement areas, and personnel associated with both the proposed project and the additional projects considered in this cumulative analysis to be visible from the same publicly accessible vantage point at the same time, the amount of visible equipment and personnel would be minor at any one location, and construction activities would be temporary. At the conclusion of proposed project-related construction activities, most staging areas would appear visually similar to existing conditions and would be revegetated as described in Section A.6.10, Surface Restoration and Revegetation. Where existing dirt access roads would be graveled or paved, the new road surfaces would be visually similar to other roadways throughout the Stanislaus National Forest. Therefore, the proposed project, in combination with the other projects considered in this cumulative analysis, would not result in a significant cumulative impact from adverse effects on scenic vistas or degradation of visual character.

Substantial New Light, Glare, and Nighttime Lighting

Neither the proposed project nor the other projects considered in this cumulative analysis would create long-term permanent new sources of light or glare. Like the proposed project, the Early Intake Dam Rehabilitation and Early Intake Bridge Replacement projects would require small amounts of localized nighttime lighting at work sites during construction activities. However, due to the limited area from which this nighttime lighting would be visible, the lack of sensitive viewers (recreationists) in or traveling through the Early Intake area at night, and the fact that nighttime lighting during construction would be temporary in nature, these two projects, in combination with the proposed project, would not result in a significant cumulative impact related to light and glare. The proposed project would also require small amounts of localized nighttime lighting at other work sites during construction activities. For the same reasons described above (visible only from a small, localized area bounded by steep canyon walls, lack of sensitive viewers, and the temporary nature of the lighting), the proposed project would not combine with the other projects considered in this cumulative analysis to result in a significant cumulative impact related to nighttime lighting.

E.3 Population and Housing

Topics:	*Potentially Significant Impact*	*Less than Significant with Mitigation Incorporated*	*Less-than-Significant Impact*	*No Impact*	*Not Applicable*
3. POPULATION AND HOUSING Would the project:					
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☒	☐	☐
b) Displace substantial numbers of existing housing units, necessitating the construction of replacement housing?	☐	☐	☐	☒	☐
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒	☐

Impact PH-1. The project would not induce substantial population growth in an area, either directly or indirectly. (Less than Significant)

In general, a project would be classified as growth-inducing if it would result in a significant increase of the local population or create a new development that would not have been established if the project were not executed. The City and County of San Francisco, through the SFPUC, owns and operates the regional water system that extends from the Sierra Nevada to San Francisco and serves San Francisco, San Mateo, Santa Clara, Alameda, and Tuolumne counties. The SFPUC has adopted and implemented two major capital improvement programs to meet the SFPUC's service goals and system performance objectives for the regional system; these programs include the Water System Improvement Program and the Hetchy Capital Improvement Projects. The Mountain Tunnel Improvements Project is one project of many designed to help the SFPUC achieve the goals of these two capital improvement programs.

The proposed project would improve the condition of the Mountain Tunnel to ensure its continued ability to provide reliable, high-quality drinking water to customers by repairing the deteriorating tunnel lining and removing the accumulation of debris in the tunnel. The proposed project would restore, not expand, the capacity of the Mountain Tunnel, and it would not expand the capacity of other key portions of the regional water system or increase the amount of water supplied to customers. Section A.7.1, Mountain Tunnel Operations, includes more details on water supply.

The volume of water that is transported to the Bay Area is constrained by the requirements of the Water System Improvement Program water supply decision, which requires implementation of mitigation measures in the event that annual average watershed deliveries exceed 265 million gallons per day.[83] Under the SFPUC's current demand projections, total demand is not expected to exceed 265 million gallons per day until after the end of the 2040 planning horizon currently used by the SFPUC. The operation of the project would not cause an increase in either demand for water or the amount of water supplied to customers. Although the project would result in the restoration of an additional 8 cubic feet per second of conveyance capacity through the Mountain Tunnel that had been lost over many decades

[83] San Francisco Planning Department, Final Program Environmental Impact Report for the San Francisco Public Utilities Commission's Water System Improvement Program, October 30, 2008, accessed January 14, 2019.

due to deterioration of the tunnel lining, the project would not expand the capacity of other key portions of the Hetch Hetchy Aqueduct such as the Foothill Tunnel, San Joaquin Pipelines, or Coast Range Tunnel. Alterations to the Mountain Tunnel component of the system would not require or result in changes to other components of the water supply operations. Therefore, the proposed project would not directly or indirectly induce the development of residences, roads, or infrastructure, or indirectly support unplanned development by communities served by water delivered through the Mountain Tunnel, because it would not change the demand for water or the amount of water supplied to SFPUC customers. For the reasons described above, the proposed improvements to the Mountain Tunnel component of the system would not require or result in changes to other components of the water supply operations. Therefore, the project would not induce population growth.

Project construction would occur between 2020 and 2026. The average number of construction personnel working simultaneously during the construction period would range between 30 and 115 workers (refer to Table A-2 in Section A, Project Description). The number of construction workers onsite would vary depending on specific construction activities and the construction phase. Although the source of the construction labor force is undetermined, it is anticipated that the regional labor force would meet the construction demand of this project, based on other capital improvement projects for the SFPUC.[84] It is expected that most of the construction crews would reside locally, in Sonora or Oakdale, and therefore would not permanently increase population in Groveland, the principal community in the project vicinity.[85] It is possible that a small portion of the workers would travel longer distances. According to the 2016 American Community Survey, there are high vacancy rates in the housing and rental markets in Groveland, Sonora, and Oakdale.[86,87,88] Therefore, there would be capacity in the local housing and rental market to accommodate a small increase in demand, if necessary.

Once the tunnel has been rehabilitated, it would be placed back into long-term service, and no additional permanent SFPUC staff would be hired. The SFPUC has adopted performance standards for this project that include a 10-day minimum planned shutdown for tunnel inspections every 10 years following its rehabilitation, and a 100-day planned shutdown of the tunnel every 20 years to allow for maintenance activities. Maintenance activities would include daily and monthly inspections of the flow control facility, and as-needed repairs along certain access roadways to ensure safe access to each of the adits and project components. Because of the short duration or the infrequency of these maintenance activities, it is expected that they would be performed by existing SFPUC staff and/or contractors. If there is a need to augment SFPUC staff during infrequent planned shutdowns, the regional labor force could meet the temporary maintenance needs for this project, and, thus, the proposed project during operations would not induce direct or indirect population growth.

For these reasons, construction, operation, and maintenance activities associated with the project would not be directly or indirectly growth-inducing, and the proposed project would have a *less-than-significant* impact on population growth in the region.

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84 Tsztoo, David, Mountain Tunnel Regional Manager, San Francisco Public Utilities Commission, e-mail correspondence with Rodney Jeung, Environmental Planning Director, AECOM, August 6, 2018.

85 Rundle, Mark, employee, San Francisco Public Utilities Commission, e-mail correspondence with Rodney Jeung, Environmental Planning Director, AECOM, August 8, 2018.

86 United States Census Bureau, 2012-2016 American Community Survey 5-Year Estimates, Groveland, California, *https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF*, accessed September 26, 2018.

87 United States Census Bureau, 2012-2016 American Community Survey 5-Year Estimates, Oakdale, California, *https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF*, accessed September 26, 2018.

88 United States Census Bureau, 2012-2016 American Community Survey 5-Year Estimates, Sonora, California, *https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF*, accessed September 26, 2018.

Impact PH-2. The project would not displace substantial numbers of existing housing units or create demand for additional housing, necessitating the construction of replacement housing. (No Impact)

There are no existing housing units on any of the proposed project improvement, construction, or staging areas. The proposed project would not create a demand for additional housing because, as discussed in Impact PH-1, it would not be a growth-inducing project. The proposed project would not displace any housing or require the construction of replacement housing. Therefore, the proposed project would have *no impact* relative to the displacement of housing.

Impact PH-3. The project would not displace substantial numbers of people, necessitating the construction of replacement housing. (No Impact)

As discussed in Impact PH-2, there are no existing housing units on the proposed project improvement, construction, or staging areas. The proposed project would not displace people or require the construction of replacement housing. Therefore, the project would have *no impact* relative to the displacement of people.

Impact C-PH. The proposed project, in combination with reasonably foreseeable future projects in the vicinity, would not result in a significant cumulative impact on growth or housing. (Less than Significant)

The geographic scope of potential cumulative population and housing impacts encompasses the 19-mile-long project area and the surrounding communities of Groveland, Sonora, and Oakdale that would temporarily accommodate construction workers for the Mountain Tunnel Improvements Project. None of the cumulative projects listed in Table B-1, would be anticipated to add a substantial number or amount of new permanent residents, housing, and/or employment to the area. Most of the cumulative projects involve long-term construction, restoration, and maintenance activities.

As discussed in Impact PH-1, potential project-specific population and housing impacts would be temporary and limited to the possibility of a slight temporary increase in demand in the rental property market in the communities of Groveland, Sonora, and Oakdale. Projects listed in Table B-1 could also result in temporary population growth due to short-term construction worker relocation, if required. These projects have varied construction schedules.

Once rehabilitated, the operation of the Mountain Tunnel would not require an increase in workers and would therefore not result in a permanent increase in population. As discussed in Impact PH-1, the proposed project would not directly generate the need for the development of residences, roads, or infrastructure, or indirectly support unplanned development by communities served by water delivered through the Mountain Tunnel. Operations and maintenance activities for most of the projects identified in Table B-1 would likely be staffed by current employees of, or contractors to, the SFPUC, the U.S. Forest Service, and Caltrans. For these reasons, project construction and operation, in combination with the other cumulative projects in the vicinity, would not induce substantial population growth, and a significant cumulative impact on population and housing growth would not occur.

As discussed in Impacts PH-2 and PH-3, the proposed project would not displace housing or people, resulting in the need for replacement housing. Therefore, there would be no cumulative impact associated with displacement of people or housing.

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E.4 Cultural Resources

Topics:	*Potentially Significant Impact*	*Less than Significant with Mitigation Incorporated*	*Less-than-Significant Impact*	*No Impact*	*Not Applicable*
4. CULTURAL RESOURCES Would the project:					
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5, including those resources listed in Article 10 or Article 11 of the San Francisco *Planning Code*?	☐	☐	☒	☐	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	☐	☒	☐	☐	☐
c) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☒	☐	☐	☐
d) Cause a substantial adverse change in the significance of a tribal cultural resource as defined in Public Resources Code §21074?	☐	☒	☐	☐	☐

Approach to Analysis

Under CEQA, a cultural resource is considered significant if it meets the criteria for listing in the California Register of Historical Resources (California Register). Significant cultural resources are termed "historical resources" under CEQA. These include both built-environment historic resources and historic and prehistoric archeological resources. CEQA section 15064.5 defines as significant any resource that:

- Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage
- Is associated with lives of persons important in our past
- 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
- Has yielded, or may be likely to yield, information important in prehistory or history

Resources that are listed in or formally determined to be eligible for listing in the National Register of Historic Places (National Register) are automatically listed in the California Register and are therefore considered historical resources for the purposes of CEQA.[89]

Article 10 and article 11 of the San Francisco Planning Code pertain to individual city landmarks and historic districts, and to conservation districts in San Francisco's downtown core area (C-3 district), respectively. Because the project does not propose improvements in San Francisco, and there are no designated San Francisco landmarks or districts in any of the proposed project improvement, construction, and staging areas, article 10 and article 11 would not apply to the project.

Prior to assessing potential impacts that could result with project implementation, the area of potential effects for each cultural resource sub-discipline (i.e., archeology and historic architecture) was established for the proposed project. According to 36 Code of Federal Regulations (CFR) 800.16(d), the "Area of potential effects

[89] The San Francisco Planning Department is the lead CEQA agency and is responsible for making California Register eligibility determinations discussed in this section. State Historic Preservation Officer consultation is underway with the U.S. Forest Service and concurrences on National Register eligibility determinations are pending, but concurrence with the eligibility reported in this section has been assumed.

means the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking." The city has adopted nearly identical language for the delineation of a CEQA-area of potential effects, an area of potential effects established for assessment of potential project effects to resources eligible for addition to the California Register, but not developed in consultation with the State Historic Preservation Officer.[90] For the current undertaking, the area of potential effects and CEQA-area of potential effects are identical, and the term "area of potential effects" is used in this document.

Both direct and indirect effects of project implementation were considered for this analysis. Direct impacts are typically associated with construction and/or ground-disturbing activities, and have the potential to immediately alter, diminish, or destroy all or part of the character and quality of archeological resources and/or historic architecture. Indirect impacts are typically associated with post-project implementation conditions that have the potential to alter or diminish the historical setting of a cultural resource (generally historic architectural properties) by introducing visual elements that that are incompatible with the location, design, setting, feeling, or historical associations that contribute to the resource's significance.

Implementation of the proposed project is not anticipated to result in indirect effects to archeological resources. Typical indirect effects, those that are reasonably foreseeable, tend to involve increased levels of vandalism or looting of archeological resources due to increased public access to resource locations. Because the proposed project is not providing new access to the general public, and because much of the project area is not accessible to the general public, there is no reason to believe that archeological resources would experience increased looting or vandalism as a result of project implementation.

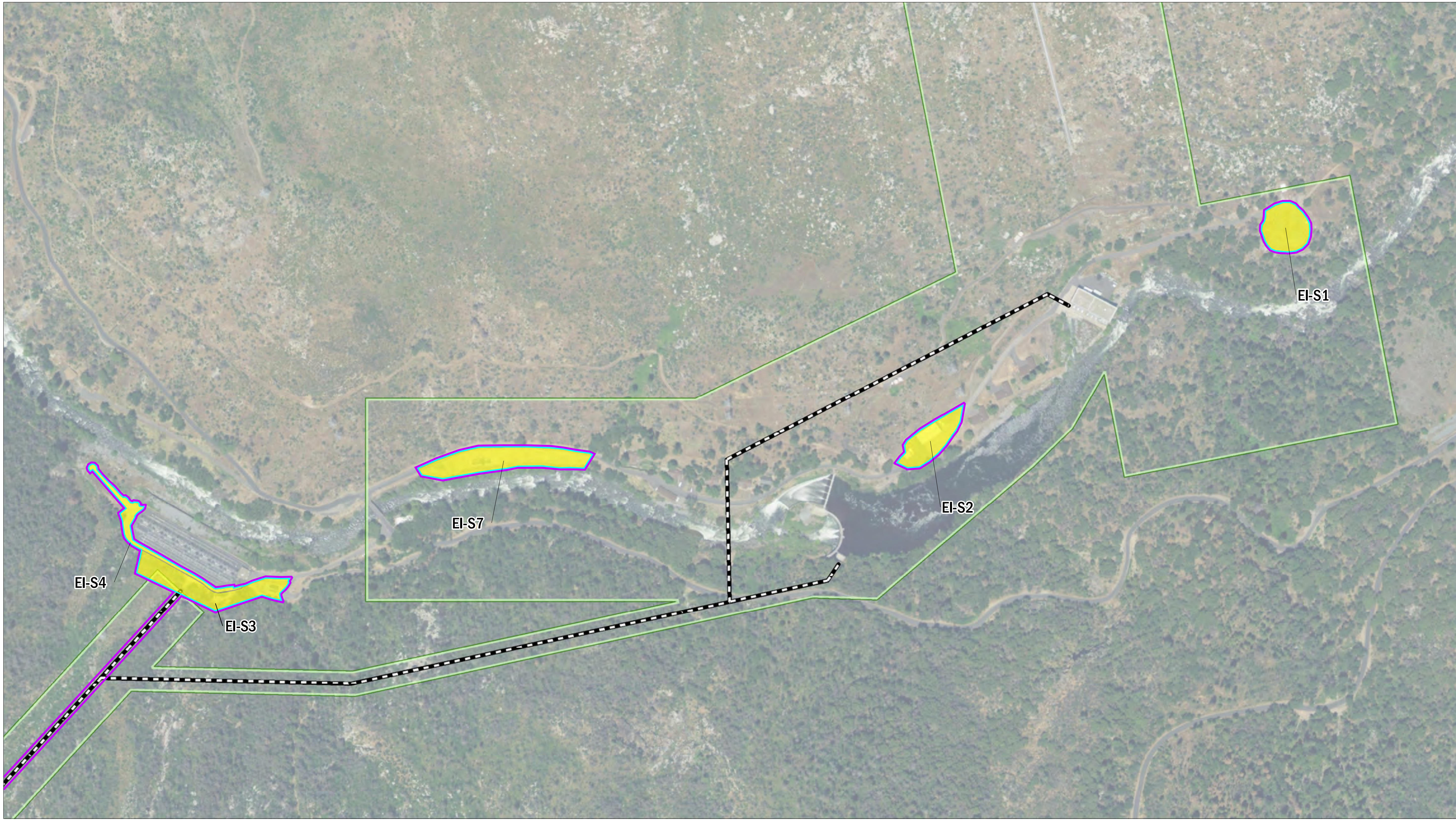
Area of Potential Effects as Delineated for Archeological Resources

For archeological resources, the area of potential effects includes all proposed ground-disturbing activities, as shown on Figure E.4-1. The vertical area of potential effects extends to the maximum depths of anticipated project excavations for all proposed ground-disturbing activities.

As depicted on Figure E.4-1, the ground-disturbing work activities associated with the project would take place in a number of noncontiguous project areas on the surface along the Mountain Tunnel corridor. The tunnel itself is not, however, included in the area of potential effects for archeological resources, because the proposed modifications and repairs to the interior of the existing tunnel would not result in ground disturbance from the land surface, and therefore would not pose a potential for effects to archeological resources. The delineation of each of the area of potential effects' discontiguous locations (i.e., the proposed project improvement, construction, and staging areas) and the justifications for the horizontal and vertical limits of the area of potential effects at each location are presented by project component work area (from east to west):

- Early Intake Adit area
- South Fork Siphon Extension and Adit area
- Adit 5/6 area
- Adit 8/9 area
- Big Creek Shaft area
- Second Garrote Shaft area
- Priest Reservoir area

[90] San Francisco Planning Department, *Archeological Glossary and Usage Guide for CEQA Documents*, Environmental Planning Division, 2013.



San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 6/10/2019

Mountain Tunnel Alignment
Raker Act
Area of Potential Effects - Historic Architecture
Area of Potential Effects - Archeology

Proposed Project Components
Staging Area

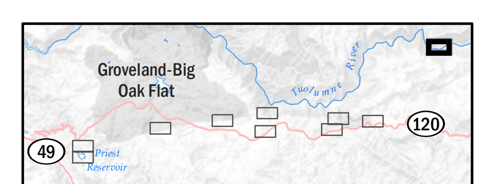
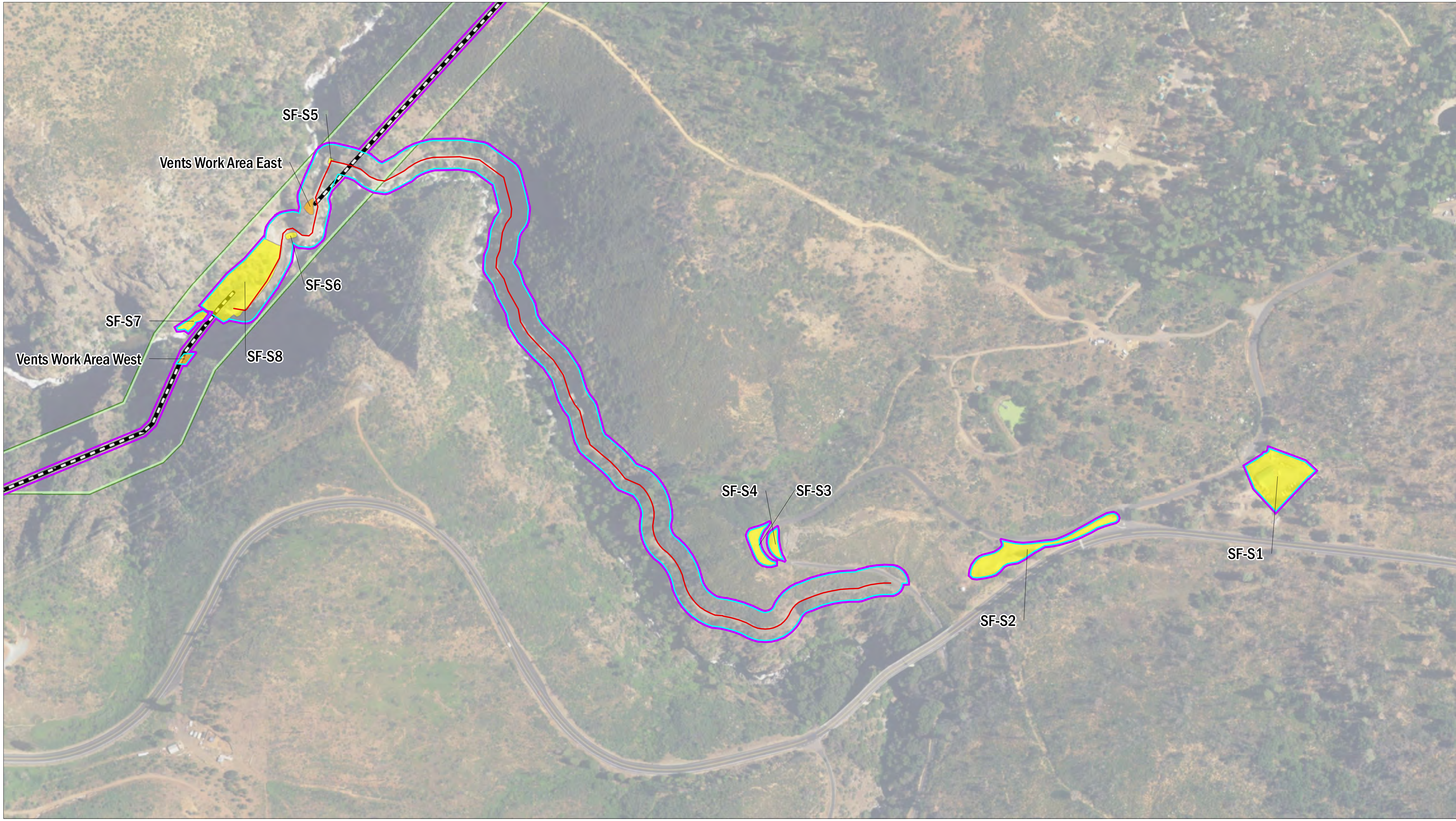


FIGURE E.4-1
Area of Potential Effects
Early Intake Area
Sheet 1 of 10



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Feet

MJA, 2019
NAIP Imagery, 2016

San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 6/10/2019

Mountain Tunnel Alignment
Raker Act
Area of Potential Effects - Historic Architecture
Area of Potential Effects - Archeology

Proposed Project Components
Proposed Road and Drainage Improvement
Staging Area
Work Area

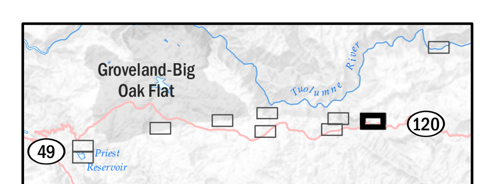
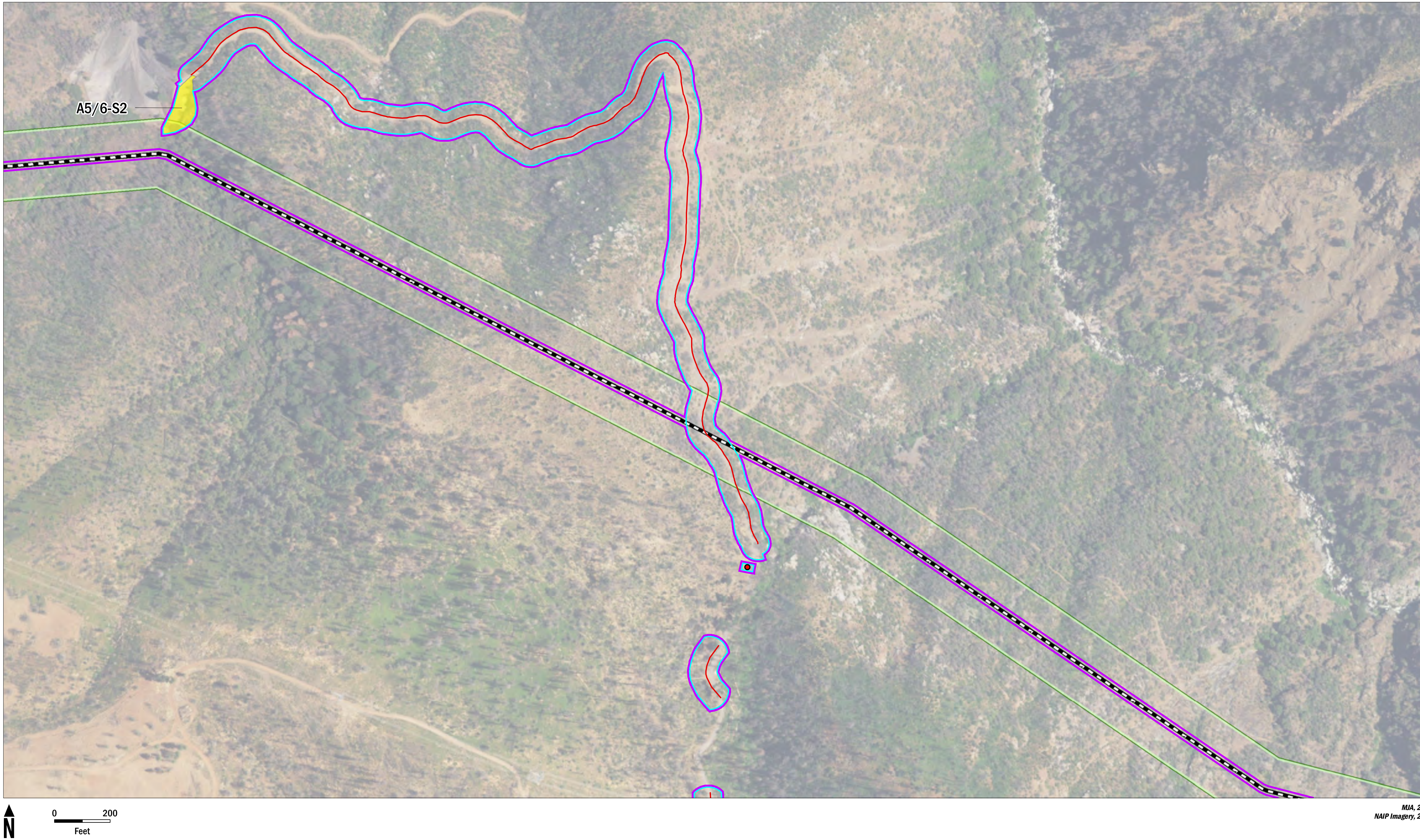


FIGURE E.4-1

Area of Potential Effects
South Fork Crossing Area
Sheet 2 of 10



San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 6/10/2019

Mountain Tunnel Alignment
Raker Act
Area of Potential Effects - Historic Architecture
Area of Potential Effects - Archeology

Proposed Project Components
Proposed Road and Drainage Improvement
Proposed Road and Drainage Improvement
Staging Area

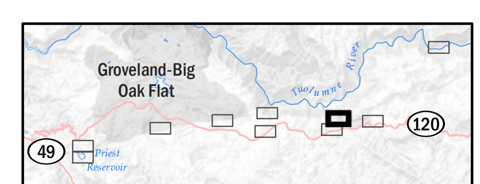


FIGURE E.4-1
Area of Potential Effects
Adit 5/6 Area
Sheet 3 of 10

San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 6/10/2019

Area of Potential Effects - Historic Architecture
Area of Potential Effects - Archeology

Proposed Project Components
Proposed Road and Drainage Improvement
Staging Area

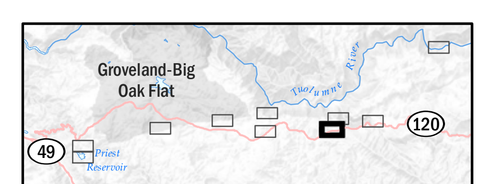
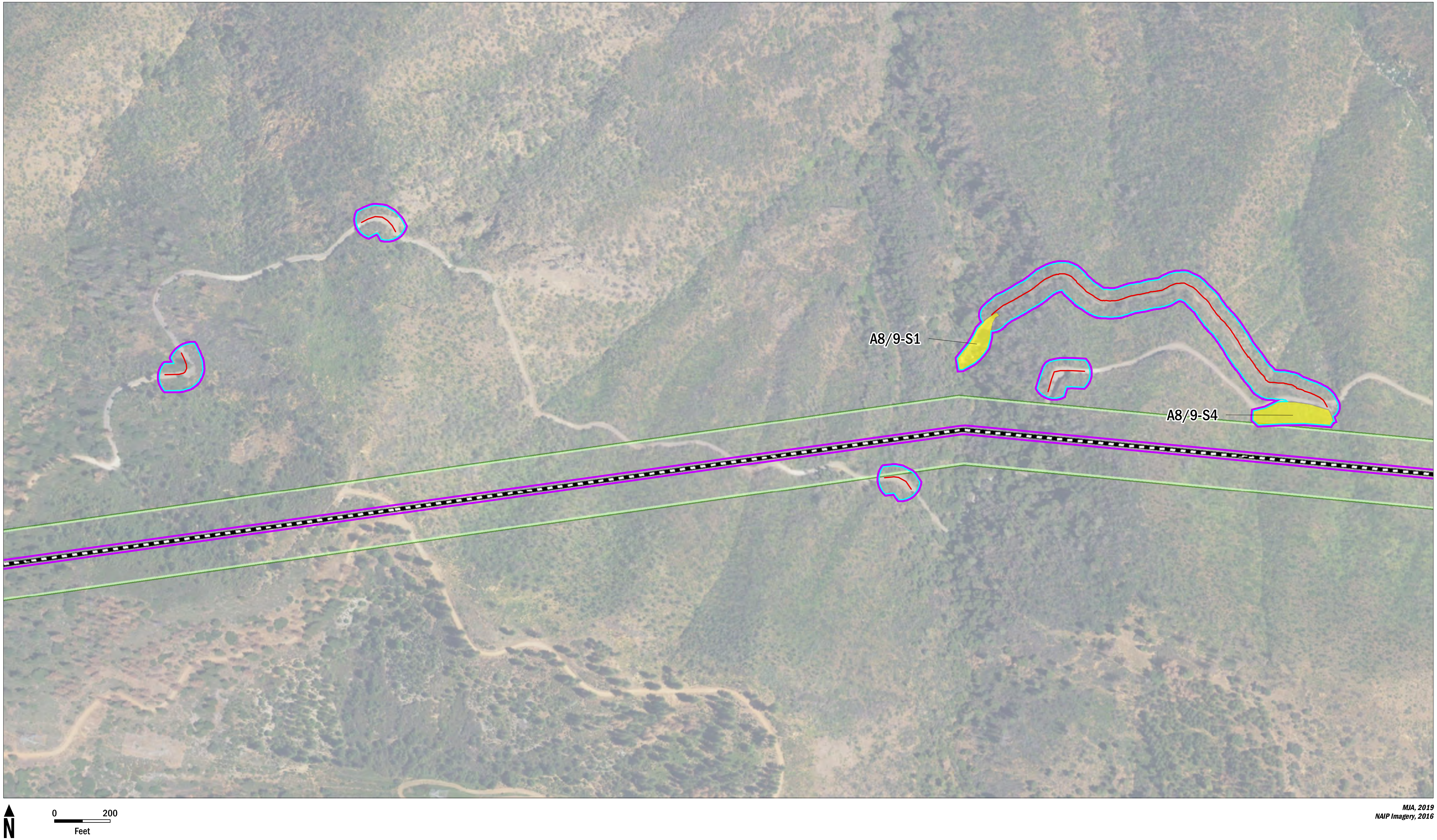


FIGURE E.4-1
Area of Potential Effects
Adit 5/6 Area
Sheet 4 of 10



San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 6/10/2019

Mountain Tunnel Alignment
Raker Act
Area of Potential Effects - Historic Architecture
Area of Potential Effects - Archeology

Proposed Project Components
Proposed Road and Drainage Improvement
Staging Area

FIGURE E.4-1
Area of Potential Effects
Adit 8/9 Area
Sheet 5 of 10

San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 6/10/2019

Area of Potential Effects - Historic Architecture
Area of Potential Effects - Archeology
Proposed Project Components
Staging Area

FIGURE E.4-1
Area of Potential Effects
Adit 8/9 Area
Sheet 6 of 10

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Feet

MJA, 2019
NAIP Imagery, 2016

San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 6/10/2019

Mountain Tunnel Alignment
Raker Act
Area of Potential Effects - Historic Architecture
Area of Potential Effects - Archeology

Proposed Project Components
Staging Area

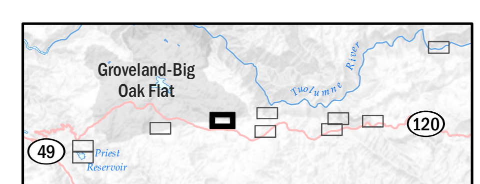
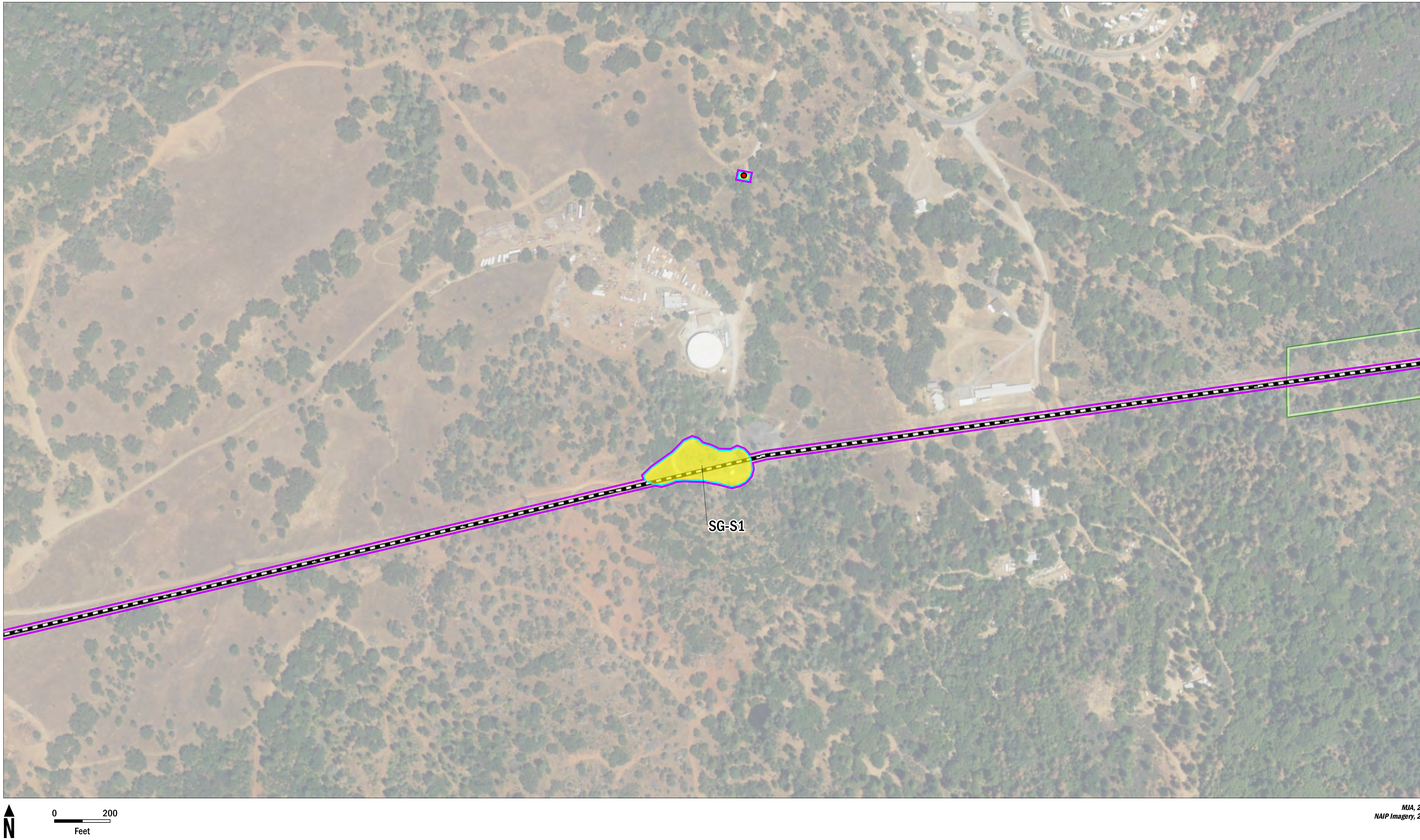


FIGURE E.4-1

Area of Potential Effects
Big Creek Shaft Area
Sheet 7 of 10



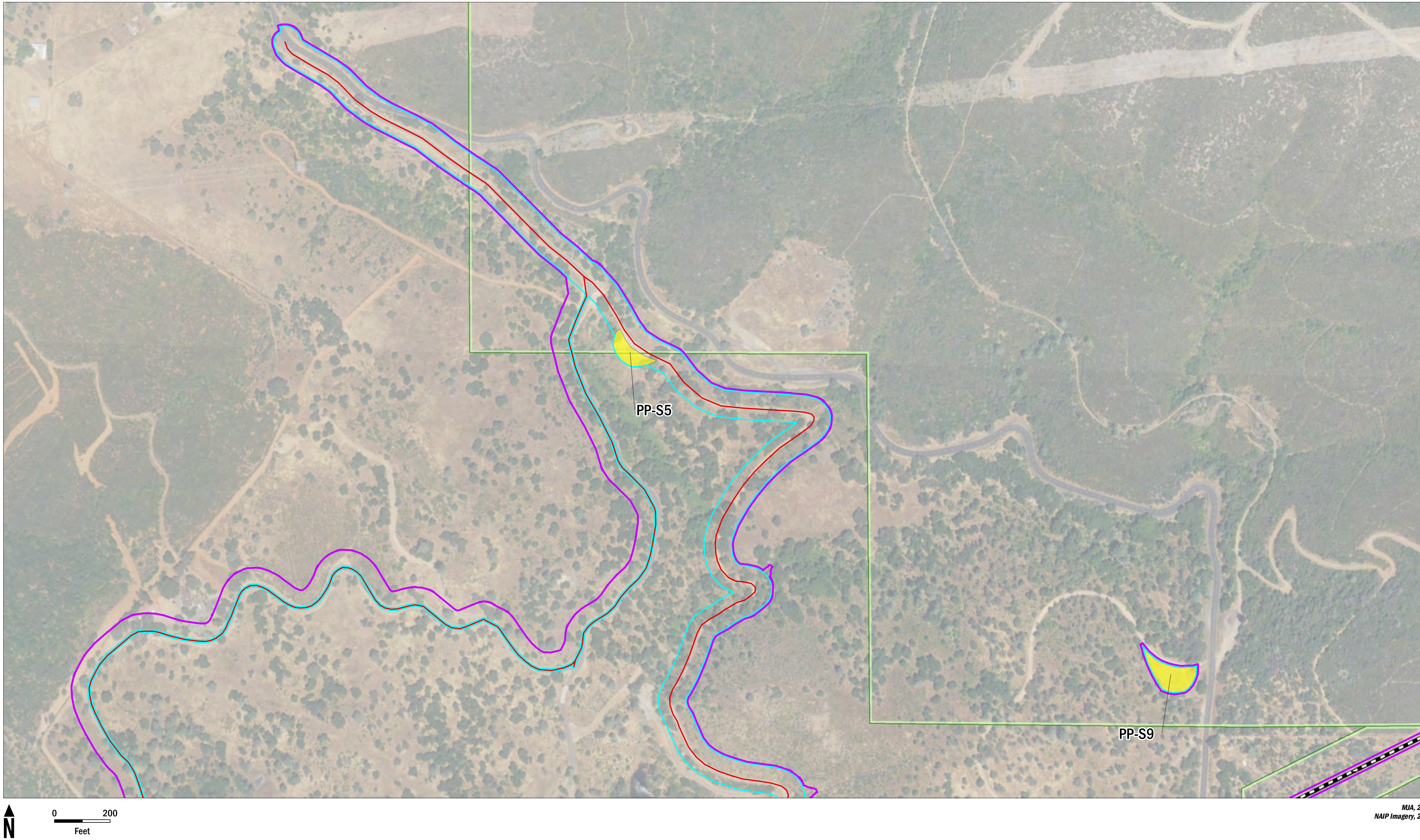
San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 6/10/2019

Mountain Tunnel Alignment
Raker Act
Area of Potential Effects - Historic Architecture
Area of Potential Effects - Archeology

Proposed Project Components
Proposed Road and Drainage Improvement
Staging Area

FIGURE E.4-1

Area of Potential Effects
Second Garrote Shaft Area
Sheet 8 of 10



San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 6/10/2019

Mountain Tunnel Alignment
Raker Act
Area of Potential Effects - Historic Architecture
Area of Potential Effects - Archeology

Proposed Project Components
Proposed Road and Drainage Improvement
Staging Area

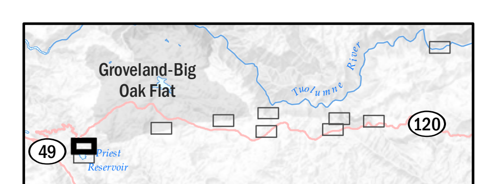
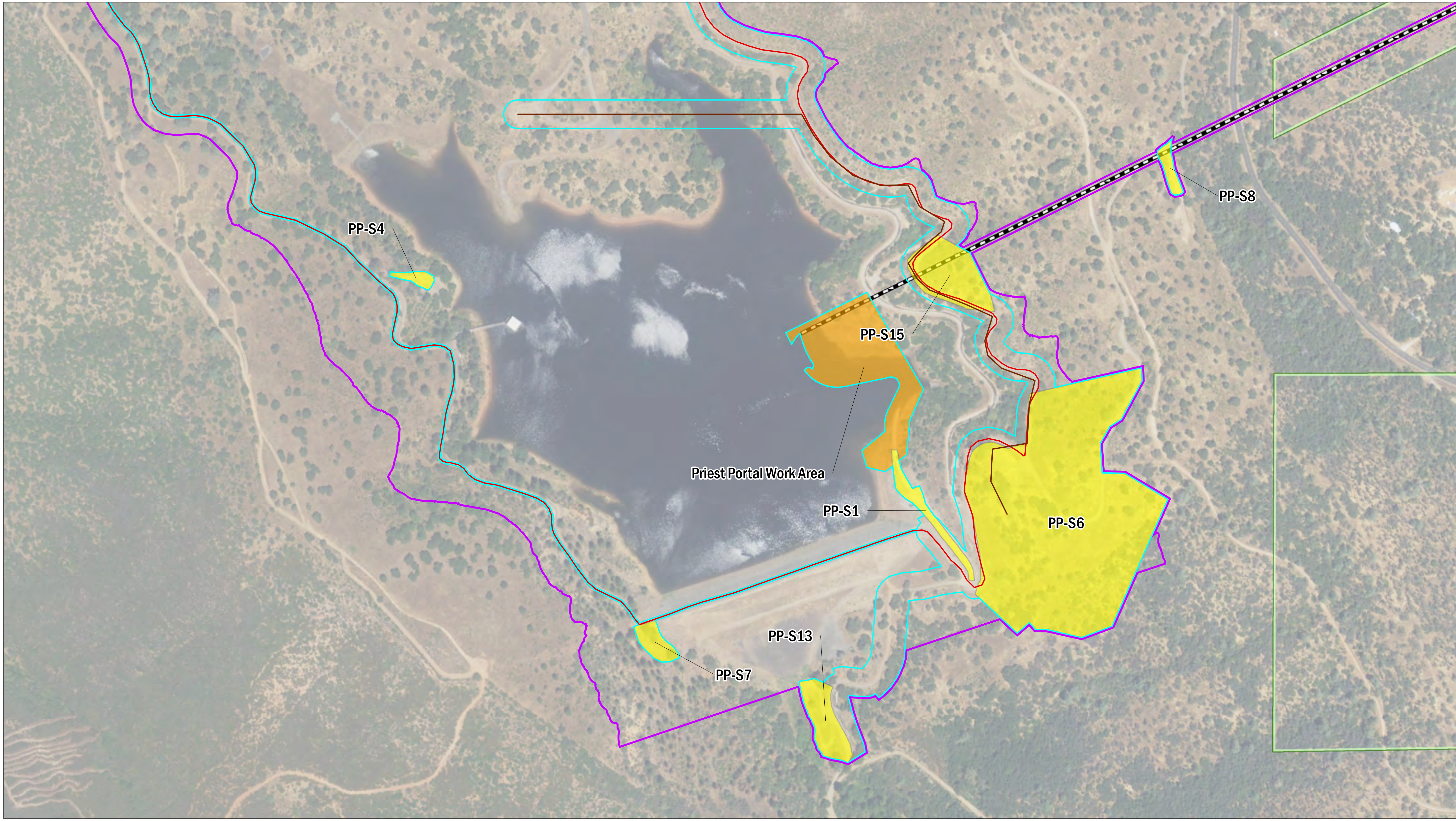


FIGURE E.4-1

Area of Potential Effects
Priest Reservoir Area
Sheet 9 of 10



San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 6/10/2019

Mountain Tunnel Alignment
Raker Act
Area of Potential Effects - Historic Architecture
Area of Potential Effects - Archeology

Proposed Project Components
Proposed Road and Drainage Improvement
Proposed Power Distribution Alignment
Staging Area
Work Area

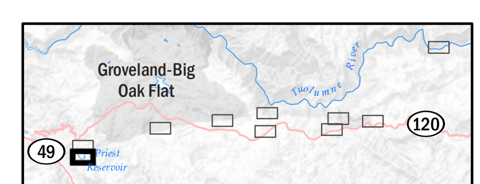


FIGURE E.4-1
Area of Potential Effects
Priest Reservoir Area
Sheet 10 of 10

Although these project components are geographically separated, only a single area of potential effects is delineated for archeological resources, because the proposed project is considered a single undertaking.

Vertical Area of Potential Effects at Each Project Component Work Area

Given the complexity of the proposed project, the depth of project-related disturbance (to delineate the vertical extent of the archeological resources area of potential effects) varies widely. Table E.4-1 identifies the anticipated vertical extent of the area of potential effects (in feet below ground surface) for each project component that involves ground disturbance at each individual work area. The horizontal area of each element is illustrated on Figure E.4-1.

Table E.4-1
Maximum Vertical Extent of APE by Improvement at Each Project Component Work Area

Early Intake Adit
• Trenching for new piping and gate valves – 2.5 feet bgs • Excavation of new bulkhead – 4 feet bgs • Preparation and routine use at Staging Areas EI-S1, EI-S2, EI-S3, EI-S4, and EI-S7 – less than 1 foot bgs
South Fork Siphon Extension and Adit
• Controlled detonation/excavation for vertical access shaft – 105 feet bgs • Drilling of vent holes – 130 feet bgs • Preparation and routine use at Staging Areas SF-S1, SF-S3, SF-S4, SF-S5, and SF-S6 – less than 1 foot bgs • Preparation and routine use at Staging Areas SF-S2 – no excavation; only geotextiles and gravel used for surface preparation • Localized scaling to remove rock hazards at Staging Areas SF-S5 and SF-S6 – less than 4 feet bgs (i.e., into the nearly vertical surface) • Leveling and obstruction removal at Staging Areas SF-S7 and SF-S8 – up to 5 feet bgs of existing debris (e.g., fractured roadbed and tunnel spoils) • South Fork Access Road (FSR 1S28B): – a maximum 40-foot vertical cut on the upslope side of the existing roadbed to accommodate road widening and turnouts – 10 feet bgs for gabion/concrete fill embankments downslope from roadbed – up to 30 feet bgs for rock dowels (i.e., into the nearly vertical rock face) – 10 feet bgs for retaining walls downslope from roadbed to support turnouts – up to 4 feet bgs to prepare roadbed for construction of proposed improvements
Adit 5/6
• Trenching for culvert at adit entrance – 5 feet bgs • Preparation and routine use at Staging Areas A5/6-S1 and A5/6-S2 – less than 1 foot bgs • Adit 5/6 Access Road (inclusive of FSR 1S01): – A maximum 40-foot bgs cut upslope from the roadbed to accommodate road widening and turnouts – 5 feet bgs to install new road culverts – 30 feet bgs for micropiles in the roadbed to support cantilevered road sections – 10 feet bgs for gabion embankments and retaining walls downslope from roadbed – less than 4 feet bgs for localized scaling to remove rock hazards – up to 30 feet bgs for rock dowels (i.e., into the nearly vertical rock face)

Table E.4-1
Maximum Vertical Extent of APE by Improvement at Each Project Component Work Area (Continued)

Adit 8/9
• Trenching for culvert at adit entrance – 5 feet bgs • Preparation and routine use at Staging Areas A8/9-S1, A8/9-S3, A8/9-S5, and A8/9-S6 – less than 1 foot bgs • Excavation required to create Staging Area A8/9-S4 – 40 feet bgs • Adit 8/9 Access Road (inclusive of FSR 1N10/Lumsden Road): – a maximum 40-foot bgs cut upslope from the roadbed to accommodate road widening and turnouts – 14 feet bgs for gabion embankments and retaining walls downslope from the roadbed – less than 4 feet bgs for localized scaling to remove rock hazards – up to 30 feet bgs for rock dowels (i.e., into the nearly vertical rock face)
Big Creek Shaft
• Preparation and routine use at Staging Area BC-S2 – less than 1 foot bgs
Second Garrote Shaft
• Excavation for new nonpermeable membrane and gravel – 1 foot bgs • New fence installation – 3 feet bgs • Preparation and routine use at Staging Area SG-S1 – less than 1 foot bgs • Culvert replacement – 5 feet bgs
Priest Reservoir
• Controlled detonation/excavation vertical access shaft – 190 feet bgs (30 feet bgs for the shaft pad at PP-S15 and then 160 feet down from the pad for the shaft) • Controlled detonation/excavation for new portal and adit – 49 feet bgs • Footings for flow control facility structure – 5 feet bgs • Power pole installation – 10 feet bgs • Preparation and routine use at Staging Areas PP-S1, PP-S4, PP-S5, PP-S7, PP-S8, PP-S9 as well as the Priest Portal Work Area – less than 1 foot bgs • Excavation required to create Staging Area PP-S6 and spoil disposal sites – 44 feet bgs • Excavation for Staging Area PP-S13 (including temporary water treatment plant) – 20 feet bgs • Rickson Road – a maximum 30-foot vertical cut upslope from the roadbed (up to 30 feet bgs for rock dowels [i.e., into the nearly vertical rock face]) • 10 feet bgs for gabion embankments and retaining walls downslope from the roadbed

Notes:

APE = Area of Potential Effects
bgs = below ground surface
FSR = Forest Service Road

Area of Potential Effects as Delineated for Historic Architectural Resources

The area of potential effects for historic architectural resources includes both direct and indirect effects, including all ground-disturbing activities, the entire alignment of the Mountain Tunnel, as well as the Priest Reservoir vicinity (Figure E.4-1). Proposed work on features of the Mountain Tunnel, like the Priest Portal, are considered direct impacts; extensive proposed modifications to the local topography, like spoils piles and the introduction of a relatively large new structure (flow control facility) are considered indirect impacts. The potential for indirect visual effects to historic architectural properties in the Priest Reservoir vicinity was determined based on the maximum height of the proposed new flow control structure (2,340 feet, North American Vertical Datum of 1988). A contour line at this maximum elevation was drawn around topographic features in its vicinity to delineate the viewshed for the new structure. Use of this maximum building height and the corresponding contour was deemed appropriate because the indirect area of potential effects drawn on this basis captures all potential built environment architectural resources within eyesight of the aboveground portion of the proposed flow control facility.

Baseline conditions for archeological and historic architectural resources in the project area of potential effects are documented in the *historic context and archeological survey report*[91] and *historic resources evaluation addendum*[92] that were prepared for this project, as well as the *historic resources evaluation*[93] prepared for the SFPUC's Mountain Tunnel Access and Adit Project. The key results of these efforts are summarized below.

Mountain Tunnel

The Mountain Tunnel is a historical resource because the State Historic Preservation Officer concurred with a qualified architectural historian's determination that it is eligible for listing in the National Register in 2018. The period of significance corresponds with the start of construction in 1917 until 1934, when the tunnel first succeeded in serving as a crucial link in the delivery system of water to San Francisco.

As part of the evaluation of the Mountain Tunnel as a historical resource, a qualified architectural historian identified both the character-defining and non-character-defining features of the Mountain Tunnel. The character-defining features are the length, alignment, and shape of excavation of the tunnel, adits, and shafts. Other character-defining features include the concrete portals at Adits 4/5, 5/6, and 8/9; and the intake valve house,[94] including its concrete construction, building footprint and form, steel sash windows, steel personnel door, gates and their control system, grizzlies, exterior pipe railing, telephone box, and exterior hanging light fixture on the northern side.

Non-character-defining features of the Mountain Tunnel include the concrete bulkheads and watertight doors added to Early Intake Adit, Adit 5/6, and Adit 8/9 in 1997; the South Fork siphon; the Priest Bypass; the modern pump houses and tanks located at Big Creek Shaft and Second Garrote Shaft; the remnants of compressor foundations outside Adit 5/6 (since demolished); Adit 8/9 (since demolished); and Second Garrote Shaft.[95]

As part of the *historic resources evaluation addendum* for the proposed project, AECOM, on behalf of the San Francisco Planning Department, prepared an updated DPR 523 form to evaluate the South Fork Adit portals and remnant concrete piers at the South Fork crossing of the Mountain Tunnel. Although the previous recordation attempted to record the South Fork crossing section of the Mountain Tunnel in 2015,

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[91] URS (a subsidiary of AECOM), *Historic Context and Archeological Survey Report for the Mountain Tunnel Improvements Proje*ct, report prepared for the San Francisco Public Utilities Commission and the San Francisco Planning Department, Environmental Planning Division, URS, San Francisco, California, 2019. On file, San Francisco Planning Department. This document contains confidential information; accordingly, it is excluded from the Administrative Record.

[92] URS (a subsidiary of AECOM), *Historic Resources Inventory and Evaluation Report Addendum for the Mountain Tunnel Improvements Project*, report prepared for the San Francisco Public Utilities Commission, URS Corporation, Portland, Oregon, June 2019.

[93] JRP Historical Consulting, LLC, Historic Resources Evaluation, Mountain Tunnel Access and Adit Improvement Project, Tuolumne County, California, July 2015.

[94] The Intake Valve House referenced in the Historic Resources Evaluation prepared for the Mountain Tunnel Access and Adit Improvement Project is called the Intake Gate House and represents the Mountain Tunnel headgates at Early Intake.

[95] JRP Historical Consulting, LLC, *Historic Resources Evaluation, Mountain Tunnel Access and Adit Improvement Project*, Tuolumne County, California, July 2015.

a field visit could not be conducted due to a rockslide. This section of the Mountain Tunnel spanning the South Fork of the Tuolumne River was completed in the 1924-1925 work season when riveted pipeline was placed atop poured-in-place concrete piers. The pipeline was in use until 1969 when it was removed and the South Fork Siphon was installed beneath the river. When the original riveted pipeline was removed in 1969, it exposed two portal openings for the South Fork Adit. The built environment resources at the South Fork crossing were described on the Mountain Tunnel Linear Feature form using photographs from a 2008 archaeological recordation showing the southern portal opening and two concrete piers, and also included photographs from the SFPUC Moccasin Archives. When identifying character-defining and non-character defining features of the Mountain Tunnel, the below-ground South Fork Siphon that replaced the 1920s above-ground piped section of the Mountain Tunnel in 1969 (after the period of significance of 1917 through 1934) was identified as a non-character defining feature. The South Fork Adit portals and the remnant concrete piers were not identified as character-defining nor as non-character defining features of the Mountain Tunnel in 2015, so their historic status was unclear. AECOM's evaluation determined that the South Fork Adit Portals and Concrete Piers do not meet the criteria for listing in the National Register or the California Register because they lack historic integrity and they are not character-defining features of the National Register/California Register-eligible Mountain Tunnel.[96]

Priest Reservoir

The *historic resources evaluation addendum* also concludes that Priest Reservoir & Priest Dam constitutes a historical resource under CEQA, because the resource meets the criteria for listing in the California Register under Criterion 1 and the National Register under Criterion A at the state level of significance for its association with the development of the city's municipal water system. Its period of significance is 1921 to 1925, which includes the period from the initial boring of the Auxiliary Outlet and Drainage Tunnel for the reservoir and the Moccasin Power Tunnel, to the filling of the reservoir with water from the completed Mountain Tunnel and the first delivery of water to the Moccasin Penstocks through the Moccasin Power Tunnel. Priest Reservoir & Priest Dam retain sufficient historic integrity to convey the resource's significance.

The character-defining features of Priest Reservoir & Priest Dam as an individual historical resource are the location of Priest Reservoir at the base of the Mountain Tunnel and above the Moccasin Penstocks; the size and shape of Priest Reservoir from damming Rattlesnake Creek; Priest Dam's placement and orientation on the southern end of Priest Reservoir; the core wall, slopes, and hand-placed riprap on the upstream face of Priest Dam; the concrete spillway; and the board-formed Inlet Control Tower and its elevated walkway supported on two concrete piers.

Non-character-defining features of Priest Reservoir & Priest Dam include the bypass pipeline, the modified Auxiliary Outlet and Drainage Tunnel, the Substation and Sampler Station Building, Rattlesnake Creek channelization, and Rickson Road.

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[96] URS (a subsidiary of AECOM), *Historic Resources Inventory and Evaluation Report Addendum for the Mountain Tunnel Improvements Project*, report prepared for the San Francisco Public Utilities Commission, URS Corporation, Portland, Oregon, June 2019. Note: A qualified architectural historian recommended that the South Fork Adit Portals and Concrete Piers are not eligible for listing in the National Register and the California Register. The San Francisco Planning Department is the lead CEQA agency and is responsible for making California Register eligibility determinations discussed in this section. State Historic Preservation Officer consultation is underway with the U.S. Forest Service and concurrences on National Register eligibility determinations are pending, but concurrence with the eligibility reported in this section has been assumed.

Other Historic-Age Built Environment

On behalf of the San Francisco Planning Department, AECOM reviewed previous survey and evaluation reports to determine whether any other historic-age built environment resources, including roads and/or historical resources, were located in the area of potential effects. The identified built-environment resources were the Early Intake Camp buildings, remnants of the 3,700-foot-long Early Intake Tramway, the South Fork Access Road/Forest Service Road 1S28B, Forest Service Road 1N10/Lumsden Road, and a section of Big Oak Flat Road. Summation of these previously recorded resources, which were all determined to be ineligible for listing in the National Register and/or the California Register, are reported in the *historic resources evaluation* prepared for the SFPUC's Mountain Tunnel Access and Adit Project. These ineligible historic-age built resources are not considered historical resources. Because they are not considered historical resources, proposed work on them would have *no impact*.

Impact CR-1. The project would not cause a substantial adverse change in the significance of a historical resource as defined in CEQA section 15064.5, including those resources listed in Article 10 or Article 11 of the San Francisco Planning Code. (Less than Significant)

The following analysis concerns potential impacts to historical resources of the built environment (i.e., nonarcheological). Potential impacts to archeological resources, both as historical resources and unique archeological resources, are addressed separately below under Impact CR-2.

Early Intake

There are five proposed staging/work areas at Early Intake: EI-S1, EI-S2, EI-S3, EI-S4, and EI-S7. Staging Areas EI-S1 and EI-S7 do not include any aboveground, historic-age built environment features, and ineligible built environment resources are located in Staging Areas EI-S2, EI-S3, and EI-S4.

The only historic architectural resource in these staging/work areas is the Early Intake Adit at the easternmost end of the Mountain Tunnel at EI-S3. Although the Early Intake Adit and its associated resources were not specifically called out as character-defining features, the concrete bulkheads and watertight doors added to Early Intake Adit in 1997 were the only parts of the Early Intake Adit that were identified as not character-defining features of the Mountain Tunnel.[97]

Work at this staging area consists of improvements to facilitate equipment access into the Mountain Tunnel through the adit. Proposed work would consist of demolishing the original man-access bulkhead and replacing it with a new, larger equipment-entry bulkhead, similar to those installed as part of the 2017 improvements at Adits 5/6 and 8/9. Other work includes removal of the existing entrance grill and entryway and installation of a new larger entrance grill to accommodate equipment access, including associated rock excavation; installation of new piping and gate valves outside the new bulkhead, including associated trenching; installation of new piping inside the new bulkhead; leveling of the invert gaps at the intersection of the Early Intake Adit and the Mountain Tunnel by demolishing protrusions/bumps at the tunnel invert for drivable access, including limited controlled detonation or mechanically breaking; and installation of a concrete ramp to transition between the existing adit invert grade and the lip of the new concrete bulkhead.

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[97] JRP Historical Consulting's 2015 historical resource evaluation report identified the character-defining and non-character-defining features of the Mountain Tunnel because it was found to be a historic property/historical resource. The State Historic Preservation Officer concurred with the finding in Polanco, Julianne, State Historic Preservation Officer, to Alessandro Amaglio, Environmental Officer at FEMA, RE: Hetch Hetchy Water and Power, Intake Switchyard Hazard Mitigation Project, San Francisco Public Utility Commission, Tuolumne County, MIN-SFPUC-HMGP-4158- 272-002, FEMA_2018_0227_001, March 13, 2018.

The proposed project work would affect the historic integrity of the Mountain Tunnel by altering the design of the adit and installing new features, as well as altering the shape of the adit by removing some material and installing a concrete ramp. The proposed work would not affect the Mountain Tunnel's integrity of location and setting. Because the Early Intake Adit was already modified in 1997 when concrete bulkheads and watertight doors were added, these proposed changes would not further affect the Mountain Tunnel's integrity of feeling and association. Therefore, the impact on the Mountain Tunnel at this location would be *less than significant.*

South Fork

There are eight proposed staging/work areas at South Fork (SF-S1 through SF-S8), two work areas (Vent Work Area West and Vent Work Area East), two new components to the Mountain Tunnel, and a section of localized improvements to an existing road (South Fork Access Road/Forest Service Road 1S28B).

Staging Area SF-S1 contains a post-1979 garage,[98] and staging/work areas SF-S5, SF-S6, SF-S7, Vent Work Area East, and Vent Work Area West do not contain any built environment resources. Staging Areas SF-S2, SF-S3, and SF-S4 are on sections of the former alignment of Big Oak Flat Road. This section of road was determined to be ineligible for inclusion in the National Register.[99] The proposed work at these three staging areas consists of temporary staging areas for parking. The South Fork Access Road was previously recorded in 2000 and determined to be ineligible for inclusion in the National Register. The State Historic Preservation Officer concurred with this finding of ineligibility, and the South Fork Access Road is therefore not considered a historical resource.[100] Because the road is not considered a historical resource, there would be *no impact*.

Proposed work at staging/work area SF-S8 consists of construction of a 750-foot-long bypass tunnel with a bulkhead and a new access shaft at the Mountain Tunnel South Fork Siphon. The current siphon is a replacement that was installed by the city in 1969 and was not identified in the National Register evaluation as a character-defining feature of the Mountain Tunnel because it was added after the resource's period of significance.[101] The proposed bypass would be below the current tunnel alignment and would connect to the 1969 siphon section. The proposed new bulkhead and access shaft would deviate slightly from the current alignment of the Mountain Tunnel, with the access shaft located in the South Fork Access Road/Forest Service Road 1S28B. Although the proposed new siphon extension, bulkhead, and access shaft affect the alignment of the Mountain Tunnel, which is a character-defining

98 U.S. Geological Survey, *Jawbone Ridge, Calif.* 7.5-Minute Map, Washington, D.C.: USGS, Photorevised 1979.

99 The segment of road was recorded in 2014 by Stanislaus National Forest staff as FS 05 16 54 0098/4396E/Big Oak Flat Road (Old Highway 120) for the *Rim Fire Hazard Tree Removal, Report No. 05 16 4396, Stanislaus National Forest* (2014) report. The road was determined to be ineligible for inclusion in the NRHP and was reported in the SFPUC's annual report, which was submitted to the State Historic Preservation Officer. Under an SFPUC Programmatic Agreement, submittal equates to concurrence. Statement of concurrence from email dated January 24, 2019, from Mae Frantz, Natural Resources and Lands Management Division, SFPUC, to Kathy Strain, Forest Heritage Resource and Tribal Relations Program Manager, Stanislaus National Forest, RE: MTIP cultural resources.

100 The State Historic Preservation Officer concurred with the finding in Daniel Abeyta, Acting State Historic Preservation Officer, to Ben L. Del Villar, Forest Supervisor, USFS, RE: Determination of Eligibility for the Proposed Repair of the South Fork Road and Replacement of a Destroyed Bridge, Stanislaus National Forest, USFS000524A, June 6, 2000.

101 JRP Historical Consulting's 2015 historical resource evaluation report identified the character-defining and non-character-defining features of the Mountain Tunnel because it was found to be a historic property/historical resource. The State Historic Preservation Officer concurred with the finding in Julianne Polanco, State Historic Preservation Officer, to Alessandro Amaglio, Environmental Officer at FEMA, RE: Hetch Hetchy Water and Power, Intake Switchyard Hazard Mitigation Project, San Francisco Public Utility Commission, Tuolumne County, MIN-SFPUC-HMGP-4158- 272-002, FEMA_2018_0227_001, March 13, 2018.

feature, the changes would be considered *less than significant* because the alignment of the tunnel in this area was already altered with the installation of the current siphon in 1969.

Preparation of SF-S8 would require the removal of up to 5 feet of existing debris (e.g., fractured roadbed and tunnel spoils). The South Fork Adit Portal on the northern side of the river and one remnant concrete pier are located within the boundary of SF-S8, but the pier would not be removed as part of the debris removal. The South Fork Adit Portals and Concrete Piers were evaluated as part of the *historic resources evaluation addendum* and were determined to be ineligible for listing in the National Register or the California Register, because they lack historic integrity and they are not character-defining features of the National Register/California Register-eligible Mountain Tunnel.[102] Because the South Fork Adit Portals and Concrete Piers are not considered historical resources, there would be *no impact* to historic architectural resources at this location.

Adit 5/6

There are two proposed staging/work areas at Adit 5/6 (A5/6-S1 and A5/6-S2), as well as proposed modifications to the existing road (Adit 5/6 Access Road/Forest Service Road 1S01), including the construction of turnouts, drainage improvements, installation of retaining walls and gabion embankments, and construction of cantilevered sections of roadbed.

The Adit 5/6 Access Road was recorded and evaluated for the *historic resources evaluation addendum*. The historic alignment of the road was cut circa 1912; it was ultimately taken over by the SFPUC system and used during the construction of the Mountain Tunnel. SFPUC made improvements to the road over time, including the cutting of the spur road into Adit 5/6, and it continues to serve as one of the many roads providing access to components of the water and power system for ongoing operations and maintenance activities. The road was determined to be ineligible for listing in the National Register or the California Register because it lacks significance and integrity.[103] Because the road is not considered a historical resource, the proposed project would have *no impact* to historic architectural resources.

A portion of an unnamed trail that is accessed off the Adit 5/6 Access Road/Forest Service Road 1S01 was also recorded and evaluated for the *historic resources evaluation addendum*. The unnamed adit access trail is a dirt footpath used by SFPUC staff to access Adit 4/5 and Adit 3/4. The trail was cut in 1917 by a city work crew during the planning stages of the Mountain Tunnel. The trail was recommended as ineligible for listing in the National Register and found to be ineligible for listing in the California Register, because

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[102] URS (a subsidiary of AECOM), *Historic Resources Inventory and Evaluation Report Addendum for the Mountain Tunnel Improvements Project*, report prepared for the San Francisco Public Utilities Commission, URS Corporation, Portland, Oregon, June 2019. Note: A qualified architectural historian recommended that the South Fork Adit Portals and Concrete Piers are not eligible for listing in the National Register and the California Register. The San Francisco Planning Department is the lead CEQA agency and is responsible for making California Register eligibility determinations discussed in this section. State Historic Preservation Officer consultation is underway with the U.S. Forest Service and concurrences on National Register eligibility determinations are pending, but concurrence with the eligibility reported in this section has been assumed.

[103] URS (a subsidiary of AECOM), *Historic Resources Inventory and Evaluation Report Addendum for the Mountain Tunnel Improvements Project*, report prepared for the San Francisco Public Utilities Commission, URS Corporation, Portland, Oregon, June 2019. Note: A qualified architectural historian recommended that the Adit 5/6 Access Road is not eligible for listing in the National Register and the California Register. The San Francisco Planning Department is the lead CEQA agency and determined the property to be ineligible. The San Francisco Planning Department is the lead CEQA agency and is responsible for making California Register eligibility determinations discussed in this section. State Historic Preservation Officer consultation is underway with the U.S. Forest Service and concurrences on National Register eligibility determinations are pending, but concurrence with the eligibility reported in this section has been assumed.

it lacks significance and integrity.[104] Because the trail is not considered a historical resource, the proposed project would have *no impact* to historic architectural resources.

Staging/work area A5/6-S1 is an existing parking lot near the southern terminus of the Adit 5/6 Access Road/Forest Service Road 1S01 that has previously been used for staging by the SFPUC for other projects. The proposed work consists of improving the existing driveway. There are no built environment resources in the staging/work area; because Adit 5/6 Access Road is not considered a historical resource, there would be *no impact* to historic architectural resources.

Staging/work area A5/6-S2 is a previously graded, compacted, and graveled area outside the entrance to Adit 5/6. This area previously contained the remnants of the compressor foundations outside Adits 5/6 that were identified by a qualified architectural historian as non-character-defining features of the Mountain Tunnel, which have since been demolished.[105] Installation of a proposed culvert would not affect the character-defining features of the Mountain Tunnel, and therefore the impact on Mountain Tunnel would be *less than significant*.

Adit 8/9

There are five proposed staging/work areas at Adit 8/9 (A8/9-S1, A8/9-S3, A8/9-S4, A8/9-S5, and A8/9 S6). The project also includes proposed modifications to the existing Adit 8/9 Access Road/Forest Service Road 1N01 (Lumsden Road), including widening and the construction of a turnout.

The section of the Adit 8/9 Access Road that branches off previously recorded Forest Service Road 1N01 (Lumsden Road) was recorded and evaluated for the *historic resources evaluation addendum*. The historic alignment of the road was cut in 1921 as part of a 3-mile-long access road that was constructed from Smith Station to the Adit 8/9 portal and used during the construction of the Mountain Tunnel. Since its completion, the portion of the Adit 8/9 Access Road that leaves Forest Service Road 1N01 (Lumsden Road) to provide direct access to the adit has been used as a private access road by SFPUC staff. The road was determined to be ineligible for listing in the National Register or the California Register, because it lacks significance and integrity.[106] Because the road is not considered a historical resource, there would be *no impact*.

Staging/work areas A8/9-S3, A8/9-S5, and A8/9-S6 do not contain any built environment resources.

Staging/work area A8/9-S1 is a previously graded, compacted, and graveled area outside the entrance to Adit 8/9. This area previously contained the remnants of the compressor foundations outside Adit 8/9 that

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104 URS (a subsidiary of AECOM), *Historic Resources Inventory and Evaluation Report Addendum for the Mountain Tunnel Improvements Project*, report prepared for the San Francisco Public Utilities Commission, URS Corporation, Portland, Oregon, June 2019. Note: A qualified architectural historian recommended that the unnamed trail that is accessed off the Adit 5/6 Access Road/Forest Service Road 1S01 is not eligible for listing in the National Register and the California Register. The San Francisco Planning Department is the lead CEQA agency and determined the property to be ineligible. A formal National Register determination has not been made but is assumed.

105 JRP Historical Consulting, LLC, *Historic Resources Evaluation, Mountain Tunnel Access and Adit Improvement Project,* Tuolumne County, California, July 2015.

106 URS (a subsidiary of AECOM), *Historic Resources Inventory and Evaluation Report Addendum for the Mountain Tunnel Improvements Project*, report prepared for the San Francisco Public Utilities Commission, URS Corporation, Portland, Oregon, June 2019. Note: A qualified architectural historian recommended that the Adit 8/9 Access Road is not eligible for listing in the National Register and the California Register. The San Francisco Planning Department is the lead CEQA agency and determined the property to be ineligible for the California Register. The San Francisco Planning Department is the lead CEQA agency and is responsible for making California Register eligibility determinations discussed in this section. State Historic Preservation Officer consultation is underway with the U.S. Forest Service and concurrence on National Register eligibility determinations are pending, but concurrence with the eligibility reported in this section has been assumed.

were identified by a qualified architectural historian as non-character-defining features of the Mountain Tunnel, which have since been demolished.[107] The proposed installation of a culvert at the adit entrance would not affect any of the character-defining features of the Mountain Tunnel; therefore, the impact on Mountain Tunnel would be *less than significant*.

At Staging Area A8/9-S4, up to 40 feet of the hillside above the existing roadway would be removed to create the staging area that abuts the southern side of the Adit 8/9 Access Road/Forest Service Road 1N10 (Lumsden Road) near the hairpin turn down into Adit 8/9. Forest Service Road 1N10/Lumsden Road was previously recorded in 2005 by Stanislaus National Forest archaeologists and determined to be ineligible for inclusion in the National Register because it lacks integrity and significance. The road was originally a late 19th century trail alignment that was widened and converted to a road in 1923. This conversion affected the trail's integrity of design, materials, workmanship, feeling, and association. Additionally, the 1923 road was not associated with any significant persons or events. The State Historic Preservation Officer concurred with this finding of ineligibility.[108] A formal California Register determination of eligibility has not been made but is assumed to also be ineligible. The road is not a historical resource or a CEQA historical resource; therefore, there would be *no impact* on historical resources at this staging area.

Similarly, the proposed turnouts on the Adit 8/9 Access Road/Forest Service Road 1N10 (Lumsden Road) would have *no impact* because the road is not considered a historical resource.

Big Creek Shaft

The one proposed staging area at Big Creek Shaft (BC-S2) is an existing graded and graveled area in the SFPUC right-of-way. The staging area is above and adjacent to the Mountain Tunnel and adjacent to the modern pump house and tank at Big Creek Shaft. As reported by a qualified architectural historian, Big Creek Shaft was drilled between 1917 and 1920 to provide access to driving faces for construction of the Mountain Tunnel. Research did not reveal the construction date of the modern pump house building that sits atop the shaft.[109] Because the pump house and tank at Big Creek Shaft were erected after the resource's period of significance, they are not character-defining features of the Mountain Tunnel and are not considered historical resources.[110] Therefore, there would be *no impact* on the Mountain Tunnel at this staging area.

Second Garrote

There is one staging area (SG-S1) and one proposed road improvement (replacement of a culvert on Second Garrote Shaft Road) at Second Garrote. The staging area is at the terminus of the access road to the shaft and would surround the shaft in an area previously graded and graveled by SFPUC. The staging area is above Mountain Tunnel and adjacent to the modern pump house and small tank at Second

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[107] JRP Historical Consulting, LLC, *Historic Resources Evaluation, Mountain Tunnel Access and Adit Improvement Project*, Tuolumne County, California, July 2015.

[108] The State Historic Preservation Officer concurred with the finding in Milford Wayne Donaldson, Historic Preservation Officer, to Tom Quinn, Forest Supervisor, USFS, RE: National Register of Historic Places (NRHP) Eligibility Determination of Two Roads, FR 1S58 (FS 05-16-1701) and FR 1N10 (Lumsden Road; FS 05-16-54-1700), Stanislaus National Forest, USFS050929R, November 1, 2005.

[109] JRP Historical Consulting, LLC, *Historic Resources Evaluation, Mountain Tunnel Access and Adit Improvement Project*, Tuolumne County, California, July 2015.

[110] JRP Historical Consulting, LLC, *Historic Resources Evaluation, Mountain Tunnel Access and Adit Improvement Project,* Tuolumne County, California, July 2015. Note: A qualified architectural historian identified these as non-character-defining features of the Mountain Tunnel. The San Francisco Planning Department is the lead CEQA agency and determined the Mountain Tunnel as eligible and therefore concurred with the list of character-defining and non-character-defining features. A formal National Register determination of eligibility and character-defining features has not been made but is assumed.

Garrote Shaft. To prevent stormwater from entering the Second Garrote Shaft, the shaft would be surrounded by a nonpermeable membrane and gravel. The existing security fencing around the Second Garrote Shaft may be expanded slightly, depending on the exact configuration of the membrane. Minor surface drainage improvements (minor grading to redirect water away from the shaft) would also be performed around the upper shaft to prevent rainwater from entering the shaft. The Second Garrote Shaft was drilled between 1917 and 1925.[111] After construction, the compressor, associated machinery, and buildings were removed. Research did not reveal the installation date of the current pump by the local water district.[112] The pump house and tank at Second Garrote Shaft were not recommended as character-defining features of the Mountain Tunnel because they were erected after the resource's period of significance.[113] The proposed work would not involve a character-defining feature of the resource. Therefore, there would be *no impact* on the Mountain Tunnel at this staging area. The proposed project would also replace an existing, damaged culvert under Second Garrote Shaft Road, approximately 850 feet south of the intersection with Highway 120. Second Garrote Shaft Road is a modern road that was cut between 1987 and 1993.[114] Because the road and the culvert that is to be replaced are less than 50 years old, they were not recorded as part of this project and are not historical resources. Therefore, the proposed road improvement along Second Garrote Shaft Road would have *no impact* on historical resources.

Priest Reservoir

Project components at Priest Reservoir include excavation of a new vertical access shaft, construction of an underground flow control facility and an aboveground building, improvement to an existing access road (Rickson Road), nine proposed staging areas (PP-S1, PP-S4, PP-S5, PP-S6, PP-S7, PP-S8, PP-S9, PP-S13, and PP-S15), Priest Work Area West and Priest Work Area East, the proposed power distribution alignment, the spoils disposal site, a temporary water treatment plant, a temporary rock-crushing plant, and construction of a new Priest Portal. The assessment of potential impacts to these resources at Priest Reservoir & Priest Dam is summarized below.

Staging/work areas PP-S4, PP-S5, PP-S7, PP-S8, and PP-S9 do not contain any aboveground, historic-age built environment features, and do not involve any ground disturbance. Accordingly, proposed project work in these areas would have *no direct effect* on historical resources.

Staging Area PP-S1

Staging Area PP-S1 is on the concrete spillway and roadway of Priest Reservoir & Priest Dam that leads to the existing Priest Portal. The spillway was identified as a character-defining feature of Priest Reservoir & Priest Dam, but the proposed project at this location consists of general staging to provide

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111 JRP Historical Consulting, LLC. "Mountain Tunnel" DPR 523 form and associated Linear Feature Record for "Second Garrotte Shaft," prepared for *Historic Resources Evaluation, Mountain Tunnel Access and Adit Improvement Project*, Tuolumne County, California, July 2015.

112 JRP Historical Consulting, LLC, *Historic Resources Evaluation, Mountain Tunnel Access and Adit Improvement Project*, Tuolumne County, California, July 2015.

113 JRP Historical Consulting, LLC, *Historic Resources Evaluation, Mountain Tunnel Access and Adit Improvement Project*, Tuolumne County, California, July 2015. Note: A qualified architectural historian identified these as non-character-defining features of the Mountain Tunnel. The San Francisco Planning Department is the lead CEQA agency and determined the Mountain Tunnel as eligible and concurred with the list of character-defining and non-character-defining features. A formal NRHP determination of eligibility and character-defining features has not been made but is assumed.

114 U.S. Geological Survey, *Groveland, Calif.* 7.5-Minute Map, Washington, D.C.: USGS, Photorevised 1987, HistoricAerials.com, Second Garrote, California, Historical imagery, 1993.

access into the tunnel during the first shutdown. Therefore, the proposed work would have *no impact* on Priest Reservoir & Priest Dam.

Priest Work Area West and Priest Work Area East

Lowering the reservoir below the existing Priest Portal invert elevation exposes flat land surrounding the concrete roadway (Staging Area PP-S1). This exposed area is referred to as the Priest Work Area West and Priest Work Area East. Construction in these areas would be restricted to dry land and be stabilized by gravel/large crushed rock. These areas would be used for general construction staging, equipment storage, and material storage for entry into and out of the tunnel. In the Priest Work Area West, a plywood bulkhead would be necessary at the existing Priest Portal to facilitate ventilation. A portal security guard would be housed in a guard shack in the Priest Work Area West. Priest Work Area East is generally on higher ground and would be used primarily for shift worker parking, light plants, and general storage. Temporary staging and work activities would be restricted to dry areas, and no work would occur in the water. The temporary establishment and use of the reservoir floor for a work area would be considered a *less-than-significant* impact on historical resources, because it would not affect the significance of Priest Reservoir & Priest Dam. The work area would be inundated when the reservoir is refilled, so that any visual effect would be temporary.

Staging Area PP-S6

Proposed work at Staging Area PP-S6 would consist of construction of a new Priest Portal and Adit and working pad, spoils disposal, a temporary rock-crushing plant, and temporary project trailer staging. This staging area or Staging Area PP-S13 would also be used for the temporary water treatment plant. These components are discussed below. This staging area would not be restored to its general pre-existing condition.

New Priest Portal and Adit. To facilitate construction of a new Priest Adit, a new Priest Portal would be constructed from this staging area to serve as an access point to the tunnel in the Priest Adit area. The new adit would be 1,250 feet long and would range in depth from the excavated, finished ground surface at the new portal to about 250 feet below the ground surface at the tunnel tie-in. Construction of the new adit and portal would affect the alignment of the Mountain Tunnel, which is a character-defining feature, but this effect would be *less than significant* because it would not materially alter the alignment of the tunnel in such a way that Mountain Tunnel could no longer convey its historical significance.

As part of the construction of a new Priest Adit and a new Priest Portal, excavation of up to 49 feet below ground surface would be required at the new portal to create a two-level working pad of approximately 1.2 acres, within the boundary of Staging Area PP-S6. The upper pad would be lined by an approximately 760-linear-foot, U-shaped wall cut (outer wall cut) with a maximum height of 49 feet, but most of the wall would range from 20 to 30 feet tall. The lower pad wall (inner cut wall) would be L-shaped, 260 linear feet, and range in height from 5 to 10 feet. Grouted bars and stained shotcrete matching the earth tones of the surrounding hillsides would be applied to the faces of the outer wall cut and the inner wall cut, and permanent, chain-link safety fences would be placed along the top of each wall.

There would be a reinforced soil slope at the southwestern corner of the lower pad. This fill slope would be approximately 90 linear feet, have a 1:1 slope, and range in height between 0 and 27 feet. The face of the slope would be covered with a welded wire-mesh face mat. Additionally, a small area of fill and cut slope would be made on the eastern side of Rickson Road and west of the upper pad, to create the Priest Portal entry ramp.

A 20-foot by 20-foot concrete pad would be poured outside the new adit entry, and a permanent security gate would be installed at the outer end of the adit.

None of the proposed improvements listed above would directly affect the character-defining features of Priest Reservoir & Priest Dam. Although the setting surrounding the Priest Reservoir & Priest Dam would be altered by the proposed facilities, the project would not result in an adverse change to the physical characteristics of Priest Reservoir & Priest Dam or its immediate surroundings, because the project would neither materially impair the historical resource nor prevent it from conveying its historical significance. Additionally, staining of the shotcrete to match the earth tones of the surrounding hillsides would complement the historic character and visual integrity of the setting in the Priest Reservoir Basin, as described in Section A.6.11, SFPUC Standard Construction Measures and Other Avoidance/Minimization Measures Included as Part of the Project. Therefore, impacts to Priest Reservoir & Priest Dam would be *less than significant*.

Spoils Disposal. Staging Area PP-S6 would also serve as the primary disposal site for the project, accommodating approximately 100,000 cubic yards of spoils materials. Vegetation and trees would be cleared, and up to 15 feet below ground surface would be excavated for two spoils piles, Spoils Disposal Area 1 and Spoils Disposal Area 2, which would be separated by Rickson Road. The base of Spoils Disposal Area 1 would be approximately 506 linear feet long and approximately 250 linear feet at the widest section of the base. This disposal area would have a 1.75:1 slope and a peak at an elevation of 2,417 feet (North American Vertical Datum of 1988). The base of Spoils Disposal Area 2 would range from approximately 570 feet long and approximately 500 feet at the widest section of the base. It would have a 1.75:1 slope and a peak at an elevation of 2,370 feet. Because the spoils piles would both be sited on hillsides, the height of each pile varies. The slopes of the spoils piles would be stacked with various sized rocks to have the appearance of a rock embankment and would not be replaced with trees or reseeded for vegetation. Temporary silt fences would be erected around the base of both spoils piles during project construction.

The introduction of these two spoils piles would not directly affect any character-defining features of Priest Reservoir & Priest Dam. Although the spoil disposal areas would alter the setting of this resource, the spoils piles, based on their proposed height, slopes, and appearance, as described above, would not result in an adverse change to the physical characteristics of Priest Reservoir & Priest Dam or its immediate surroundings, because they would neither materially impair the historical resource nor prevent it from conveying its historical significance. Impacts to Priest Reservoir & Priest Dam would therefore be *less than significant*.

Temporary Rock-Crushing and Water Treatment Plant. A temporary 20,000–square-foot rock-crushing plant would be sited in the eastern section of staging/work area PP-S6. A temporary water treatment plant may also be sited within PP-S-6. Because the plants would be temporary, this project work would have a *less-than-significant* impact on Priest Reservoir & Priest Dam.

Temporary Project Trailer Staging. A temporary project trailer and parking area is proposed within the boundary of PP-S6. This area is graded, paved, and currently used as a parking and spoils location by SFPUC. Work would not involve any excavation, and therefore the proposed work would have *no impact* on Priest Reservoir & Priest Dam.

Staging Area PP-S13

Staging Area PP-S13 is sited at the base of the downstream slope of the dam, 145 feet below the dam crest. Work here would consist of a 20-foot maximum depth excavation for leveling the site for the construction of a temporary water treatment plant, unless this facility is sited within PP-S6, as described above. The staging area would not affect any character-defining features of the Priest Reservoir & Priest Dam. The excavation for leveling would be in a low area below the dam and the water treatment plant would be temporary; therefore, project work at PP-S13 would have a *less-than-significant* impact on Priest Reservoir & Priest Dam.

Staging Area PP-S15

A flow control facility would be constructed on a two-level excavated pad of up to 30 feet below ground surface, located entirely within the limits of Staging Area PP-S15. The excavated pad would be covered in crushed rock or aggregate base, both for the construction phase and for permanent use. The main wall cut for the excavated pad (Cut Wall 1) would traverse both pads and would be approximately 360 linear feet with a maximum height of 31 feet, but most of the wall would range from 0 to 21 feet tall. A wall along the northern edge of the lower pad (Cut Wall 2) would be perpendicular to Cut Wall 1 and be approximately 56 linear feet and approximately 10 feet tall. Cut Wall 1 and Cut Wall 2 would have grouted bars and stained shotcrete to match the earth tones of the surrounding hillsides applied to the cut faces, and a permanent, chain-link safety fence would be placed along the top of Cut Wall 1. The lower pad would be used as an overflow parking area, and a metal staircase would be erected along Cut Wall 2 to provide access from the overflow parking area up to the flow control facility building.

The flow control facility would include up to two control valves and two dewatering pumps, housed in a deep shaft on the shore of Priest Reservoir. The shaft would extend approximately 160 feet below the excavated pad and would be approximately 55 feet in finished (internal) diameter, with a 55-foot by 66-foot finished bottom bell. A permanent building would be constructed above the shaft to protect the facility and provide safe operations and maintenance access. The structure would be approximately 85 feet by 85 feet and 30 feet tall, constructed of concrete masonry block, and would have a removable roof for removal of the large flow control valves and isolation valves. SFPUC would use or match the same stained, split-face concrete masonry block of the Substation and Sampler Control Building for the construction of the flow control facility building. Excavation of the 160-foot-deep shaft below the excavated pad would affect the alignment of the Mountain Tunnel, which is a character-defining feature, but this effect would be *less than significant* because it would not materially alter the alignment of the tunnel in such a way that Mountain Tunnel could no longer convey its historical significance.

Five permanent concrete pads would be added to the upper pad. The largest would be a reinforced concrete crane pad that would measure 70 feet by 40 feet, sited north of the flow control facility building for future maintenance needs. A 50-foot by 25-foot vehicular pad would be sited immediately east of the crane pad and north of the flow control facility building. Three smaller concrete pads would be sited immediately west of the flow control facility building and would be protected on three sides by a chain-link safety fence.

An L-shaped gabion wall, approximately 130 linear feet and up to 12 feet tall, is proposed along the western boundary of the staging area on the eastern side of Rickson Road. Another gabion wall is proposed on the western side of Rickson Road; it would be approximately 240 feet long and approximately 15 feet tall.

None of these proposed improvements listed above would directly affect character-defining features of Priest Reservoir & Priest Dam. The Priest Reservoir & Priest Dam would be affected by changes to its immediate setting, including the proposed excavation and grading, various wall construction, permanent concrete pads, and construction of a new structure; however, the project would not result in an adverse change of the physical characteristics of Priest Reservoir & Priest Dam or its immediate surroundings, because these project elements would neither materially impair the historical resource nor prevent it from conveying its historical significance. Additionally, staining of the shotcrete to match the earth tones of the surrounding hillsides and using or matching the same stained, split-face concrete masonry block of the Substation and Sampler Control Building complements the historic character and visual integrity of the setting in the Priest Reservoir Basin, as described in Section A.6.11, SFPUC Standard Construction Measures and Other Avoidance/Minimization Measures Included as Part of the Project. Therefore, impacts to Priest Reservoir & Priest Dam would be *less than significant*.

Power Distribution Line

A permanent power source would be required for the flow control facility at Priest Reservoir. The power would be drawn from existing SFPUC lines north of Priest Reservoir, and a new overhead line and 30 new poles would be installed over a distance of about 3,200 feet in the historical architecture indirect area of potential effects. Approximate pole locations are displayed on Figures A-4.17 and A-11. Of the 30 proposed poles, 24 are closely sited along the western side of, and following the alignment of, Rickson Road from approximately 650 feet north from Staging Area PP-S15, down to the new Priest Portal location. New power poles would have a height of approximately 40 feet, similar to the two existing poles in the Priest Reservoir Basin. The overhead power distribution system is an extension of an existing facility in the indirect historic architecture area of potential effects in the Priest Reservoir vicinity.

Installation of the proposed power poles would not directly affect character-defining features of Priest Reservoir & Priest Dam. The Priest Reservoir & Priest Dam would be affected by changes to its immediate setting by their introduction. The area where the new poles would be installed only constitutes a small portion of the Priest Reservoir shore, and the close proximity of the placement of the poles in an area where there are currently no power poles would create a visual intrusion, but the poles would not result in an adverse change of the physical characteristics of Priest Reservoir & Priest Dam or its immediate surroundings, because they would neither materially impair the historical resource nor prevent it from conveying its historical significance. Therefore, impacts to Priest Reservoir & Priest Dam would be *less than significant*.

Rickson Road

Rickson Road, along its eastern branch, would be improved for heavy truck and construction vehicle use by widening the existing road, adding a drainage ditch on the inboard side, adding shoulders, and modifying the curves to have a minimum radius to accommodate a large crane. Along its western branch, the road would be repaired as needed (e.g., fixing potholes) during the construction period and then repaved at the end of the construction period. Rickson Road was not identified in the historic architectural resources investigation for this project as a character-defining feature of Priest Reservoir & Priest Dam. Because it is not a character-defining feature, the proposed work would be considered a *less-than-significant* impact on Priest Reservoir & Priest Dam.

Mountain Tunnel Improvements

Tunnel improvements inside Mountain Tunnel would include debris removal, lining repairs, invert[115] paving, steel lining placement, and pressure grouting.

Debris Removal (Unlined Tunnel Section)

To improve hydraulic performance in the siphon and to reduce the potential for water quality impacts, removal of the rock debris in portions of the tunnel is proposed. Debris removal from inside the tunnel

[115] The invert is the floor or bottom of the tunnel.

would not include any physical alterations to any of the character-defining features of the Mountain Tunnel and would, therefore, have *no impact* on Mountain Tunnel.

Lining Repairs (Lined Tunnel Section)

Lining repairs would occur throughout the concrete-lined portion of the tunnel. Each identified defect in the tunnel lining would be cleaned, pressure-washed, and covered with shotcrete or mortar. This proposed project work consists of repairs to a character-defining feature of the Mountain Tunnel, the shape of excavation of the tunnel. Because the concrete repair work would match the current lining and conform to the shape of the tunnel, this proposed work would be considered a *less-than-significant* impact on Mountain Tunnel.

Invert Paving (Unlined Tunnel Section)

To allow for drivable access from Adit 5/6, the unlined invert would be paved with concrete between Adit 5/6 and Station 386+26. Concrete paving thickness would vary between 6 and 15 inches. This proposed project work consists of repairs to a character-defining feature of the Mountain Tunnel, the shape of excavation of the tunnel. Because the new concrete paving would be at the bottom of the tunnel and would not affect the horseshoe shape of the tunnel, this proposed work would be considered a *less-than-significant* impact on Mountain Tunnel.

Localized Steel Lining

Where pressure inside the tunnel is greater than the exterior pressure from the surrounding rock, water can leak out of the tunnel. To address this issue, a watertight steel pipe lining would be installed at susceptible areas. Upon completion of a continuous steel lining, backfill grouting would be injected and a polyurethane coating would be applied to the surface inside the tunnel to protect the steel lining from corrosion. The maximum length of a steel segment would be 40 feet, given the size of the adits. Shorter steel segments may be needed to install the steel lining at bends near Priest Portal and to enter through Adits 5/6 and 8/9. In unlined portions of the tunnel, a heavily reinforced concrete lining may be placed in lieu of welded steel pipe. This proposed project work consists of alteration of a character-defining feature of the Mountain Tunnel, the shape of excavation of the tunnel, but it would not rise to the level of substantial change because it would not materially alter the shape of the tunnel in such a way that the Mountain Tunnel can no longer convey its historical significance. Impacts to the Mountain Tunnel would therefore be *less than significant*.

Pressure Grouting

Initial contact grouting would be completed for the entire lined portion of the tunnel. Areas that continue to seep groundwater into the tunnel beyond acceptable limits would be redrilled and regrouted with finer cement grouts. This proposed project work consists of repairs along a character-defining feature of the Mountain Tunnel, the shape of excavation of the tunnel. Because the proposed grouting work would not affect the shape of the tunnel, this proposed work would be considered a *less-than-significant* impact on Mountain Tunnel.

Impact Summary

Although some of the proposed project work would affect character-defining features of the Mountain Tunnel, it would not rise to the level of substantial change, because it would not materially alter the tunnel in such a way that the Mountain Tunnel can no longer convey its historical significance.

None of the proposed project improvements or construction would directly affect any character-defining features of Priest Reservoir & Priest Dam. The Priest Reservoir & Priest Dam would be affected by changes to its immediate setting, including the proposed excavation and grading, various wall construction, permanent concrete pads, two spoils piles, erection of security fences, installation of power poles, and construction of a new structure. However, these project components individually and collectively would not result in an adverse change of the physical characteristics of Priest Reservoir & Priest Dam or its immediate surroundings, because they would neither materially impair the historical resource nor prevent it from conveying its historical significance. The project would also incorporate exterior design treatments to the new built features (matching the same stained, split-face concrete masonry block of the Substation and Sampler Control Building for the flow control facility building and staining the four shotcrete-covered wall cuts at Priest Reservoir), which would complement the historic character and visual integrity of the setting in the Priest Reservoir Basin and would not materially impair the Priest Reservoir & Priest Dam or its immediate surroundings to such an extent that the resource would be unable to convey its historical significance.

Additionally, as described in Section A.6.11, SFPUC Standard Construction Measures and Other Avoidance/ Minimization Measures Included as Part of the Project, the SFPUC would include photo-documentation to archivally preserve the setting and conditions of the geographic landscape, spatial organization, and historic fabric of the Priest Reservoir & Priest Dam in the Priest Reservoir basin prior to the start of project construction activities.

In conclusion, the proposed project work would not result in a substantial adverse change in the significance of the Mountain Tunnel or Priest Reservoir & Priest Dam; therefore, impacts to the built environment historical resources would be *less than significant*.

Impact CR-2. The project could cause a substantial adverse change in the significance of an archeological resource pursuant to section 15064.5. (Less than Significant with Mitigation)

The following discussion assesses impacts to archeological resources meeting the requirements for listing as historical resources pursuant to CEQA Guidelines section 15064.5, as described above. In addition, impacts to unique archeological resources as also described in section 15064.5 and Public Resources Code section 21083.2.71 are addressed. If an archeological site does not meet the criteria for inclusion in the California Register but would meet the definition of a unique archeological resource as outlined in Public Resources Code section 21083.2, project impacts to that resource also may be significant. A unique archeological resource implies an archeological artifact, object, or site about which it can be clearly demonstrated that—without merely adding to the current body of knowledge—there is a high probability it meets one of the following criteria:

- The archeological artifact, object, or site contains information needed to answer important scientific questions, and there is a demonstrable public interest in that information
- The archeological artifact, object, or site has a special and particular quality, such as being the oldest of its type or the best available example of its type
- The archeological artifact, object, or site is directly associated with a scientifically recognized important prehistoric or historic event or person

Impacts to archeological resources that do not qualify either for listing on the California Register or as a unique archaeological resource receive no further consideration under CEQA.

Inventory efforts for archeological resources included a review of ethnographic and historic literature and maps, archeological base maps and site records, survey reports, and atlases of historic places on file at the Central California Information Center; a Sacred Lands File review and tribal contact list by the California Native American Heritage Commission; Native American contact letters to all individuals identified by the commission; a review of files held by the Forest Heritage Program of Stanislaus National Forest; and an archeological pedestrian reconnaissance of the entire area of potential effects. These efforts were documented in the *historic context and archeological survey report* prepared for the project.[116]

The archeological resources identified in the project area of potential effects are discussed below. As with the area of potential effects discussion above, the archeological resources are presented according to the relevant component at which they are located.

Existing conditions were considered to evaluate the potential for exposing previously undiscovered archeological sites during project implementation. Many of the staging areas occur on existing paved surfaces, based on field surveys completed for this analysis. Because no ground disturbance would be required to use these areas for staging, there would be no potential impact to archeological resources, known or currently undiscovered, beneath the existing paved surface. Likewise, some staging would occur on existing graded and graveled areas where minor surface preparation may be required (less than 1 foot for minor grading and grubbing) to level the surface. Given the shallow depth of ground disturbance for this type of surface preparation, there is very little potential for previously unknown buried archeological resources to be exposed (i.e., those lying buried more than 2 or 3 feet below the surface with no surface manifestation).

In some instances where previously used staging areas occur within the confines of a previously recorded archeological resource and there is the potential for damage to the site resulting from the use of the area for staging by the project, the SFPUC would, as part of the project design, install fabrics and gravel to create the work surface rather than implementing the minor grading/grubbing. In addition, the SFPUC would install permanent boulder barriers, temporary fencing, and/or signage where needed to prevent vehicles and/or the labor force from driving and/or walking on known archeological deposits outside the established staging areas. The installation of the fabric and gravel in lieu of the minor grading and grubbing would prevent the scouring and rutting of the ground surface; and the installation of barricades, temporary fencing, and signage (as needed) would confine the contractor and their vehicles to the designated staging area. Lastly, the SFPUC's Standard Construction Measures, including Standard Archeological Measure 1 (Archeological Discovery), apply to the proposed project even in areas where impacts to archeological resources are not anticipated (e.g., where ground disturbance is minimal). Together, these protective measures would avoid the potential to impact the underlying resource (see Section A.6.11, SFPUC Standard Construction Measures and Other Avoidance/Minimization Measures Included as Part of the Project).

As indicated in Table E.4-1, some of the proposed project activities would entail excavation or grading directly on bedrock, which would not have the potential to harbor buried archeological resources. Therefore, any of the project activities that would occur in bedrock would not have the potential to expose previously unidentified archeological resources.

Early Intake Area

Early Intake Adit provides access at the easternmost end of the Mountain Tunnel. Ground-disturbing activities associated with work in this area would include excavation for installation of a new bulkhead door, and trenching for the installation of new piping and gate valves inside the adit. Because the

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[116] URS (a subsidiary of AECOM), *Historic Context and Archeological Survey Report for the Mountain Tunnel Improvements Proje*ct, report prepared for the San Francisco Public Utilities Commission and the San Francisco Planning Department, Environmental Planning Division, URS, San Francisco, California, 2019. This document contains confidential information; accordingly, it is excluded from the Administrative Record.

excavation for door and the trenching for new piping would occur inside the confines of the existing tunnel that was excavated into bedrock, there is no potential effect to archeological resources, and these activities receive no further analysis in this section. Project implementation in this area would also require the establishment of five staging areas: EI-S1, EI-S2, EI-S3, EI-S4, and EI-S7. Disturbance of surface soils for site preparation would be negligible, and there could also be soil disturbance during their routine use. For this reason, a nominal depth (less than 1 foot) for potential soil disturbance is included to account for site preparation, vehicle travel, and other potential sources of soil disturbance associated with the use of the staging areas.

Early Intake Project Components (see Figure E.4-1, Sheet 1)

Staging Area EI-1. Staging Area EI-S1 is in a parking area for the Stanislaus National Forest/Kirkwood trailhead to Preston Falls at the end of the paved road on the northern side of the Tuolumne River and east of the Kirkwood Powerhouse. The parking area is located on a built-up pad that is supported by a rock retaining wall and backfilled with small imported gravels.

Staging Area EI-2. Staging Area EI-S2 is in a paved parking area north of the Tuolumne River and west of the Kirkwood Powerhouse. EI-S2 includes a one- and two-story wood-framed rectangular building (formerly a bunkhouse, constructed in 1959) and a gas station; the entire staging area is paved and developed.

Staging Areas EI-S3 and EI-S4. Staging Areas EI-S3 and EI-S4 are contiguous and are adjacent to the Intake Switchyard south of the Tuolumne River. Both EI-S3 and EI-S4 are in an area that was developed during the construction of the Early Intake Dam. Both EI-S3 and EI-S4 are paved or graveled, although, as mapped, the southern portion of EI-S3 extends slightly up the adjacent steep hillside that would not likely be used for staging.

Staging Area EI-S7. Staging Area EI-S7 is on the northern side of the Tuolumne River between the bridge over the river and the Early Intake Diversion Dam. The northern portion of the staging area is on the paved road; the southern portion of the staging area is on a flat terrace above the river that is currently being used for materials storage and staging.

Early Intake Archeological Resources

As reported in the *historic context and archeological survey report,* the entire area of potential effects for the Early Intake area has been subject to archeological inventory efforts by AECOM (on behalf of the San Francisco Planning Department) for the current undertaking. No archeological resources have been identified at EI-S1, EI-S2, EI-S4, or EI-S7. At EI-S3, two previously undocumented archeological resources, EI-S3-1 and EI-S3-2, have been identified, and each is discussed below.

EI-S3-1: EI-S3-1 is a building pad with a stacked rock retaining wall recorded in Staging Area EI-S3 during the 2019 AECOM survey. The retaining wall is constructed of dry-laid rubble and is backfilled with gravel. The surrounding roads are paved and on the pad is a modern metal pole barn that is much smaller than the pad. Based on aerial photographs, the pole barn was constructed following the 2013 Rim Fire.

EI-S3-2: EI-S3-2 is a modified drainage that runs along the southwestern edge of the EI-S3 work area. The drainage parallels the paved road and is culverted beneath the road. Near the culvert, the bottom of the ditch is paved with rock and grouted with concrete. A rock and concrete headwall and wingwall protect the mouths of the corrugated metal pipe culvert beneath road. This feature was likely constructed circa 1960 to keep water from the Early Intake Adit away from the switchyard.

Impact Assessment

Temporary Construction Staging at EI-S1, EI-S2, EI-S4, and EI-S7. There are no known or suspected resources in the EI-S1, EI-S2, EI-S4, and EI-S7 staging areas. Because project implementation here would for the most part use previously paved and/or graded surfaces, minimal ground disturbance in these staging areas would be required (i.e., less than 1 foot below ground surface). Therefore, the potential for previously unidentified archeological resources to be exposed during project implementation is negligible. Although negligible, the potential to inadvertently uncover previously unknown archeological resources during ground-disturbing activities cannot be completely dismissed. The inadvertent exposure of a previously unknown archeological resource could be a significant impact because the effects of the disturbance would permanently alter the integrity of the deposit where exposed. Implementation of **Mitigation Measures M-CR-2a Accidental Discovery**, and potentially **M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources**, as necessary (e.g., if Native American resources were discovered), would reduce impacts to a less-than-significant level by requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources in the EI-S1, EI-S2, EI-S4, and E-S7 staging areas would be *less than significant with mitigation*.

Temporary Construction Staging at EI-S3. The proposed staging area is primarily on a previously graded and graveled surface and, if any ground disturbance is required, the amount of soil disturbance would be minor (i.e., less than 1 foot below ground surface). The potential that project implementation would result in the uncovering of archeological deposits associated with either EI-S3-1 or EI-S3-2 is therefore negligible. Although archaeological features were recorded during survey of these areas, these features are on the margin of the staging areas and would not be affected by project activities. Furthermore, it is not anticipated that archaeological deposits would be associated with features of this time. It therefore is not anticipated that the use of EI-S3 for temporary staging would cause a substantial adverse change in the significance of the recorded resources pursuant to CEQA Guidelines section 15064.5. Similar to the other staging areas in the Early Intake area, neither EI-S3-1 nor EI-S3-2 would be impacted by project implementation, but the potential to inadvertently uncover previously unknown archeological resources during ground-disturbing activities cannot be completely dismissed. The inadvertent exposure of a previously unknown archeological resource could be a significant impact because the effects of the disturbance would permanently alter the integrity of the deposit where exposed. Implementation of **Mitigation Measure M-CR-2a Accidental Discovery**, and potentially additional mitigation as necessary, including **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources** (e.g., if Native American resources were discovered), would reduce impacts to a less-than-significant level by requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources in the EI-S3 staging area would be *less than significant with mitigation*.

South Fork Area

To address water infiltration into the tunnel, a 750-foot-long extension of the existing siphon is proposed. This siphon extension would be constructed via conventional rock excavation methods, including drilling and controlled detonation, as well as mechanical excavation. Construction access for the siphon extension would be from a new 105-foot-deep, approximately 20-foot-diameter vertical access shaft in Staging Area SF-S8 (see below). In addition, vent outlets connecting to the existing tunnel on both the eastern and western side of the South Fork Siphon would be needed. Eight staging areas would be established in the South Fork Area: SF-S1, SF-S2, SF-S3, SF-S4, SF-S5, SF-S6, SF-S7, and SF-S8. At Staging Areas SF-S7 and SF-S8, disturbance as deep as 5 feet below ground surface may be required for leveling and removal of rocks. A nominal value (less than 1 foot) for the depth of potential disturbance is included for the remaining staging areas, to account for the routine use of those staging areas.

South Fork Project Components (see Figure E.4-1, Sheet 2)

Staging Area SF-S1. Staging Area SF-S1 is in an SFPUC maintenance yard on Cherry Lake Road/Forest Service Road 1N07. The yard is graveled and encircled with a chain-link and barbed wire fence. The maintenance yard has been cut and leveled to allow for construction of a building in the yard, as well as for parking and equipment storage/staging.

Staging Area SF-S2. Staging Area SF-S2 is a graded dirt and gravel area along a section of Old Big Oak Flat Road west of where Cherry Lake Road/Forest Service Road 1N07 intersects Highway 120. It is used informally for parking and may also be used for staging.

Staging Area SF-S3 and SF-S4. Staging Areas SF-S3 and SF-S4 are small, flat, graded dirt and gravel pull-outs along the paved alignment of Old Big Oak Flat Road north of Highway 120. These pull-outs are currently used as ad hoc parking for access to the South Fork of the Tuolumne River downstream of the Highway 120 bridge. Both staging areas have been graded and somewhat regularly maintained. The eastern edge of SF-S4 is currently being used for the storage of spoils (not by the SFPUC), with Jersey barriers segregating the proposed staging area from the existing rock and concrete debris.

Staging Areas SF-S5 and SF-S6. Staging Area SF-S5 is a small paved area at the northern end of the bridge on the South Fork Access Road/Forest Service Road 1S28B over the Middle Fork of the Tuolumne River. The ground surface of the staging area is completely paved, which likely occurred when the bridge was replaced in the 2000s. Staging Area SF-S6 is also a small paved turnout on the South Fork Access Road/Forest Service Road 1S28B. The staging area is bordered by cliffs on the north and west and is subject to frequent rock falls. Netting has been installed to capture the falling rock and the staging area is delineated with red-painted "no parking" zones.

Staging Areas SF-S7 and SF-S8. Staging Area SF-S7 is below and just southwest of the Mountain Tunnel portal on the northern bank of the river. SF-S7 is rocky and much of the area is overgrown with vegetation. SF-S8 is likewise located on the northern side of the South Fork of the Tuolumne River, much of it comprising the paved South Fork Access Road/Forest Service Road 1S28B as well as an area near South Fork Adit that is covered with a layer of shotcrete. A modern concrete slab, metal railing, and metal staircase that provide access to the portal also occur at SF-S8.

Vent Work Areas East and West. Vent Work Area East is a nearly vertical component of the project, situated on a rocky bluff above the South Fork Access Road/Forest Service Road 1S28B after it crosses the Middle Fork of the Tuolumne River. Vent Work Area West is likewise a nearly vertical component of the project, situated above the South Fork of the Tuolumne River and across the river from the terminus of the South Fork Access Road/Forest Service Road 1S28B. The work area is on a rocky cliff face that rises abruptly up from the river.

South Fork Access Road Improvements. The SFPUC has proposed improvements to the generally paved South Fork Access Road/Forest Service Road 1S28B in the canyon of the South Fork of the Tuolumne River. The road connects the South Fork area of the Mountain Tunnel to Big Oak Flat Road. Proposed improvements include road widening, rock scaling, the placement of rock dowels to secure the rock face above the road, and the installation of both retaining walls and gabions to support the new roadbed.

South Fork Archeological Resources

No archeological resources have been identified at SF-S1, SF-S3, SF-S4, SF-S5, SF-S6, SF-S8, or the two Vent Work Areas. Two archeological resources, P-55-000110 and P-55-004524/P-55-006750, have been identified within SF-S2; and a feature of one resource, P-55-002994 (Mountain Tunnel), has been recorded in SF-S7.[117] P-55-000110 (a former segment of railroad) reportedly once occurred in SF-S2, but no evidence of the resource was identified during the AECOM archeological survey. Although it has not been found again, P-55-000110 and the other resources occurring in the area of potential effects are discussed individually below.[118]

EI-S3 P-55-000110. P-55-000110 consists of the alignment of the Hetch Hetchy Railroad. The railroad was constructed circa 1916 or 1917 to provide access and transport for the Hetch Hetchy project. The grade was not identified during AECOM's 2019 survey. Staging Area SF-S2 has been heavily graded and a large push pile of soil, rock, and other debris borders the edge of the staging area. It is possible that this particular remnant of the railroad has been destroyed by previous ground-disturbing activities.

P-55-004524/P-55-006750. P-55-004524/P-55-006750 is a multicomponent site that contains both a sparse prehistoric component and the remains of a Hetch Hetchy construction work camp. Artifacts recorded in the portion of the site within which project components would occur include a sparse scatter of obsidian and quartz debitage.[119] Historic-period artifacts are also present, including barrel hoops, nails, cans, glass, and ceramics, as well as a previously undocumented concrete footing.

P-55-002994. The Mountain Tunnel itself has been previously assigned resource number P-55-002994. Although a resource of the built environment and thus addressed in Impact CR-1 above, the Mountain Tunnel was originally recorded on archeological site forms.[120] Because the archeological site record prepared for P-55-002994 is still being circulated by the Central California Information Center, the resource is discussed here. The portion of the Mountain Tunnel at South Fork has been identified as "Feature C"; this originally consisted only of the 1969 subsurface siphon currently in use;[121] subsequently, the aboveground remnants of the original pipeline across the river, including the foundation elements on either side of river, were added to Feature C of P-55-002994.[122] In an assessment of the Mountain Tunnel, a qualified architectural historian determined that South Fork crossing suffered a loss of integrity of

[117] The alignment of the Mountain Tunnel runs beneath SF-S8; however, it is below the vertical limits of the APE.

[118] URS (a subsidiary of AECOM), *Historic Context and Archeological Survey Report for the Mountain Tunnel Improvements Proje*ct, report prepared for the San Francisco Public Utilities Commission and the San Francisco Planning Department, Environmental Planning Division, URS, San Francisco, California, 2019. This document contains confidential information; accordingly, it is excluded from the Administrative Record.

[119] Waste flakes from stone tool manufacturing.

[120] Richard Kardash and H.K. Gibbs, Archaeological Site Record for P-55-2994/CA-TUO-2016H, 1981, on file at the Central California Information Center, California State University, Stanislaus, Turlock, California. This document contains confidential information; accordingly, it is excluded from the Administrative Record.

[121] Richard Kardash and H.K. Gibbs, Archaeological Site Record for P-55-2994/CA-TUO-2016H, 1981, on file at the Central California Information Center, California State University, Stanislaus, Turlock, California. This document contains confidential information; accordingly, it is excluded from the Administrative Record.

[122] Drew M. Bailey, William Self Associates, Continuation Sheet to Archaeological Site Record for P-55-2994/CA-TUO-2016H, 1981, on file at the Central California Information Center, California State University, Stanislaus, Turlock, California. This document contains confidential information; accordingly, it is excluded from the Administrative Record.

design, materials, workmanship, and feeling, because of the 1969 demolition of the original pipeline.[123] This assessment includes the existing piers that supported the original aboveground crossing.

A previously unidentified concrete weir was identified during the archeological survey in the course of the river along the access road into the crossing.[124] At the crossing, the previously noted leveled area of rock rubble—likely spoils from the drilling of the Mountain Tunnel—covered with shotcrete was also found again during the recent archeological survey.[125] The shotcrete is a more recent addition by the SFPUC, perhaps as a means of providing a relatively level and stable work surface; however, it is also surmised that the shotcrete was applied to the rock rubble to prevent erosion.[126]

Impact Assessment

Creating Vents in Vent Work Areas East and West. Drilling would occur at the Vent Work Area East from within the hillside extending upward into the ceiling until daylighting on the cliff face. For Vent Work Area West, drilling from inside the hillside would not be necessary, but the existing air vents would be extended through piping attached to the ground to a higher elevation on the steep canyon wall. There are no known or suspected archeological resources in these locales. Therefore, there would be *no impact* to archeological resources from project construction activities at the Vent Work Areas East and West.

Temporary Construction Staging SF-S1, SF-S3, SF-S4, SF-S5, and SF-S6. There are no known or suspected resources in the SF-S1, SF-S3, SF-S4, SF-S5, and SF-S6 staging areas. Because project implementation in these staging areas would for the most part use previously paved and/or graded surfaces, minimal ground disturbance would be required (i.e., less than 1 foot below ground surface). Therefore, the potential for previously unidentified archeological resources to be exposed during project implementation is negligible. Consequently, use of SF-S1, SF-S3, SF-S4, SF-S5, and SF-S6 for temporary staging would not cause a substantial adverse change in the significance of any recorded resources pursuant to CEQA Guidelines section 15064.5, because none are present. Likewise, the proposed use of these areas is not anticipated to disturb any human remains, including those interred outside of formal cemeteries, nor cause a substantial adverse change in the significance of a tribal cultural resource as defined in Public Resources Code section 21074, because the limited ground disturbance would be unlikely to encounter human remains even were they present.

Although ground disturbance is minimal, the potential to inadvertently uncover previously unknown archeological resources during ground-disturbing activities cannot be completely dismissed. The inadvertent exposure of a previously unknown archeological resource could be a significant impact because the effects of the disturbance would permanently alter the integrity of the deposit where exposed. Implementation of **Mitigation Measure M-CR-2a Accidental Discovery**, and potentially additional mitigation as necessary, including **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources** (e.g., if Native American resources were discovered), would

[123] JRP Historical Consulting, LLC, *Historic Resources Evaluation, Mountain Tunnel Access and Adit Improvement Project*, Tuolumne County, California, July 2015.

[124] URS (a subsidiary of AECOM), *Historic Resources Inventory and Evaluation Report Addendum for the Mountain Tunnel Improvements Project*, report prepared for the San Francisco Public Utilities Commission, URS Corporation, Portland, Oregon, June 2019, 2019.

[125] URS (a subsidiary of AECOM), *Historic Resources Inventory and Evaluation Report Addendum for the Mountain Tunnel Improvements Project*, report prepared for the San Francisco Public Utilities Commission, URS Corporation, Portland, Oregon, June 2019, 2019.

[126] Drew M. Bailey, William Self Associates, Continuation Sheet to Archaeological Site Record for P-55-2994/CA-TUO-2016H, 1981, on file at the Central California Information Center, California State University, Stanislaus, Turlock, California. This document contains confidential information; accordingly, it is excluded from the Administrative Record.

reduce impacts to a less-than-significant level by requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources in the SF-S1, SF-S3, SF-S4, SF-S5, and SF-S6 staging areas would be *less than significant with mitigation*.

Temporary Construction Staging SF-S2. Two archeological resources, P-55-000110 and P-55-004524/ P-55-006750, have been previously identified at Staging Area SF-S2. P-55-000110 was not found again during AECOM's 2019 survey efforts and may have been destroyed by recent grading activities in the proposed staging area.[127] Nonetheless, remnants of the resource could occur beneath spoil piles currently found in the staging area. Proposed Staging Area SF-S2 is on previously graded and graveled surfaces; however, because of the presence of P-55-004524/P-55-006750, no site grading or other ground-disturbing activities are proposed to prepare the site for staging. Furthermore, as presented in Section A.6.11 (SFPUC Standard Construction Measures and Other Avoidance/Minimization Measures, included as part of the Project), the SFPUC proposes placing geotextile fabrics and gravel in this staging area to prevent rutting. Therefore, the potential that project implementation would result in the uncovering of archeological materials associated with P-55-000110 or P-55-004524/P-55-006750 is negligible. Because the use of SF-S2 for temporary staging would not cause a substantial adverse change in the significance of the recorded resources pursuant to CEQA Guidelines section 15064.5, impacts to P-55-000110 or P-55-004524/ P-55-006750 would be *less than significant.*

Temporary Construction Staging SF-S7 and SF-S8. As detailed in the *historic context and archeological survey report*,[128] features associated with P-55-002994 (the Mountain Tunnel) have been identified in the immediate vicinity of the area of potential effects, including one feature in the SF-S8 staging area. This feature in SF-S8 consists of a concrete pier that supported the original above-grade Mountain Tunnel pipe across the South Fork, which was demolished and replaced with a below-grade siphon in 1969.[129] Other similar concrete piers in the vicinity but outside the area of potential effects are on both sides of the river in this vicinity.

Preparation of SF-S7 and SF-S8 would require the removal of up to 5 feet of existing debris (e.g., fractured roadbed and tunnel spoils) to develop a level and stable working surface but would not significantly impact P-55-002994. The concrete pier recorded as a component of P-55-002994 in SF-S8 is not a contributing element of the resource because it, along with the other features in this locale, no longer retains sufficient integrity to warrant inclusion in the National Register and/or California Register. From an archeological perspective, the piers alone would not be eligible for inclusion to either register under any criteria. Because the piers in the project vicinity, including the pier in SF-S8, would not be eligible for listing in either the National Register and/or California Register either as a component of the historic Mountain Tunnel or as an individual resource, damage to the pier during removal of rubble would not

[127] URS (a subsidiary of AECOM), *Historic Context and Archeological Survey Report for the Mountain Tunnel Improvements Proje*ct, report prepared for the San Francisco Public Utilities Commission and the San Francisco Planning Department, Environmental Planning Division, URS, San Francisco, California, 2019. This document contains confidential information; accordingly, it is excluded from the Administrative Record.

[128] URS (a subsidiary of AECOM), *Historic Context and Archeological Survey Report for the Mountain Tunnel Improvements Proje*ct, report prepared for the San Francisco Public Utilities Commission and the San Francisco Planning Department, Environmental Planning Division, URS, San Francisco, California, 2019. This document contains confidential information; accordingly, it is excluded from the Administrative Record.

[129] JRP Historical Consulting, LLC, Historic Resources Evaluation, Mountain Tunnel Access and Adit Improvement Project, Tuolumne County, California, 2015.

cause a substantial adverse change in the significance of the resource pursuant to CEQA Guidelines section 15064.5.

It is, however, possible that during the removal of the debris from both SF-S7 and SF-S8, currently unknown archeological features, in particular remnants of the Hetch Hetchy South Fork Camp, could be inadvertently exposed. The inadvertent exposure of a previously unknown archeological resource could be a significant impact because the effects of the disturbance would permanently alter the integrity of the deposit where exposed. Implementation of **Mitigation Measure M-CR-2a Accidental Discovery,** and potentially **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources,** as necessary (e.g., if Native American resources were discovered), would reduce impacts to a less-than-significant level by requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources in the SF-S7 and SF-S8 staging areas would be *less than significant with mitigation*.

South Fork Access Road Improvements. As detailed in the *historic context and archeological survey report* prepared for this project, portions of P-55-002994 have been identified along the South Fork Access Road/ Forest Service Road 1S28B, which is slated for proposed improvements. The identified feature of P-55-002994 in this vicinity consists of what has been interpreted as a concrete weir that has been constructed atop bedrock in the cascade of the South Fork just east of the confluence of the South Fork and the Middle Fork of the Tuolumne River.[130] The weir may have been associated with the Mountain Tunnel work camp at this location, of which no other archaeological evidence has been documented. The feature is not, however, depicted on the South Fork Camp No. 2 facilities map,[131] and may have simply been a feature designed to divert the flow of the river through the cascades away from the South Fork Access Road. Although the weir falls within the horizontal limits of the area of potential effects, because the proposed road improvements would not include the removal of bedrock from the river side of the road, the weir would be untouched (it is below the vertical limits of the area of potential effects).

Proposed improvements to the South Fork Access Road/Forest Service Road 1S28B would entail a variety of ground-disturbing activities, the majority of which would occur directly within bedrock where there is no potential for archeological resources to occur. However, although most of the proposed work would occur in bedrock, there are likely areas of undisturbed soil in the area of potential effects delineated for these proposed road improvements. It is therefore possible that previously unidentified archeological resources, perhaps obscured below the existing pavement surfaces, could be inadvertently exposed during project implementation. The inadvertent exposure of previously unknown archeological resources, including those containing human remains, could be a significant impact because the integrity of the resource where exposed would be permanently altered. Implementation of **Mitigation Measure M-CR-2a Accidental Discovery** and potentially additional mitigation as necessary, including **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources** (e.g., if Native American resources were discovered) would reduce impacts to a less-than-significant level by

[130] URS (a subsidiary of AECOM), *Historic Context and Archeological Survey Report for the Mountain Tunnel Improvements Proje*ct, report prepared for the San Francisco Public Utilities Commission and the San Francisco Planning Department, Environmental Planning Division, URS, San Francisco, California, 2019. This document contains confidential information; accordingly, it is excluded from the Administrative Record.

[131] Hetch Hetchy Water and Power, South Fork Camp No. 2 map, 1921.

requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources in the road corridor would be *less than significant with mitigation.*

Adit 5/6 Area

As detailed in the project description, project components in this area include the installation of a 36-inch-diameter culvert adjacent to the entrance to Adit 5/6. Two staging areas are also proposed in the Adit 5/6 Area: A5/6 S1 (0.86 acre) and A5/6 S2 (0.31 acre). A nominal value (less than 1 foot) for the depth of potential disturbance is assumed for the staging areas, to account for their routine use for staging. The trench to install the culvert would be entirely within Staging Area A5/6-S2 and would extend to a maximum depth of 5 feet. There are also proposed modifications to the existing road, including the construction of turnouts, drainage improvements, installation of retaining walls and gabion embankments, and construction of cantilevered sections of roadbed.

Adit 5/6 Project Components (see Figure E.4-1, Sheets 3 and 4)

Staging Area A5/6-S1. Staging Area A5/6-S1 is in an existing parking lot that has previously been used for staging and parking by the SFPUC, forest service, and the general public. The parking lot is an abandoned section of Highway 120 that has been graveled and routinely graded.

Staging Area A5/6-S2. Staging Area A5/6-S2 is a flat terrace outside the entrance to Adit 5/6 that was cut into the hillside for the original construction of the adit. The terrace has been routinely graded, compacted, and graveled.

Adit 5/6 Access Road Improvements. The SFPUC proposes improvements to the approximately 1.5-mile-long Adit 5/6 Access Road/Forest Service Road 1S01, including road widening. Improvements would entail the installation of gabions, retaining walls, cantilevered sections, and building turnouts; the scaling of rock faces and the placement of rock dowels to secure these faces; and the removal of vegetation and trees adjacent to the road, where necessary in certain instances to ensure adequate clearance for construction vehicles or road safety (e.g., cutting into a hillside could compromise the stability of an upslope tree, requiring its removal). Each of the gabion embankments and retaining walls downslope from the roadbed potentially disturb soils up to 10 feet below the current ground surface. The majority of the road is graveled, except for a portion near the intersection of Forest Service Roads 1S01 with 1S25Y, which is graded, packed dirt. In addition to the proposed turnouts and vegetation removal, the SFPUC is proposing to remove and replace or install new drainage improvements along the access road. Each of these improvements would be installed in a portion of the road that has recently been graveled. As discussed in the Project Description, the SFPUC would also place geotextile fabric prior to graveling existing portions of the road where the road bisects known cultural resources.

Adit 5/6 Archeological Resources

As detailed in the *historic context and archeological survey report* completed for the Mountain Tunnel Improvements project, the entire area of potential effects for the Adit 5/6 project area has been subject to archeological inventory efforts, both by AECOM (on behalf of the San Francisco Planning Department) for the current undertaking and by others in the past. Two archeological resources have been identified in the Adit 5/6 area of the project, P-55-000575 and P-55-009623.

P-55-000575. P-55-000575 consists of an isolated obsidian biface that was originally identified on the northern edge of the Adit 5/6 Access Road/Forest Service Road 1S01. It is very possible that the artifact is not *in situ*, but rather has been displaced from one of the nearby prehistoric lithic deposits—in particular P-55-002971, which is to the east of where this obsidian biface was discovered. Because this isolated archeological artifact does not meet the criteria for the National Register or California Register eligibility, it will receive no further consideration herein.

P-55-009623. P-55-009623 is the site of the former Adit 5/6 Work and Camp Site and comprises numerous historic-era features, including foundation remnants, railroad grade (with ties), rock walls, building pads, and artifacts (industrial and domestic) associated with the original construction of the Hetch Hetchy system. Remaining site constituents are situated primarily on the steep slopes found both above and below the access road, as well as on the excavated terrace that would be used as staging (A5/6-S2). Formerly extant features of the site, primarily foundations from the structures and machinery that were used during the construction of the adit and tunnel, were documented and then demolished as part of a previous undertaking, following a determination that these features were noncontributing elements of P-55-009623.[132]

Impact Assessment

Temporary Construction Staging at A5/6-S1. There are no known or suspected resources in Staging Area A5/6-S1. Temporary construction staging at A5/6-S1 would occur on existing graveled and graded surfaces that have been permitted for use as staging areas in the past. Because project implementation would require minimal ground disturbance in staging areas (i.e., less than 1 foot below ground surface), the potential for previously unidentified archeological resources to be exposed during project implementation is negligible. Although the potential to inadvertently uncover previously unknown archeological resources during ground-disturbing activities is negligible, the potential to expose unknown archeological resources cannot be completely dismissed. The inadvertent exposure of a previously unknown archeological resource could be a significant impact because the effects of the disturbance would permanently alter the integrity of the deposit where exposed. Implementation of **Mitigation Measure M-CR-2a Accidental Discovery**, and potentially additional mitigation as necessary, including **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources** (e.g., if Native American resources were discovered), would reduce impacts to a less-than-significant level by requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources in the A6/6-S1 staging area would be *less than significant with mitigation*.

Temporary Construction Staging at A5/6-S2. Staging Area A5/6-S2 is within the confines of a known resource, the Adit 5/6 Work and Camp Site (P-55-009623). The proposed staging area is, however, located on a previously graded and graveled surface; features associated with the site in the staging area were removed as part of prior development at the staging area. Use of the area would require little ground disturbance for construction staging (i.e., less than 1 foot below ground surface). Additionally, the disturbance would be within the roadbed of a substantial road cut that was recently improved as part of the SFPUC’s Adit and Access Project. Although proposed trenching for culvert installation is estimated to be 5 feet, this excavation would occur at the mouth of the existing adit, which was cut into the native

132 JRP Historical Consulting, LLC, Historic Resources Evaluation, Mountain Tunnel Access and Adit Improvement Project, Tuolumne County, California, July 2015.

bedrock. The potential that archeological deposits associated with P-55-009623 could be present in this cut is negligible. Therefore, project implementation at Staging Area A5/6-S2 would not cause a substantial adverse change in the significance of the recorded resource pursuant to CEQA Guidelines section 15064.5.

Although P-55-009623 would not be significantly impacted by project implementation, the potential to expose unknown archeological resources cannot be completely dismissed. Such resources, if present, would likely be limited to Hetch Hetchy Water and Power activities because prior to the construction of the Hetch Hetchy system, the project location was on a very steep hillside. The inadvertent exposure of a previously unknown archeological resource could be a significant impact because the effects of the disturbance would permanently alter the integrity of the deposit where exposed. Implementation of **Mitigation Measure M-CR-2a Accidental Discovery** and potentially additional mitigation as necessary, including **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources** (e.g., if Native American resources were discovered), would reduce impacts to a less-than-significant level by requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources in the A5/6-S2 staging area would be *less than significant with mitigation*.

Adit 5/6 Access Road Improvements. Portions of Adit 5/6 Access Road/Forest Service Road 1S01 slated for improvements would occur in areas of elevated archeological sensitivity, because of the proximity to the Adit 5/6 Work and Camp site (P-55-009623) and other recorded prehistoric and historic archeological resources. Project engineers have designed the road improvements to avoid known archeological resources, either proposing no improvements through known prehistoric resources or, in the case of P--55-009623, avoiding all recorded features and artifact deposits as well as areas where archival evidence indicates features had been located. Given the archeological sensitivity, however, there would still be a potential for construction activities (required for the proposed road improvements) to inadvertently expose—and therefore affect by permanently altering the integrity of the deposit at the discovery—previously unknown archeological resources, including those that may be eligible for listing on the National Register and/or the California Register.

The inadvertent exposure of a previously unknown archeological resource could be a significant impact. Implementation of **Mitigation Measure M-CR-2a Accidental Discovery**, and potentially additional mitigation as necessary, including **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources** (e.g., if Native American resources were discovered), would reduce impacts to a less-than-significant level by requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources along the A5/6 Access Road would be *less than significant with mitigation*.

Adit 8/9 Area

Project components in this area include the installation of a 36-inch-diameter culvert adjacent to the entrance to Adit 8/9. Five staging areas are also proposed in the Adit 8/9 Area: A8/9-S1, A8/9-S3, A8/9-S4, A8/9-S5, and A8/9-S6. At Staging Area A8/9-S4, as much as 40 feet of the hillside above the existing roadway would have to be removed to create the final staging area. A nominal value (less than 1 foot) for the depth of potential disturbance is assumed for the remaining staging areas to account for their routine use during project implementation. The trench to install the culvert would be entirely within Staging Area A8A8/9-S1 and would extend to a maximum depth of 5 feet. There are also proposed modifications to the existing road, including the construction of turnouts, drainage improvements, and installation of retaining walls and gabion embankments.

Adit 8/9 Project Components (see Figure E.4-1, Sheets 5 and 6)

Staging Area A8/9-S1. Staging Area A8/9-S1 is on a flat terrace outside the entrance to Adit 8/9 that was cut into the hillside for the original construction of the adit. The terrace has been routinely graded, compacted, and graveled.

Staging Area A8/9-S3. Staging Area A8/9-S3 is in an existing dirt parking area south of Ferretti Road. The staging area is ringed by large boulders added to prevent vehicles from traveling off road. Bordering the western side of the proposed staging area is FSR IS52Y.

Staging Area A8/9-S4. Staging Area A8/9 S4 is on an existing graded, compacted, and graveled turnout at the intersection of FSR 1N10 and the access spur to Adit 8/9. Creation of Staging Area A8/9-S4 would require cutting into the face of the adjacent cut-bank, the estimated cut approaching 40 feet in height.

Staging Area A8/9-S5. Staging Area A8/9-S5 is northwest of Highway 120, southeast of Casa Loma Road, and southwest of Ferretti Road. Staging is proposed on an existing graded and graveled area actively used for parking by rafting companies.

Staging Area A8/9-S6. Staging Area A8/9-S6 is north of Highway 120 and south of Casa Loma Road, to the northeast of Ferretti Road. Staging is proposed primarily on an existing graded and graveled area actively used for the staging of construction materials by Caltrans.

Adit 8/9 Access Road Improvements. The SFPUC has proposed improvements to the Adit 8/9 Access Road/Forest Service Road 1N10 (Lumsden Road). The area of work would occur in discontinuous stretches of the graveled road and would include general widening, the creation of turnouts, the installation of retaining walls and gabions, scaling of rock faces, the installation of rock dowels, and tree and vegetation removal. The SFPUC is also proposing to remove and replace or install new drainage improvements along the access road. The gabion embankments and retaining walls downslope from the roadbed would each potentially disturb soils up to 10 feet below the current ground surface.

Adit 8/9 Archeological Resources

As detailed in the historic context and archeological survey report completed for the Mountain Tunnel Improvements project, the entire area of potential effects for the Adit 8/9 project area has been subject to archeological inventory efforts by both AECOM (on behalf of the San Francisco Planning Department) for the current undertaking as well as others in the past. Two previously recorded archeological resources have been identified in the area of potential effects; FS No. 05-16-54-1705 in A8/9-S3 and P-55-009624 in A8/9-S1.

FS No. 05-16-54-1705. This archeological resource consists of a historic-period refuse deposit. The resource was described as a "domestic or local historic dump" that exhibits evidence of modern camping and hunting activity; its origin has not been determined. Identified artifacts include ceramic sherds (including stoneware, refined earthenware, and whiteware), glass fragments, ferrous metal pieces, faunal remains, and milled wood.

P-55-009624. P-55-009624 is the site of the former Adit 8/9 Work and Camp Site and comprises numerous historic-era features, including foundation remnants, building pads, and artifacts associated with the original construction of the Hetch Hetchy system.

Impact Assessment

Temporary Construction Staging at A8/9-S1. Staging Area A8/9-S1 is within the confines of a known resource, the Adit 8/9 Work and Camp Site (P-55-009624). The proposed staging area is, however, situated on a previously graded and graveled surface. Use of the area would require little ground disturbance for construction staging (i.e., less than 1 foot below ground surface), and any such disturbance would be within a substantial cut that was made into the hillside to construct the adit. The potential that project implementation would result in the uncovering archeological deposits associated with P-55-009624 is therefore negligible.

Although the potential to impact P-55-009643 is negligible, given the minor degree of soil disturbance required for project implementation, the potential to expose unknown archeological resources cannot be completely dismissed. Such resources, if present, would likely be limited to Hetch Hetchy Water and Power activities prior to the construction of the Hetch Hetchy system, because the project location was on a very steep hillside. The inadvertent exposure of a previously unknown archeological resource could be a significant impact because the effects of the disturbance would permanently alter the integrity of the deposit where exposed. Implementation of **Mitigation Measure M-CR-2a Accidental Discovery** and potentially additional mitigation as necessary, including **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources** (e.g., if Native American resources were discovered), would reduce impacts to a less-than-significant level by requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources in the A8/9-S1 staging area would be *less than significant with mitigation.*

Temporary Construction Staging at A8/9-S3. Archeological resource FS-05-16-54-1705 has been recorded within the confines of Staging Area A8/9-S3. The proposed staging area is on a previously graded and graveled surface, and there is nothing to suggest the presence of a subsurface deposit in the very exposed area. Use of the area would require little ground disturbance for construction staging (i.e., less than 1 foot below ground surface). Furthermore, as detailed in the project description (see Section A.6.11, SFPUC Standard Construction Measures and Other Avoidance/Minimization Measures Included as Part of the Project), the SFPUC would place signage to warn the workforce to not stray outside of the work area; this, in addition to geotextiles and gravel on this staging area to prevent rutting, would prevent physically disturbance to the archeological deposit located here. The potential that project implementation would result in the uncovering of archeological deposits associated with FS-05-16-54-1705 is therefore negligible.

Although impacts to FS-05-16-54-1705 are not anticipated, the potential to expose unknown archeological resources cannot be completely dismissed. The inadvertent exposure of a previously unknown archeological resource could be a significant impact because the effects of the disturbance would permanently alter the integrity of the deposit where exposed. Implementation of **Mitigation Measure M-CR-2a Accidental Discovery**, and potentially additional mitigation as necessary, including **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources** (e.g., if Native American resources were discovered), would reduce impacts to a less-than-significant level by requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources in the A8/9-S3 staging area would be *less than significant with mitigation.*

Temporary Construction Staging at A8/9-S4. No archeological resources have been recorded within the confines of Staging Area A8/9-S4. Development of this staging area would require up to 40 feet of cut to create the work surface. Although every attempt has been made to identify archeological resources in the staging area, there remains the potential that previously unknown archeological resources could be exposed during project implementation. The inadvertent exposure of a previously unknown archeological resource could be a significant impact because the disturbance would permanently alter the integrity of the resource where unearthed. Implementation of **Mitigation Measure M-CR-2a Accidental Discovery,** and potentially additional mitigation as necessary, including **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources** (e.g., if Native American resources were discovered), would reduce impacts to a less-than-significant level by requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources in the A8/9-S4 staging area would be *less than significant with mitigation.*

Temporary Construction Staging at A8/9-S5. There are no known or suspected resources in Staging Area A8/9-S5. Because project implementation requires minimal ground disturbance in this staging area (i.e., less than 1 foot below ground surface), the potential for previously unidentified archeological resources to be exposed during project implementation is negligible.

Although every attempt has been made to identify archeological resources in the staging area, there remains the potential that previously unknown archeological resources could be exposed during project implementation. The inadvertent exposure of a previously unknown archeological resource could be a significant impact because the disturbance would permanently alter the integrity of the resource where unearthed. Implementation of **Mitigation Measure M-CR-2a Accidental Discovery**, and potentially additional mitigation as necessary, including **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources** (e.g., if Native American resources were discovered), would reduce impacts to a less-than-significant level by requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources in the A8/9-S5 staging area would be *less than significant with mitigation.*

Adit 8/9 Access Road Improvements. A section of the Adit 8/9 Access Road/Forest Service Road 1N10 (Lumsden Road) proposed for improvements bisects the Adit 8/9 Work and Camp site (P-55-009624). Project engineers have designed the road improvements along the section of the access road through P-55-009624 to avoid all recorded features, locations of potential resources discovered during archival research,[133] and artifact concentrations of this archeological site. Specifically, the proposed retaining walls, gabions, drainage features, and the rock dowels to help secure the upslope rock faces were designed with input from the San Francisco Planning Department's archeological consultant team to avoid the recorded as well as potential attributes of the site. Consequently, the proposed road improvements in P-55-009624

[133] URS (a subsidiary of AECOM), *Historic Context and Archeological Survey Report for the Mountain Tunnel Improvements Proje*ct, report prepared for the San Francisco Public Utilities Commission and the San Francisco Planning Department, Environmental Planning Division, URS, San Francisco, California, 2019. This document contains confidential information; accordingly, it is excluded from the Administrative Record.

would not cause a substantial adverse change in the significance of an archeological resource (i.e., P-55-009624) pursuant to CEQA Guidelines section 15064.5.

With the exception of P-55-009624, no other archeological resources were identified during AECOM's 2019 investigation along the portions of the access route to Adit 8/9 slated for road improvements.[134] Although every attempt has been made to avoid known archeological resources along the access road, there remains the potential for construction activities to inadvertently expose—and therefore significantly affect—previously unknown archeological resources, including those that may be eligible for listing on the National Register and/or the California Register.

The inadvertent exposure of a previously unknown archeological resource could be a significant impact. Implementation of **Mitigation Measure M-CR-2a Accidental Discovery,** and potentially additional mitigation as necessary, including **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources** (e.g., if Native American resources were discovered), would reduce impacts to a less-than-significant level by requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources would be *less than significant with mitigation*.

Big Creek Shaft Area

There is one proposed staging/work area, BC-S2, at Big Creek Shaft. A nominal value (less than 1 foot) for the depth of potential disturbance is assumed for this staging area to account for its routine use during project implementation.

Big Creek Shaft Project Components (see Figure E.4-1, Sheet 7)

Staging Area BC-S2. This proposed staging area is in the SFPUC's Big Creek Shaft facility and is situated primarily on a previously compacted, graded, and graveled flat terrace. The staging area is in a cleared area lying beneath the SFPUC's transmission lines (and above the Mountain Tunnel).

Big Creek Shaft Archeological Resources

As detailed in the *historic context and archeological survey report* completed for the Mountain Tunnel Improvements project, the entire area of potential effects for the Big Creek Shaft project area has been subject to archeological inventory efforts by both AECOM (on behalf of the San Francisco Planning Department) for the current undertaking, as well as others in the past. P-55-000441 has been recorded in the portion of the project footprint delineated for BC-S2.

P-55-000441. This resource consists of concrete foundations, industrial and domestic artifacts, and tailings associated with drilling the Big Creek Shaft. Domestic artifacts included but were not limited to colorless and amber glass vessel fragments; a complete green, machine-made bottle; canning jar seals; a sanitary seam can; and ceramics, which included a white cup fragment and a small fragment with a possible Blue Willow design.

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[134] URS (a subsidiary of AECOM), *Historic Context and Archeological Survey Report for the Mountain Tunnel Improvements Projec*t, report prepared for the San Francisco Public Utilities Commission and the San Francisco Planning Department, Environmental Planning Division, URS, San Francisco, California, 2019. This document contains confidential information; accordingly, it is excluded from the Administrative Record.

Impact Assessment

Temporary Construction Staging at BC-S2. Archeological site P-55-000441 is within the confines of temporary Staging Area BC-S2. The proposed staging area is, however, a previously graded and graveled surface. Use of the area would require little ground disturbance for construction staging (i.e., less than 1 foot below ground surface), and any such disturbance would be in a previously graded and graveled area where there is no evidence of features, buried deposits, or artifacts. The potential that project implementation would result in the uncovering of archeological deposits associated with P-55-000441 is therefore negligible. The use of BC-S2 for temporary staging would therefore not cause a substantial adverse change in the significance of the P-55-000441 pursuant to CEQA Guidelines section 15064.5.

Although P-55-000441 would not be significantly impacted by project implementation, the potential to expose unknown archeological resources cannot be completely dismissed. The inadvertent exposure of a previously unknown archeological resource could be a significant impact because the effects of the disturbance would permanently alter the integrity of the deposit where exposed. Implementation of **Mitigation Measure M-CR-2b Accidental Discovery** and potentially additional mitigation as necessary, including **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources** (e.g., if Native American resources were discovered), would reduce impacts to a less-than-significant level by requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources in the BC-S2 staging area would be *less than significant with mitigation*.

Second Garrote Shaft Area

Project components in the Second Garrote Shaft Area include the installation of a nonpermeable membrane at the shaft, as well as a new fence to enclose the existing facility. To support construction activities in the area, Staging Area SG-S1 would be established. The nonpermeable membrane around the shaft and fence would be installed within the limits of SG-S1. In addition to the proposed work directly at the shaft, a culvert on the access road to the Second Garrote Shaft would be replaced.

Second Garrote Project Components (see Figure E.4-1, Sheet 8)

Staging Area SG-S1. Temporary Staging Area SG-S1 is situated in the SFPUC's Second Garrote Shaft facility. The staging area sits in the cleared terrace that was created for the drilling of the Second Garrote Shaft. Much of the terrace also appears to be composed of waste rock that was generated with the drilling of the shaft. The terrace been compacted, graded, and graveled to create the facility, including the Second Garrote Pump Station (a component of the facility). The graveled access road that loops around the facility is also within the boundaries of Staging Area SG-G1. The area west of the pump station, also within Staging Area SG-S1, is littered with waste rock.

Installation of Nonpermeable Membrane and Fence. To prevent stormwater from entering Second Garrote Shaft from the surface, a nonpermeable membrane would be placed around the shaft. A perimeter fence would be installed that would surround the shaft area, including the new nonpermeable membrane. Installation of the pad would involve nominal ground disturbance, at most up to 1 foot in depth, but the security fence would require post holes of up to 5 feet in depth.

Replacement Culvert on Second Garrote Access Road. An existing culvert on the Second Garrote Access Road that was damaged during previous storm events would be replaced as part of the current project.

Work would involve removing the existing culvert, installing a replacement culvert, and backfilling on top of the newly installed culvert. The maximum depth of excavation is anticipated to be 5 feet below ground surface, with much of that within soils previously excavated for installation of the original culvert.

Second Garrote Archeological Resources

As detailed in the *historic context and archeological survey report* completed for the Mountain Tunnel Improvements project, the entire area of potential effects for the Second Garrote Shaft vicinity has been subject to archeological inventory efforts by both AECOM (on behalf of the San Francisco Planning Department) for the current undertaking, as well as others in the past. P-55-000316 has been recorded in the portion of the project footprint delineated for SG-S1.

P-55-000316. This historic-period resource consists of concrete machine foundations, various pieces of ferrous metal debris, and tailings associated with the drilling of the Second Garrote Shaft, a component of the Hetch Hetchy system.

Impact Assessment

Temporary Construction Staging at SG-S1. Archeological site P-55-000316 is within the confines of temporary Staging Area SG-S1. The proposed staging area is, however, situated on a previously graded and graveled surface that is in large part composed of spoils resulting from the original drilling of the Second Garrote Shaft, and there is no evidence of features, artifacts, or archaeological deposits within the staging area footprint. Use of the area would require little ground disturbance for construction staging (i.e., less than 1 foot below ground surface), and any such disturbance would be within a previously graded and graveled area. The potential that project implementation would result in the uncovering of archeological deposits associated with P-55-000316 is therefore negligible.

Although P-55-000316 would not be significantly impacted by project implementation, the potential to expose unknown archeological resources cannot be completely dismissed. The inadvertent exposure of a previously unknown archeological resource could be a significant impact because the effects of the disturbance would permanently alter the integrity of the deposit where exposed. Implementation of **Mitigation Measure M-CR-2a Accidental Discovery** and potentially additional mitigation as necessary, including **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources** (e.g., if Native American resources were discovered), would reduce impacts to a less-than-significant level by requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources in the SG-S1 staging area would be *less than significant with mitigation*.

Construction of Nonpermeable Membrane and Fencing. Construction of the new nonpermeable membrane and installation of the fencing would occur on the previously graded terrace that sits primarily on waste rock from the drilling of the Second Garrote Shaft. The excavation for the nonpermeable membrane would be confined to previously disturbed soils and waste rock; however, the post holes for the new fencing could extend into undisturbed soils. It is possible that while excavating these post holes, previously undiscovered archeological materials could be inadvertently exposed. The inadvertent exposure of previously unknown archeological resources could be a significant impact because the integrity of the deposit would be permanently altered where the resource was unearthed. Implementation of **Mitigation Measure M-CR-2a Accidental Discovery** and potentially additional mitigation as necessary, including **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources** (e.g., if Native American resources were discovered), would reduce impacts to a less-than-significant level by requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources would be *less than significant with mitigation*.

Installation of Replacement Culvert in Second Garrote Access Road. Although no archeological resources were identified during the archeological survey of the culvert work area,[135] the area is archeologically sensitive. A prehistoric lithic scatter and remnants of the Gold Rush-community of Second Garrote (recorded as P-55-000024) are located within 300 feet of the culvert replacement work site. Although every attempt has been made to identify archeological resources in the work area, there remains the potential that previously unknown archeological resources could be exposed during project implementation. The inadvertent exposure of a previously unknown archeological resource could be a significant impact because the integrity of the deposit would be permanently altered where the resource was unearthed. Implementation of **Mitigation Measure M-CR-2a Accidental Discovery,** and potentially additional mitigation as necessary, including **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources** (e.g., if Native American resources were discovered), would reduce impacts to a less-than-significant level by requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources would be *less than significant with mitigation*.

Priest Reservoir Area

A variety of project components would be developed at Priest Reservoir, including the excavation of a new adit to provide access to the Mountain Tunnel at its Priest Portal terminus. The adit would be conventionally mined (e.g., controlled detonation) to its tie-in point from a pad that would be created at a depth 44 feet from the existing ground surface. In addition to this pad excavation for the adit, a 30-foot-deep vertical access shaft would also be excavated within which an underground flow control facility would be constructed. A surface structure over the flow control facility shaft is proposed. To support construction in the Priest Reservoir Area, a Priest Portal Work Area (2.7 acres) and nine staging areas are proposed: PP-S1, PP-S4, PP-S5, PP-S6, PP-S7, PP-S8, PP-S9, PP-S13, and PP-S15. Three of these staging areas would require grading: PP-S6 to 44 feet below surface where the pad would be excavated to support the mining of the new adit (spoil disposal, a rock-crushing plant, and potentially a water treatment plant would be located at PP-S6 during the construction period); PP-S13 to 20 feet below surface for construction of a temporary water treatment plant unless it is sited at PP-S6; and PP-S15 where the vertical shaft would be excavated to a depth of 30 feet. A nominal value (less than 1 foot) for the depth of potential disturbance is assumed for the remaining six staging areas to account for the routine use of these staging areas during project implementation.

[135] URS (a subsidiary of AECOM), *Historic Resources Inventory and Evaluation Report Addendum for the Mountain Tunnel Improvements Project*, report prepared for the San Francisco Public Utilities Commission, URS Corporation, Portland, Oregon, June 2019, 2019.

Project implementation in the Priest area would also require improvements to approximately 6,600 feet of an existing access road (Rickson Road), and the construction of a proposed power distribution line.

Priest Reservoir Project Components (see Figure E.4-1, Sheets 9 and 10)

Priest Portal Work Area. The Priest Portal Work Area encompasses portions of the rolling hillside of the Priest Reservoir eastern shoreline and extends into the reservoir. It includes an aboveground segment of the aqueduct, and its southern extent includes a section of a concrete-lined spillway. The exposed shoreline above the water line is sparsely vegetated and areas below the water line include gravel and riprap.

Staging Area PP-S1. Staging Area PP-S1 is near the southeastern extent of Priest Reservoir, immediately adjacent to the eastern end of the dam. The dam's concrete-lined spillway is within the limits of Staging Area PP-S1. The areas to be used for staging have been previously compacted, graded, and graveled.

Staging Area PP S4. Staging Area PP-S4 is on the western shore of Priest Reservoir, north of the Priest Reservoir outlet tower. Staging Area PP-S4 is a previously used staging area and has been graded, compacted, and partially graveled.

Staging Area PP-S5. Staging Area PP-S5 is on the southern edge of Rickson Road and consists of an existing staging area that has been previously compacted, graded, and graveled.

Staging Area PP-S6. Staging Area PP-S6 is at the southeastern end of Priest Reservoir and includes portions of an existing, graded, compacted, and graveled staging area above which rises a densely vegetated, moderately steep, rolling hillside.

Staging Area PP-S7. Staging Area PP-S7 is at the southwestern end of Priest Reservoir, adjacent to the western abutment of the dam. PP-S7 consists of a previously graded, compacted, and graveled pad, some of it appearing to be imported material from dam construction.

Staging Area PP-S8. Staging Area PP-S8 is approximately 0.25 mile east of Priest Reservoir, on the southern side of a graveled access road that enters the project area via the Priest-Coulterville Road. Staging Area PP-S8 consists of an unpaved area that has been used as a cull deck for cut trees for the staging of dirt/gravel spoils piles.

Staging Area PP-S9. This staging area is approximately 0.34 mile east/northeast of Priest Reservoir, on the southern edge of a dirt access road entering the project vicinity via the nearby Priest-Coulterville Road. Staging is proposed to occur on the existing graded, compacted, and graveled area.

Staging Area PP-S13. Staging Area PP-S13 is approximately 354 feet south of the outboard toe of Priest Dam. Staging Area PP-S13 has been previously graded, compacted, and used for staging in the past. This vicinity was subject to significant erosion following recent flood events.

Staging Area PP-S15. Staging Area PP-S15 is on a slope above a section of Rickson road running along the eastern shore of Priest Reservoir. Staging Area PP-S15 consists of a gently rolling hillside where some grading and modern infrastructure installation has recently taken place just up from Rickson Road.

Rickson Road Improvements. Rickson Road is an approximately 3-mile-long predominantly paved loop road that provides access into and around the Priest Reservoir Area. Approximately 6,600 feet of Rickson Road along the eastern shoreline of Priest Reservoir would be widened to accommodate the proposed project. Road improvements include gabion embankments and retaining walls downslope from the roadbed, each potentially disturbing soils up to 10 feet below the current ground surface. The segment of Rickson Road that follows the western shoreline of Priest Reservoir would be repaired as needed during the construction period and then repaved at the end of construction; the road repairs and repaving would not involve any widening, slope stabilization, or drainage modifications.

Proposed Power Distribution Alignment. The proposed power distribution alignment extends eastward along the northern shore of the reservoir; across a finger of the reservoir below the mouth of Rattlesnake Creek; on to the eastern shore, where it intersects Rickson Road; then southward along Rickson Road, terminating in Staging Area PP-S6. The portion of the alignment along the northern shore includes segments of a previously graded, compacted, and graveled access road, and an existing power pole. Approximately 30 poles would be set, each being placed in an approximately 10-foot-deep drilled hole.

Priest Reservoir Archeological Resources

As detailed in the *historic context and archeological survey report* completed for the Mountain Tunnel Improvements project, the entire area of potential effects for the Priest Reservoir vicinity has been subject to archeological inventory efforts by both AECOM (on behalf of the San Francisco Planning Department) for the current undertaking, as well as others in the past. AECOM's 2019 archeological investigation determined that one archeological resource (P-55-009407) has been recorded in PP-S4; two resources (PP-S6-1 and PP-S6-2) have been recorded in PP-S6;[136] one resource (PP-S15-1) has been recorded in PP-S15; and one resource (P-55-005991) has been mapped in the alignment of the proposed power distribution line.

P-55-005991. This site consists of a variety of historic-period artifacts, including a ferrous metal stove pipe, roof outlets, a shovel blade, condensed milk cans, a blue enamel metal basin, a smashed bucket, metal, and a possible wagon axle that were discovered in a pile of back dirt from previous bulldozing that occurred somewhere in the general vicinity. These materials were not *in situ* because they were found in a spoils pile. Prior to AECOM's 2019 survey, the site vicinity had been graded, and only two artifacts were observed: a rectangular fragment of ferrous metal and a tin can. Morgan reported that the material comprising P-55-005991 was redeposited and that the site had likely been destroyed prior to recordation. Although little of the resource was found in the current area of potential effects, it is a secondary deposit and as such retains no integrity. Lacking integrity, the resource would not be eligible for the National or California Registers.

PP-S6-1. This newly identified archeological resource consists of a large (40 by 24 feet) flat terrace excavated into hillside and an adjacent historic-period prospecting pit. Other than these two modifications to the natural landscape, no cultural materials were identified in the site area. The resource was recommended as ineligible for listing in the California Register and National Register.

PP-S6-2. This newly identified archeological resource comprises a scatter of historic-period artifacts, including a metal water pitcher and wash basin, a barrel hoop, and 10 ferrous metal cans. An extended Phase 1 subsurface survey completed by AECOM (on behalf of the San Francisco Planning Department) at the site found no evidence of subsurface deposit (beyond 8 or 9 inches in depth), and the artifacts were limited in nature, suggesting a short-term, temporary mining site. Therefore, the site was recommended as ineligible for listing in either the California or National Registers.

PP-S15-1. This archeological resource consists of two historic-period prospecting pits. Other than these two remnants of historic mining activities, no cultural materials were identified in the site area. The resource was recommended as ineligible for listing in the California Register and National Register.

[136] A previously recorded archeological resource, P-55-004763, was not relocated during completion of the archeological survey of PP-S6. It is presumed to have been misplotted.

Impact Assessment

Temporary Use and/or Construction Staging at Priest Portal Work Area, PP-S1, PP-S5, PP-S7, PP-S8, PP-S9, and PP-S13. There are no known or suspected resources in the Priest Portal Work Area, PP-S1, PP-S5, PP-S7, PP-S8, PP-S9, and PP-S13 staging areas. Because project implementation here would, for the most part, use previously paved and/or graded surfaces, minimal ground disturbance in these staging areas would be required (i.e., less than 1 foot below ground surface). The potential for previously unidentified archeological resources to be exposed during project implementation is therefore negligible.

Although negligible, the potential to expose unknown archeological resources cannot be completely dismissed. The inadvertent exposure of a previously unknown archeological resource could be a significant impact because the effects of the disturbance would permanently alter the integrity of the deposit where exposed. Implementation of **Mitigation Measure M-CR-2a Accidental Discovery,** and potentially additional mitigation as necessary, including **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources** (e.g., if Native American resources were discovered), would reduce impacts to a less-than-significant level by requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources in the Priest Portal Work Area, PP-S1, PP-S5, PP-S7, PP-S8, PP-S9, and PP-S13 staging areas would be *less than significant with mitigation.*

Temporary Construction Staging at PP-S4. Features of archeological resource P-55-009407 are present around the edges of Staging Area PP-S4; none, however, extends into the staging area. Similarly, no artifacts have been identified in the exposed footprint of the staging area, which has been previously graded and used as a staging area. Use of the area for the current project would require little ground disturbance for construction staging (i.e., less than 1 foot below ground surface). Because it appears that any cultural material that may have been present in this area has been removed by prior grading, the potential for project implementation to result in the uncovering of archeological deposits associated with P-55-009407 appears to be negligible.

Although no impact to P-55-009407 is anticipated, the potential to expose unknown archeological resources cannot be completely dismissed. The inadvertent exposure of a previously unknown archeological resource could be a significant impact because the effects of the disturbance would permanently alter the integrity of the deposit where exposed. Implementation of **Mitigation Measure M-CR-2a Accidental Discovery** and potentially additional mitigation as necessary, including **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources** (e.g., if Native American resources were discovered), would reduce impacts to a less-than-significant level by requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources in the PP-S4 staging area would be *less than significant with mitigation.*

Temporary Construction Staging at PP-S6. Two newly recorded archeological resources, PP-S6-1 and PP-S6-2, have been recorded in Staging Area PP-S6. Staging Area PP-S6-1 consists entirely of an excavated terrace and a single mining pit situated on a west-facing slope above Rickson Road. As detailed in the *historic context and archeological survey report*,[137] both resources were recommended as ineligible for the California and National Registers and thus warrant no further consideration under CEQA.

Because PP-S6 would require up to 44 feet of excavation, it is possible that during project implementation previously undocumented archeological resources could be inadvertently exposed. There are a number of archeological resources that have been identified near the area of potential effects in this vicinity that elevate the archeological sensitivity of the area around PP-S6. The inadvertent exposure of a previously unknown archeological resource could be a significant impact because the integrity of the deposit would be permanently altered where the resource was unearthed. Implementation of **Mitigation Measure M-CR-2a Accidental Discovery,** and potentially additional mitigation as necessary, including **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources** (e.g., if Native American resources were discovered), would reduce impacts to a less-than-significant level by requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources in the PP-S6 staging area would be *less than significant with mitigation.*

Temporary Construction Staging at PP-S15. One archeological resource, newly recorded site PP-S15-1, has been recorded in Staging Area PP-S15. As detailed in the *historic context and archeological survey report*,[138] this resource was recommended as ineligible for the California and National Registers and thus warrants no further consideration under CEQA. Because there are a number of mining-related features in the vicinity, it is possible that excavation of the 30-foot-deep vertical access shaft could expose previously undocumented archeological resources. The inadvertent exposure of a previously unknown archeological resource could be a significant impact because the integrity of the deposit would be permanently altered where the resource was unearthed. Implementation of **Mitigation Measure M-CR-2a Accidental Discovery** and potentially additional mitigation as necessary, including **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources** (e.g., if Native American resources were discovered), would reduce impacts less-than-significant level by requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources in the PP-S15 staging area would be *less than significant with mitigation.*

Proposed Rickson Road Improvements. As detailed in the *historic context and archeological survey report* prepared for this project, no archeological resources have been identified in the area of potential effects delineated for the proposed Rickson Road improvements. Proposed improvements to Rickson Road along the section that parallels the western shore of Priest Reservoir require little if any ground disturbance, so the potential to inadvertently expose previously unknown archeological resources is low but not completely dismissible. In contrast, a variety of ground-disturbing activities are proposed along

[137] URS (a subsidiary of AECOM), *Historic Resources Inventory and Evaluation Report Addendum for the Mountain Tunnel Improvements Project*, report prepared for the San Francisco Public Utilities Commission, URS Corporation, Portland, Oregon, June 2019, 2019.

[138] URS (a subsidiary of AECOM), *Historic Resources Inventory and Evaluation Report Addendum for the Mountain Tunnel Improvements Project*, report prepared for the San Francisco Public Utilities Commission, URS Corporation, Portland, Oregon, June 2019, 2019.

the course of Rickson Road that parallels the eastern shore of Priest Reservoir. There is therefore an increased potential that previously unidentified archeological resources could be inadvertently exposed during project implementation in that vicinity. The inadvertent exposure of previously unknown archeological resources, including those containing human remains, could be a significant impact because the integrity of the resource where exposed would be permanently altered. Implementation of **Mitigation Measure M-CR-2a Accidental Discovery** and potentially additional mitigation as necessary, including **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources** (e.g., if Native American resources were discovered), would reduce impacts to a less-than-significant level by requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources in the road corridor would be *less than significant with mitigation.*

Proposed Power Distribution Alignment. Archeological resource P-55-005991 was previously recorded in the alignment of the proposed power distribution line. The site was presumed to be a secondary deposit because of its location in a spoils pile and because general vicinity has been damaged by grading. Only two of the previously reported artifacts were found again, suggesting that the site may have been destroyed, perhaps during the removal of the spoil piles in which the artifacts were observed. Regardless, because the material was not recorded *in situ*, the resource would not be eligible for listing in the National or California registries.[139] It is possible that during excavation of the holes for the utility poles previously undocumented archeological resources could be encountered. The inadvertent exposure of a previously unknown archeological resource could be a significant impact because the integrity of the deposit would be permanently altered where the resource was unearthed. Implementation of **Mitigation Measure M-CR-2a Accidental Discovery** and potentially additional mitigation as necessary, including **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources** (e.g., if Native American resources were discovered), would reduce impacts to a less-than-significant level by requiring that field personnel be made aware of the potential to encounter cultural resources and the potential impacts to these resources from soil disturbance, and that soils-disturbing activities must be immediately suspended until the Environmental Review Officer has determined the additional measures to be undertaken. As a result, impacts to previously unidentified historically significant and/or unique archeological resources in the Power Distribution Alignment would be *less than significant with mitigation*.

Impact Summary

Because of the complexity and areal extent of the project, the potential impacts resulting from project implementation were identified by individual project component in each of the specific project areas in the text above. In this section, the impacts are presented on a project level and the details of the measures required to mitigate the potential impacts are outlined.

The project has the potential to inadvertently expose—and therefore affect—previously unknown archeological resources, including those that may be eligible for listing on the National Register and/or the California Register. The inadvertent exposure of a previously unknown archeological resource would be a potentially significant impact because the integrity of the deposit would be permanently altered where the resource was unearthed. However, implementation of **Mitigation Measure M-CR-2a,**

[139] URS (a subsidiary of AECOM), *Historic Resources Inventory and Evaluation Report Addendum for the Mountain Tunnel Improvements Project*, report prepared for the San Francisco Public Utilities Commission, URS Corporation, Portland, Oregon, June 2019, 2019.

Accidental Discovery Measures, would reduce impacts to a less-than-significant level by requiring that field personnel be made aware of potential impacts to resources from soil disturbance and that, in the event of a discovery, a qualified archaeologist will assess the find and, in consultation with the lead agency, conduct archaeological documentation, monitoring, testing, or data recovery as warranted. In addition, where the project would result in ground disturbance in a known archaeological site, and it cannot be demonstrated that no features or deposits associated with the site are present in the proposed work area, **Mitigation Measure M-CR-2b, Archaeological Monitoring** would be implemented. These conditions occur at SF-S7 and SF-S8 because of the potential for archeological features and artifacts associated with the South Fork Camp to be located beneath the rubble that is now present but would be removed during project implementation. **Mitigation Measure M-CR-2b Archeological Monitoring** requires a qualified archaeologist to be present to observe excavation and, in the event of a find, to assess the find and, in consultation with the lead agency, conduct archaeological documentation, data recovery, or other treatment measures as warranted. Therefore, impacts to previously unidentified historically significant and/or unique archeological resources in the area of potential effects for the proposed project would be *less than significant with mitigation.*

Mitigation Measure M-CR-2a: Accidental Discovery (Environmental Planning Archeological Mitigation Measure I)

The following mitigation measure is required 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) and (c), on tribal cultural resources as defined in *CEQA Statute* section 21074, and on human remains and associated or unassociated funerary objects.

ALERT sheet: The SFPUC shall distribute the Planning Department archeological 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 soils-disturbing activities within the project site. Prior to any soils-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.

Training: A preconstruction training shall be provided to all construction personnel performing or managing soils-disturbing activities by a qualified archeologist prior to the start of soils-disturbing activities on the project. The training may be provided in person or using a video and include a handout prepared by the qualified archeologist. The video and materials will be reviewed and approved by the Environmental Review Officer. The purpose of the training is to enable personnel to identify archeological resources that may be encountered and to instruct them on what to do if a potential discovery occurs. Images of expected archeological resource types and archeological testing and data recovery methods should be included in the training.

Affidavit: The SFPUC shall provide the Environmental Review Officer with a signed affidavit from the responsible parties (prime contractor, subcontractor(s), and utilities firm) to the Environmental Review Officer confirming that all field personnel have received copies of the Alert Sheet and have taken the preconstruction training.

Stop work provision: Should any indication of an archeological resource be encountered during any soils-disturbing activity of the project, the project Head Foreman and/or the SFPUC shall immediately notify the Environmental Review Officer and shall immediately suspend any soils-disturbing activities in the vicinity of the discovery until the Environmental Review Officer has determined what additional measures should be undertaken.

Discoveries on nonfederal lands: On fee-owned land or easements on private property, if the Environmental Review Officer determines that an archeological resource may be present within the project site, the SFPUC shall retain the services of an archeological consultant from the pool of qualified archeological consultants maintained by the Planning Department archeologist. The archeological consultant shall advise the Environmental Review Officer as to whether the discovery is an archeological resource, 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 Environmental Review Officer may require, if warranted, specific additional measures to be implemented by SFPUC. The Environmental Review Officer may also determine that the archeological resource is a tribal cultural resource and will consult with affiliated Native Americans tribal representatives, if warranted.

Measures might include preservation in situ of the archeological resource; an archeological monitoring program; an archeological testing program; and an interpretative program. If an archeological monitoring program, archeological testing program, or interpretative program is required, it shall be consistent with the Environmental Planning division guidelines for such programs and reviewed and approved by the Environmental Review Officer. The Environmental Review Officer may also require that the SFPUC immediately implement a site security program if the archeological resource may be at risk from vandalism, looting, or other damaging actions.

The archeological consultant shall submit a Draft Final Archeological Resources Report to the Environmental Review Officer that evaluates the historical significance of any discovered archeological resource and describes the archeological and historical research methods employed in the archeological testing/monitoring/data recovery program(s) undertaken. The Draft Final Archeological Resources Report shall include a curation and deaccession plan for all recovered cultural materials. The Draft Final Archeological Resources Report shall also include an Interpretation Plan for public interpretation of all significant archeological features.

Copies of the Draft Final Archeological Resources Report shall be sent to the Environmental Review Officer for review and approval. Once approved by the Environmental Review Officer, the consultant shall also prepare a public distribution version of the Final Archeological Resources Report. Copies of the Final Archeological Resources Report shall be distributed as follows: California Archaeological Site Survey Central California Information Center shall receive one copy and the Environmental Review Officer shall receive a copy of the transmittal of the Final Archeological Resources Report to the Central California Information Center. The Environmental Planning division of the Planning Department shall receive one bound and one unlocked, searchable PDF copy on compact disc of the Final Archeological Resources 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. In instances of public interest in or the high interpretive value of the resource, the Environmental Review Officer may require a different or additional final report content, format, and distribution than that presented above.

Discoveries on federal lands: In the event that either cultural resources are discovered, or historic properties are inadvertently affected on a Raker Act right-of-way or on National Forest System lands, the SFPUC shall notify both the Environmental Review Officer and the federal land manager. Treatment of the discovery and any tribal consultation shall be conducted under the guidance of the Forest Heritage Resources Program Manager and in accordance with the Archaeological Resource Protection Act of 1979, as amended (93 Stat. 721, et seq.; 16 United States Code [U.S.C.] 470 et. seq.), section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470), and its implementing regulations, entitled Protection of Historic Properties (36 CFR part 800).

The Forest Heritage Resources Program Manager shall submit written notification describing the circumstances of the discovery to the Regional Heritage Program Leader and the California State Historic Preservation Officer (e.g., letter or email notification). The Forest Heritage Resources Program Manager will provide written reports describing the status or resolution of the discovery/inadvertent effect every six months until it is resolved.

Discoveries of human remains and associated or unassociated funerary objects on nonfederal lands: If human remains and associated or unassociated funerary objects are discovered during any soils-disturbing activity on lands owned in fee by the City of San Francisco, or easements on private property, all applicable state and federal laws shall be followed. This shall include immediate notification of the Tuolumne County Sheriff's Office and Coroner's Office and/or the Mariposa County Sheriff's Office and Coroner's Office, depending on the county in which the discovery is made; 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 who shall appoint a Most Likely Descendant (Public Resources Code section 5097.98). The Environmental Review Officer shall also be immediately notified upon discovery of human remains. The archeological consultant, SFPUC, Environmental Review Officer, and Most Likely Descendant shall have up to but not beyond six days after the discovery to make all reasonable efforts to develop an agreement for the treatment of human remains and associated or unassociated funerary objects with appropriate dignity (CEQA Guidelines. section 15064.5[d]). The agreement should take into consideration the appropriate excavation, removal, recordation, analysis, curation, possession, and final disposition of the human remains and associated or unassociated funerary objects. Nothing in existing state regulations or in this mitigation measure compels the SFPUC and the Environmental Review Officer to accept recommendations of a Most Likely Descendant. The archeological consultant shall retain possession of any Native American human remains and associated or unassociated burial objects until completion of any scientific analyses of the human remains or objects as specified in the treatment agreement if such as agreement has been made or, otherwise, as determined by the archeological consultant and the Environmental Review Officer. If no agreement is reached state regulations shall be followed including the reinterment of the human remains and associated burial objects with appropriate dignity on the property in a location not subject to further subsurface disturbance (Public Resources Code section 5097.98).

Discoveries of human remains and associated or unassociated funerary objects on federal lands: If human remains and associated or unassociated funerary objects are discovered during any soils-disturbing activity on a Raker Act right of way or on National Forest System lands, all applicable federal laws shall be followed, and SFPUC shall notify the Forest Heritage Resources Program Manager and Environmental Review Officer immediately. The SFPUC shall ensure that all work within 300 feet of the discovery will cease, the area will be secured, and the Heritage Resources Program Manager shall notify, depending on the location of the discovery, either the Tuolumne County Sheriff's Office and Coroner's Office and/or the Mariposa County Sheriff's Office and Coroner's Office of the discovery.

Native American human remains, funerary objects, sacred objects, or items of cultural patrimony found on federal land will be handled according to section 3 of the Native American Graves Protection and Repatriation Act and its implementing regulations (43 CFR Part 10); the Archaeological Resource Protection Act of 1979, as amended (93 Stat. 721, et seq.; 16 U.S.C. 470 et. seq.), and the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470f; 479h-2) and its implementing regulations, entitled Protection of Historic Properties (36 CFR part 800). Any human remains, funerary objects, sacred objects, or items of cultural patrimony encountered during project operations shall be treated with dignity and respect. All treatment, care, and handling shall be carried out in consultation with the Tuolumne Me-Wuk Tribe of Indians.

Mitigation Measure M-CR-2b, Archeological Monitoring, below, also would be implemented for ground-disturbing work within the boundaries of identified archaeological sites that have the potential for surviving buried deposits or features, as assessed above. This measure would apply to project implementation at SF-S7 and SF-S8.

Mitigation Measure M-CR-2b: Archeological Monitoring (Environmental Planning Archeological Mitigation Measure II)

Based on the reasonable potential that archeological resources may be present within the project site, the following measures shall be undertaken to avoid any potentially significant adverse effect from the proposed project on buried historical resources and on human remains and associated or unassociated funerary objects. The SFPUC shall, in consultation with the Environmental Review Officer, retain the services of a qualified archaeological consultant. The archeological consultant shall undertake an archeological monitoring program. All plans and reports prepared by the consultant as specified herein shall be submitted first and directly to the Environmental Review Officer for review and comment, and shall be considered draft reports subject to revision until final approval by the Environmental Review Officer. Archeological monitoring and/or data recovery programs required by this measure could suspend construction of the project for up to a maximum of four weeks. At the direction of the Environmental Review Officer, the suspension of *construction* can be extended beyond four weeks only if such a suspension is the only feasible means to reduce to a less-than-significant level potential effects on a significant archeological resource as defined in CEQA Guidelines Sect. 15064.5 (a) and (c).

Consultation with descendant communities on nonfederal lands: On lands owned in fee by the City and County of San Francisco or easements on private property, upon discovery during monitoring of an archeological site[140] associated with descendant Native Americans, or in the event that potential effects to such a site are identified during monitoring, the SFPUC shall contact an official representative of the Tuolumne Me-Wuk Tribe of Indians and the Environmental Review Officer. The representative of the descendant group shall be given the opportunity to monitor archeological field investigations of the site and to offer recommendations to the Environmental Review Officer regarding appropriate archeological treatment of the site, of recovered data from the site, and, if applicable, any interpretative treatment of the associated archeological site. A copy of the Final Archeological Resources Report shall be provided to the representative of the descendant group.

Consultation with descendant communities on federal lands: If the discovery is on a Raker Act right of way or on National Forest System lands, SFPUC shall immediately contact the Forest Heritage Program Manager and the Environmental Review Officer. Treatment of the discovery and any tribal consultation shall be conducted under the guidance of the Forest Heritage Resources Program Manager and in accordance with the Archaeological Resource Protection Act of 1979, as amended (93 Stat. 721, et seq.; 16 U.S.C. 470 et. seq.), section 106 of the National Historic Preservation Act of 1966,

[140] The term "archeological site" is intended here to minimally include any archeological deposit, feature, burial, or evidence of burial.

as amended (16 U.S.C. 470), and its implementing regulations, entitled Protection of Historic Properties (36 CFR part 800).

Archeological monitoring program for nonfederal lands (including fee-owned land and easements on private property). The archeological monitoring program shall minimally include the following provisions:

- The archeological consultant, SFPUC, and Environmental Review Officer shall meet and consult on the scope of the archeological monitoring program reasonably prior to any project-related soils-disturbing activities commencing. The Environmental Review Officer in consultation with the project archeologist shall determine what project activities shall be archeologically monitored. In most cases, any soils-disturbing activities, such as demolition, foundation removal, excavation, grading, utilities installation, foundation work, driving of piles (foundation, shoring, etc.), site remediation, etc., shall require archeological monitoring because of the potential risk these activities pose to archaeological resources and to their depositional context;
- The archeological consultant shall undertake a worker training program for soil-disturbing workers that will include an overview of expected resource(s), how to identify the evidence of the expected resource(s), and the appropriate protocol in the event of apparent discovery of an archeological resource;
- The archeological monitor(s) shall be present on the project site according to a schedule agreed upon by the archeological consultant and the Environmental Review Officer until the Environmental Review Officer has, in consultation with the archeological consultant, determined that project construction activities could have no effects on significant archeological deposits;
- The archeological monitor shall record and be authorized to collect soil samples and artifactual/ecofactual material as warranted for analysis;
- If an intact archeological deposit is encountered, all soils-disturbing activities in the vicinity of the deposit shall cease. The archeological monitor shall be empowered to temporarily redirect demolition/excavation/pile driving/construction crews and heavy equipment until the deposit is evaluated. The archeological consultant shall immediately notify the Environmental Review Officer of the encountered archeological deposit. The archeological consultant shall, after making a reasonable effort to assess the identity, integrity, and significance of the encountered archeological deposit, present the findings of this assessment to the Environmental Review Officer.

If the Environmental Review Officer in consultation with the archeological consultant determines that a significant archeological resource is present and that the resource could be adversely affected by the proposed project, at the discretion of the SFPUC either:

A. The proposed project shall be redesigned so as to avoid any adverse effect on the significant archeological resource; or

B. An archeological data recovery program shall be implemented, unless the Environmental Review Officer determines that the archeological resource is of greater interpretive than research significance and that interpretive use of the resource is feasible.

If an archeological data recovery program is required by the Environmental Review Officer, the archeological data recovery program shall be conducted in accord with an archeological data recovery plan. The project archeological consultant, SFPUC, and Environmental Review Officer shall meet and consult on the scope of the archeological data recovery plan. The archeological consultant shall prepare a draft archeological data recovery plan that shall be submitted to the Environmental Review Officer for review and approval. The archeological data recovery plan shall identify how the proposed data recovery program will preserve the significant information the archeological resource is expected to contain. That is, the archeological data recovery plan will identify what scientific/historical research questions are applicable to the expected resource, what data classes the resource is expected to possess, and how the expected data classes would address the applicable research questions. Data recovery, in general, should be limited to the portions of the historical property that could be adversely affected by the proposed project. Destructive data recovery methods shall not be applied to portions of the archeological resources if nondestructive methods are practical.

The scope of the Archeological Data Recovery Plan shall include the following elements:

- *Field Methods and Procedures*. Descriptions of proposed field strategies, procedures, and operations.
- *Cataloguing and Laboratory Analysis*. Description of selected cataloguing system and artifact analysis procedures.
- *Discard and Deaccession Policy*. Description of and rationale for field and post-field discard and deaccession policies.
- *Interpretive Program*. Consideration of an on-site/off-site public interpretive program during the course of the archeological data recovery program.
- *Security Measures*. Recommended security measures to protect the archeological resource from vandalism, looting, and nonintentionally damaging activities.
- *Final Report*. Description of proposed report format and distribution of results.
- *Curation*. Description of the procedures and recommendations for the curation of any recovered data having potential research value, identification of appropriate curation facilities, and a summary of the accession policies of the curation facilities.

Final Archeological Resources Report. The archeological consultant shall submit a Draft Final Archeological Resources Report to the Environmental Review Officer that evaluates the historical significance of any discovered archeological resource and describes the archeological and historical research methods employed in the archeological testing/monitoring/data recovery program(s) undertaken. The Draft Final Archeological Resources Report shall include a curation and deaccession plan for all recovered cultural materials. The Draft Final Archeological Resources Report shall also include an Interpretation Plan for public interpretation of all significant archeological features.

Copies of the Draft Final Archeological Resources Report shall be sent to the Environmental Review Officer for review and approval. Once the draft final report is approved by the Environmental Review Officer, the consultant shall also prepare a public distribution version of the Final Archeological Resources Report. Copies of the Final Archeological Resources Report shall be distributed as follows: California Archaeological Site Survey Central California Information Center shall receive one copy and the Environmental Review Officer shall receive a copy of the transmittal of the Final Archeological Resources Report to the Central California Information Center. The Environmental Planning division of the Planning Department shall receive one bound and one unlocked, searchable PDF copy of the Final Archeological Resources Report on compact disc, 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. In instances of public interest in or the high interpretive value of the resource, the Environmental Review Officer may require a different or additional final report content, format, and distribution than that presented above.

Archeological monitoring program on federal lands: On a Raker Act right of way or National Forest System lands, an archeological monitoring program shall be conducted by a qualified archeologist under the direction of the Stanislaus National Forest Heritage Program Manager. The scope, schedule, and reporting format for monitoring on federal land shall be performed according to the specifications provided by the Heritage Program Manager with the same objectives as stated above for archaeological monitoring on nonfederal land.

Human remains, associated or unassociated funerary objects on nonfederal lands. If human remains and associated or unassociated funerary objects are discovered during any soils-disturbing activity, all applicable state and federal laws shall be followed, including immediate notification of the either the Tuolumne County Sheriff's Office and Coroner's Office and/or the Mariposa County Sheriff's Office and Coroner's Office, depending on where the discovery occurred; 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, who shall appoint a Most Likely Descendant (Pub. Res. Code Sec. 5097.98). The Environmental Review Officer shall also be immediately notified upon discovery of human remains. The archeological consultant, SFPUC, Environmental Review Officer, and Most Likely Descendant shall make all reasonable efforts to develop an agreement for the treatment of human remains and associated or unassociated funerary objects with appropriate dignity (CEQA Guidelines. Sec. 15064.5(d)) within six days of the discovery of the human remains. This proposed timing shall not preclude the PRC 5097.98 requirement that descendants make recommendations or preferences for treatment within 48 hours of being granted access to the site. The agreement should take into consideration the appropriate excavation, removal, recordation, analysis, curation, possession, and final disposition of the human remains and associated or unassociated funerary objects. Nothing in existing state regulations or in this mitigation measure compels the SFPUC and the Environmental Review Officer to accept recommendations of a Most Likely Descendant. The archeological consultant shall retain possession of any Native American human remains and associated or unassociated burial objects until completion of any scientific analyses of the human remains or objects as specified in the treatment agreement if such as agreement has been made or, otherwise, as determined by the archeological consultant and the Environmental Review Officer. If no agreement is reached, state regulations shall be followed, including the reinterment of the human remains and associated burial objects with appropriate dignity on the property in a location not subject to further subsurface disturbance (Pub. Res. Code Sec. 5097.98).

Human remains, associated or unassociated funerary objects on federal lands: If human remains and associated or unassociated funerary objects are discovered during any soils-disturbing activity on a Raker Act right of way or on National Forest System lands, all applicable federal laws shall be followed, and the SFPUC shall notify the Heritage Resources Program Manager and Environmental Review Officer immediately. The SFPUC shall ensure that all work within 300 feet of the discovery will cease, the area will be secured, and the Heritage Resources Program Manager shall notify the Tuolumne County Sheriff's Office and Coroner's Office and/or the Mariposa County Sheriff's Office and Coroner's Office (depending on where the discovery occurred) of the discovery.

Native American human remains, funerary objects, sacred objects, or items of cultural patrimony found on federal land will be handled according to Section 3 of the Native American Graves

Protection and Repatriation Act and its implementing regulations (43 CFR Part 10); the Archaeological Resource Protection Act of 1979, as amended (93 Stat. 721, et seq.; 16 U.S.C. 470 et. seq.), and the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470f; 479h-2) and its implementing regulations, entitled Protection of Historic Properties (36 CFR part 800). Any human remains, funerary objects, sacred objects, or items of cultural patrimony encountered during project operations shall be treated with dignity and respect. All treatment, care, and handling shall be carried out in consultation with the Tuolumne Me-Wuk Tribe of Indians.

Impact CR-3. The project could disturb human remains, including those interred outside of formal cemeteries. (Less than Significant with Mitigation)

Although there are no known cemeteries or previously identified archeological resources known to contain human remains in the area of potential effects, project implementation could result in the inadvertent discovery of previously unknown human remains, including those interred outside of formal cemeteries. Implementation of **Mitigation Measure M-CR-2a Accidental Discovery,** and potentially additional mitigation as necessary, including **Mitigation Measures M-CR-2b Archeological Monitoring** and **M-CR-4 Tribal Cultural Resources** (e.g., if Native American human remains were discovered), would reduce impacts on human remains to a less-than-significant level by requiring appropriate protection, consultation and treatment in the event of the discovery of human remains. Therefore, impacts to previously unidentified human remains including those interred outside formal cemeteries during project implementation would be *less than significant with mitigation.*

Impact CR-4. The project would not cause a substantial adverse change in the significance of a tribal cultural resource as defined in Public Resources Code section 21074. (Less than Significant with Mitigation)

A tribal cultural resource is defined in Public Resources Code section 21074 as a site, feature, place, cultural landscape, sacred place, or object with cultural value to a "California Native American tribe," that is also either (a) included or determined to be eligible for inclusion in the California register; or (b) included in a local historic register, as defined in Public Resources Code section 5020.1(k). There are no known eligible resources in the area of potential effects eligible for listing in the California register or otherwise. Similarly, the Native American Heritage Commission review of their Sacred Lands File failed to identify resources of concern to the local Native American community in any of the project sites that comprise the area of potential effects.

Pursuant to Assembly Bill 52, effective July 1, 2015, within 14 days of a determination that an application for a project is complete or a decision by a public agency to undertake a project, the lead agency is required to contact the Native American tribes that are culturally or traditionally affiliated with the geographic area in which the project is located. Notified tribes have 30 days to request consultation with the lead agency to discuss potential impacts on tribal cultural resources and measures for addressing those impacts.

On July 27, 2018, the Planning Department mailed a "Tribal Notification Regarding Tribal Cultural Resources and CEQA" related to this project to Native American tribal representatives who requested notification. During the 30-day comment period, no Native American tribal representatives contacted the Planning Department to request consultation. However, unknown archeological resources may be encountered during construction that could be identified as tribal cultural resources at the time of discovery or at a later date. Therefore, the potential adverse effects of the proposed project on previously unidentified archeological resources, as discussed under Impact CR-2, also represent a potentially significant impact on tribal cultural resources. Implementation of **Mitigation Measure M-CR-2a**

Accidental Discovery and **Mitigation Measure M-CR-4 Tribal Cultural Resources, Tribal Consultation and Implementation of Tribal Cultural Resources Treatment Plan**, and potentially **Mitigation Measure M-CR-2b Archeological Monitoring** would reduce potential adverse effects on tribal cultural resources to *less than significant with mitigation*. **Mitigation Measure M-CR-4** would require either preservation–in-place of the tribal cultural resources, if determined effective and feasible, or a tribal cultural resources treatment plan developed in consultation with affiliated Native American tribal representatives.

Mitigation Measure M-CR-4. Tribal Cultural Resources, Tribal Consultation and Implementation of Tribal Cultural Resources Treatment Plan

In the event of an accidental discovery of cultural resources of Native American origin on fee-owned land or easements across private land, the Environmental Review Officer will consult with the tribal representative(s) of the Tuolumne Me-Wuk Tribe of Indians to determine whether the resource represents a Tribal Cultural Resource. If the tribe indicates that the resource is a Tribal Cultural Resource, the Environmental Review Officer shall consult with the SFPUC and the tribe to determine whether effective long-term protection and the avoidance of impacts are feasible, and to identify how this will be accomplished. Potential means may include, but would not be limited to, measures such as flagging of boundaries on the ground prior to work and avoiding the resource; allowing brush to grow to obscure the resource; and blocking vehicle access routes to or across the resource. The identified measures will be memorialized in a memorandum attached to the archaeological site record.

If the Environmental Review Officer, in consultation with the Tuolumne Me-Wuk Tribe of Indians and the SFPUC, determines that there are no feasible and effective means of preserving the tribal cultural resource in place, the Environmental Review Officer and SFPUC shall consult with tribal representatives and a qualified archeologist to implement additional applicable measures, such as archeological testing or monitoring, as appropriate to preserve the archeological values of the resource. The SFPUC shall supply the tribe with copies of the reports of archeological work. The SFPUC's archeological consultant shall prepare and distribute to the Tuolumne Me-Wuk Tribe of Indians a synopsis of archeological results for the use of the tribe in a format of the tribe's choice.

In addition, in cases where project work will substantially damage a significant Tribal Cultural Resource, and if requested by the tribe, the Environmental Review Officer and SFPUC shall consult with the tribe to develop a Tribal Cultural Resources Treatment Plan. This plan shall identify additional interpretive, educational or cultural measures to preserve the tribal cultural values represented by the resource, and shall be implemented by SFPUC. The plan shall identify, as applicable, materials, content and formats, venues for installation, and producers or artists for the displays, as applicable; a long-term maintenance program; and a schedule for implementation. The plan will be subject to approval by SFPUC and the Environmental Review Officer. The plan may include, but would not be limited to, measures such as the following:

- Development and installation or distribution of interpretive products such as artifact displays, interpretive signage, and artist installations by Native American artists
- Preparation, distribution, and/or archival preservation of oral histories
- Educational materials or classroom teaching kits related to the affected resource

- One or more archaeological training presentations for the tribe and identification of opportunities for the tribe to participate in future archaeological projects or resource monitoring
- Measures to ensure access to traditional resources, such as basketry or stone tool materials associated with the tribal cultural resource site, or to provide access to alternative sources of such material at other protected locations

In the event of an accidental discovery of cultural resources of Native American origin that are on federal land, the SFPUC will notify the Forest Heritage Resources Program Manager and the Environmental Review Officer. Treatment of the discovery and tribal consultation shall be conducted under the guidance of the Heritage Resources Program Manager and in accordance with the Archaeological Resource Protection Act of 1979, as amended (93 Stat. 721, et seq.; 16 U.S.C. 470 et. seq.), Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470), and its implementing regulations, entitled Protection of Historic Properties (36 CFR part 800).

Impact C-CR. The project and reasonably foreseeable future projects would not result in a considerable contribution to cumulative impacts related to cultural resources. (Less than Significant)

Built Environment Cumulative Impacts

The cumulative context for impacts to the built environment includes the geographic area of the proposed project (i.e., Tuolumne County, and, to a lesser extent, Mariposa County), where there are other similar types of historic resources. The cumulative projects identified in Table B-1 are all proximate to the proposed project, and none have the potential to result in significant impacts to the Mountain Tunnel, Priest Reservoir & Priest Dam, or any other historic resources involving public works from a period of significance (1917 through 1934) similar to that of the proposed project.

This analysis identifies ten projects, proposed by SFPUC, U.S. Forest Service, and Caltrans, that could contribute to significant cumulative impacts in combination with impacts of the proposed project. Of these ten projects, only four include built environment resources, and they are all proposed by SFPUC: Early Intake Dam Rehabilitation Project, Early Intake Bridge Replacement Project, Transmission Line Clearance Mitigation Project, and Kirkwood Penstock Project. The Early Intake Dam Rehabilitation Project proposes the installation of a Carpi liner to extend the serviceable life of the dam. The Early Intake Dam was constructed in 1924 as part of the Hetch Hetchy project and falls within the period of significance (1917 through 1934); the Mountain Tunnel Intake Structure is a character-defining feature of the National Register and California Register-eligible Mountain Tunnel, as identified by a qualified architectural historian in 2015. However, these project improvements to existing facilities consist of ongoing operation, repair, and maintenance that are not anticipated to have significant effects on cultural resources involving the built environment.

The Early Intake Bridge Replacement Project proposes replacement of the existing bridge at a higher elevation to meet the high river flows and improving the roads to match the new bridge. The current bridge was constructed in 1965 and was widened in 2006; because it was constructed after the period of significance (1917 through 1934), it is not considered under cumulative impacts to the built environment.

The Transmission Line Clearance Mitigation Project is a 15-year-long regulatory project, addressing the 2010 North American Electric Reliability Corporation’s Alert, to correct deficiencies in transmission conductor clearances by modifying 54 towers on lines 5 and 6 and 18 towers on lines 3 and 4 between Holm Powerhouse and Warnerville Switchyard. All improvements are modifications to existing towers and conductors, except for 10 sites proposed for grading in the wire zone. The Reliable Power Project is a transmission vegetation management program to minimize the risk of power outages and fires from vegetation contact with transmission lines on or near the right-of-way for electrical transmission lines; to repair and replace culverts associated with transmission line access roads; and to construct a sand storage shed to stockpile sand for winter road treatments needed for access during winter months. The proposed improvements would occur in the transmission line right-of-way and along access roads to the right-of-way. The right-of-way and road treatments, including culvert replacements, overlap geographically with the proposed project, but the Reliable Power Project would mitigate its impacts to a less-than-significant level using the same cultural resource mitigation measures identified in this document. In addition, the SFPUC has adopted standardized cultural resource best management practices in other CEQA documents for ongoing transmission line programs to avoid, minimize, and mitigate impacts to cultural resources. As a result, significant cumulative impacts to cultural resources would not occur.

The Kirkwood Penstock Project proposes to make repairs to the lining, recoating, extensive foundation treatment, and rock protection at selective locations of the penstock that have experienced significant movement of the foundation materials, resulting in the penstock detaching from one fixed saddle directly below one of the anchor blocks. The Canyon Tunnel resource, consisting of the tunnel, the Kirkwood Penstock, and the Kirkwood Powerhouse constructed in the 1960s, does not display sufficient significance to be eligible for listing in the national register or the California register at the local, regional, state, or national level. Because Kirkwood Penstock is not a historical resource, the Kirkwood Penstock Project would not contribute to significant cumulative impacts on the historic built environment.

Archeological Cumulative Impacts

The relevant affected area for cumulative archeological impacts is the project's area of potential effects and the surrounding area, defined as the geographic span of the projects identified in Table B-1. The cumulative projects identified on Table B-1 involve some amount of ground-disturbing activity and are in the vicinity of the proposed project. Except for projects that are essentially upgrades or maintenance projects of existing infrastructure where previously excavated soils are being reexcavated and/or regraded, ground-disturbing activities associated with the identified cumulative projects have the potential to result in a significant cumulative impact on archeological resources.

As discussed under Impact CR-2 above, the proposed project has been designed to avoid impacts to known archeological resources. The inadvertent discovery of previously undiscovered buried archeological resources, however, cannot be dismissed. Although the likelihood of inadvertently exposing previously unknown (i.e., as yet undiscovered) buried archeological resources—including those containing human remains as well as those that may be considered tribal cultural resources—is generally low, there remains the potential that ground-disturbing construction activities in the area of potential effects could result in cumulatively considerable contributions to significant cumulative impacts on archeological resources, due to the potential disturbance of unknown intact archeological deposits.

However, implementation of **Mitigation Measure M-CR-2a, Accidental Discovery; Mitigation Measure M-CR-2b, Archeological Monitoring; and Mitigation Measure M-CR-4, Tribal Cultural Resources Interpretive Program** would reduce the significance of these potential impacts to archeological resources from the project by ensuring the identification and proper treatment of archeological resources, including those with human remains and those determined to be tribal cultural resources inadvertently exposed during construction. Therefore, the project's contribution to cumulative archeological impacts during construction would not be cumulatively considerable.

E.5 Transportation and Circulation

Topics:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Not Applicable
5. TRANSPORTATION AND CIRCULATION Would the project:					
a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?	☐	☐	☒	☐	☐
b) Conflict with an applicable congestion management program, including but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?	☐	☐	☒	☐	☐
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	☐	☒
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses?	☐	☐	☒	☐	☐
e) Result in inadequate emergency access?	☐	☐	☒	☐	☐
f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?	☐	☐	☒	☐	☐

The proposed project is not within 2 miles of a public airport or private airstrip and would not involve any activities or improvements that would impact air traffic patterns; the closest airport to proposed project is Pine Mountain Airport, approximately 2.7 miles from the nearest proposed project component. Therefore, significance criterion 5(c) is *not applicable* to this project and is not discussed further in this section.

Impact TR-1. The project would not conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system. This takes into account all modes of transportation—including mass transit and nonmotorized travel—and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit. (Less than Significant)

Construction-Related Traffic

Proposed aboveground project improvements include enhancing the roads that provide access to the tunnel and to construction and staging areas. These proposed improvements would facilitate construction and long-term maintenance of the tunnel. As described in Table E.5-1, below, the improvements include graveling and

Table E.5-1
Access Roads for the Proposed Project

Project Component: Access Roads	Features	Accessibility/Public Use	Proposed Road Improvements
Early Intake: Cherry Lake Road (Forest Service Road 1N07)	Two-lane, paved	Accessed via Highway 120; open to the public	None
South Fork: South Fork Access Road	One-lane, lower one-third paved, upper two-thirds graveled	Accessed via Highway 120; no public access	• Concrete pave roadbed along two-thirds graveled segment • Repair concrete pavement • Widen road/construct turnouts • Install drainage features • Install slope stabilization
Adit 5/6: Forest Service Road 1S01 (also referred to as Ham Hall Road and/or Adit 5/6 Access Road)	One-lane, graveled	Accessed via Highway 120; no public access	• Widen and install drainage facilities on road • Install slope stabilization • Gravel roads that rut during construction
Adit 8/9: Forest Service Road 1N10 (also known as Lumsden Road and/or Adit 8/9 Access Road) and a spur road off Forest Service Road 1N10	One-lane, unpaved; spur is graveled	Accessed via Ferretti Road north of Highway 120 Forest Service Road 1N10 is open year-round to the public; the public is restricted from access to the spur road to Adit 8/9	• Widen road • Install slope stabilization • Gravel roads that rut during construction
Big Creek Shaft: Big Creek Shaft Road	Two-lane, paved	Accessed via Highway 120; open to the public	None
Second Garrote Shaft: Second Garrote Shaft Road	One to two lanes, unpaved	Accessed via Old Highway 120 south of Highway 120; northern portion of the unpaved road accessible to the public	• Lay down geotextile fabric and gravel • Replace damaged culvert • Gravel roads that rut during construction
Priest Reservoir: Rickson Road	3.3-mile-long paved road	Gated entrance on Priest-Coulterville Road from Highway 120 connects to Rickson Road; no public access	• Along the eastern 1.25-mile segment, widen and gravel/pave road, improve drainage features, and install slope protection • Along the western 1.65-mile segment, repair roads, as needed, during construction and repave in the final year of construction

paving roads, and installation of periodic turnouts needed for construction traffic circulation and safety. The proposed roadway improvements would also provide safer conditions after construction, when the improved access routes would be used for periodic inspections and maintenance, or for repairs to the tunnel and the proposed flow control facility at Priest Reservoir.

Construction traffic would result in short-term increases in traffic volumes near project construction and staging areas along Highway 120 and the access roads identified in Table E.5-1. The applicable transportation plans, ordinances, and policies address the long-term operations and effectiveness of the transportation network; therefore, short-term construction activities associated with the proposed project would not affect the long-term use and conditions of the transportation system because the proposed project would not increase the capacity of the system, alter intersections, or affect the operations and facilities of alternative transportation modes, including walking, biking, or transit. Project construction would occur between 2020 and 2026; however, construction activities would not be continuous through the entire project schedule (see Figure A-12 in Section A, Project Description). Some activities, such as roadway improvements and preparation of staging areas, would occur during the initial phases of the project to prepare for subsequent phases; and some activities, such as internal tunnel repairs and invert paving, would only be conducted during planned tunnel shutdowns during winter months. It is therefore unlikely that simultaneous construction activities at all project improvement locations would occur during any stage of the project. Short-term increases in traffic would be variable throughout the planned construction duration.

It is projected that most construction workers would reside locally, traveling from Sonora or Oakdale.[141] It is possible that a small portion of the workers would travel from longer distances, from Tuolumne County, Stanislaus County, and Calaveras County, and that some construction workers may reside locally during the work week and commute home on weekends. The number of construction workers for individual activities per shift would range from 9 to 22 during the duration of work activities, a period that would range from 1 month to 20 months, depending on the project component. The total personnel working across all shifts at any one time during the full construction duration would range between 30 and 115 workers (refer to Table A-2 in Section A, Project Description). This small number of worker commute trips would not be expected to noticeably increase regular vehicle traffic in the vicinity, because most of the workforce is anticipated to be local and would likely otherwise be commuting within the region for other jobs. A maximum increase of 115 personal vehicles using Highway 120 to commute to the project sites would not exceed the capacity of the highway, should the maximum number of employees commute from farther away than anticipated.

Materials Delivery and Spoils Disposal. Highway 120 is the primary highway leading to all construction sites and would be used as a delivery route for materials and movement of materials, equipment, and spoils among staging areas. Table A-9 in Section A, Project Description, presents the number of truck trips resulting from material deliveries. Over the construction duration, the average number of large truck material deliveries would be six per day. Construction materials would come from the local George Reed plant in Jamestown, along with some equipment and supplies from Tuolumne County, Stanislaus County, Calaveras County, and San Joaquin County; more than half of the large truck materials deliveries would be to Priest Reservoir.

[141] Rundle, Mark, employee, SFPUC, e-mail correspondence with Rodney Jeung, Environmental Planning Director, AECOM. August 8, 2018.

As described in Section A, Project Description, spoils disposal would occur at the PP-S6 disposal area near Priest Reservoir. Spoils from underground improvements at Early Intake (<10 cubic yards) would be transported to two nearby temporary debris storage areas at E1-S2 and EI-S7, which are along a public road off Cherry Lake Road (Forest Service Road 1N07), and ultimately trucked to the Priest Reservoir spoils disposal area at PP-S6. With the limited amount of spoils (and therefore only a few truck trips), impacts from transport along Cherry Lake Road/Forest Service Road 1N07 would be negligible. The spoils transported along the adit roads (Adit 5/6, Adit 8/9, and South Fork) would use smaller 3-cubic-yard trucks. The 3-cubic-yard trucks would transfer spoils to 16-cubic-yard trucks that would haul the spoils along Highway 120 to the PP-S6 disposal area. As shown in Table A-8 in Section A, Project Description, the maximum number of 16-cubic-yard truck trips per day (assuming all activities are occurring concurrently) along Highway 120 would be approximately 18; transport of spoils would largely be completed by the end of the second year of construction. Spoils generated at Priest Reservoir would be transported to the rock-crushing plant and disposal area via 8-cubic-yard trucks; and this transport would occur on SFPUC roads that are not accessible to the public. In addition, if the removed trees must be hauled away, then an estimated 195 8-cubic-yard truck trips would be needed to remove the trees from the Priest Reservoir area and an additional 440 3-cubic-yard truck trips would be needed to remove the trees from the other staging areas and access roads. The number of truck trips would be reduced if these loads are transferred to larger 16-cubic yard trucks for hauling to the disposal facilities.

Road Closures During Construction. Section A.6.4, Site Access, describes proposed construction routing and timing at two access roads: Old Big Oak Flat Road (access to South Fork Crossing area) and Forest Service Road 1N10/Lumsden Road (access to Adit 8/9). On Old Big Oak Flat Road, construction trucks would infrequently drive against the flow of one-way traffic on an approximately 300-foot-long segment of the road; traffic control (e.g., flaggers, cones, and signage) would be implemented to reduce conflicts with non-construction-related vehicles, as described in Section A.6.4.

Forest Service Road 1N10/Lumsden Road improvements would be conducted overnight during the primary rafting season (May 1 through Labor Day in September) to avoid interfering with recreational use of the road. In the first year of construction during the primary rafting season, the Adit 8/9 Access Road improvements would require nightly closure of Forest Service Road 1N10/Lumsden Road between 7 p.m. and 7 a.m. daily from Sunday evening to Friday morning. After Labor Day through the end of April in the second year of construction, Lumsden Road would be fully closed during construction. Lumsden Road would be fully open to the public during the rafting season of the second year of construction. Full closure of Lumsden Road may be required after Labor Day through the end of November in the second year of construction to complete work activities if weather delays occur during the prior work periods. Forest Service Road 1N10/Lumsden Road is used for recreational access and does not serve as a primary local connector road.[142] As described below for Impact TR-2, similar to the standards, goals, and policies identified in the counties' circulation elements, the Tuolumne County and Mariposa County Regional Transportation Plans address circulation impacts due to future development and area growth over the long term, and do not apply to construction projects.

In the short term, the contractor would be required to implement traffic control measures sufficient to reduce traffic conflicts on roads affected by construction of the project (see SFPUC Standard Construction Measure 4 in Section A.6.11, SFPUC Standard Construction Measures and Other Avoidance/ Minimization Measures Included as Part of the Project). These general traffic control measures may

[142] A connector road provides vehicular access between towns and other major traffic generators and links smaller local roads with nearby towns or larger roads.

include, but would not be limited to, flaggers and/or construction warning signage of work ahead; scheduling truck trips during nonpeak hours to the extent feasible; maintaining access to driveways, private roads, and off-street commercial loading facilities; and coordination with local emergency responders to maintain emergency access. Implementation of traffic control measures would reduce temporary construction-related impacts on traffic. Additional information regarding site-specific traffic control measures during construction activities at Old Big Oak Flat Road and the temporary closure of Forest Service Road 1N10/Lumsden Road are described further in Section A.6.4, Site Access.

Highway 120 Impacts During Construction. According to the California Department of Transportation (Caltrans) Transportation Concept Report for Highway 120, the average annual daily traffic ranged from 3,500 to 7,500 in 2017, for the segment along Highway 120 (from Highway 49 South to the Yosemite National Park entrance to the east) that includes the project work areas.[143] Using conservative assumptions that correspond to the air quality emissions analysis (see Section E.7, Air Quality), 132 truck trips per day would occur for materials delivery and spoils disposal. This estimate assumes that all construction at Adit 5/6, Adit 8/9, and Priest Reservoir would occur concurrently and would represent the most intensive construction period. In fact, some of the improvements at the Priest Reservoir area would be constructed sequentially and would not overlap; similarly, activities during shutdown periods would not overlap with nonshutdown periods. In addition, spoil disposal from excavation activities at the Priest Reservoir area would be transported to the rock-crushing plant and disposal area at PP-S6 and therefore would not travel on Highway 120. Adding the maximum number of construction workers and assuming that each employee drives a vehicle to and from the work site, a total of 362 trips (132 haul and materials delivery trips plus 230 worker trips) would be made along Highway 120 during the proposed project construction period. These additional trips between 2020 and 2026 would increase the average annual daily traffic volumes along Highway 120, but would not conflict with the horizon year level-of-service standard of C for rural segments of the highway, plans to improve shoulders along the highway in communities to address active transportation needs, or expansion and upgrading of the Intelligent Transportation System (e.g., vehicle monitoring stations and changeable message signs). Therefore, the project would not conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system.

Additional truck trips would be required to remove trees from the Priest Reservoir area and other staging areas and access roads; however, these trips would not overlap with those associated with project construction. As reported above, tree removal would involve an estimated 195 8-cubic-yard truck trips to and from the Priest Reservoir area, and an additional 440 3-cubic-yard truck trips to clear the trees from the other staging areas and access roads. If required, these additional truck trips would be spread out over the first year of construction and would only marginally increase the daily truck trips generated by project construction, which would not conflict with the horizon year level-of-service standard of C for rural segments of the highway or other an applicable plans, ordinances, or policies establishing measures of effectiveness for the performance of the circulation system.

Operations and Maintenance

The proposed project would involve few vehicular trips on public roadways after the tunnel repairs are completed and the project is operational. Section A.7.2, Mountain Tunnel Maintenance, and Section A.7.3,

[143] Caltrans (California Department of Transportation), Transportation Concept Report, State Route 120, District 10, June 2017, *http://www.dot.ca.gov/d10/tcr-csmp/sr120/SR120TCRFinalDraft0614207.pdf?_sm_au_=iVVt55D7J58sQs0V*, accessed September 29, 2018.

Flow Control Facility Operations and Maintenance, describe the schedule and frequency of project-related operations and maintenance. During operation, maintenance would be performed along certain access roadways as needed, including removal of small rock debris from netting or roadways, repair of roadway segments that may be damaged by fires or inclement weather, and removal of hazard trees. Overall, these maintenance trips would be smaller in number and more infrequent than the construction-related trips, and consequently would not have a long-term effect on traffic circulation to or in the vicinity of the proposed project. No new employees are proposed to be hired, and operational and maintenance activities are expected to be performed by existing staff and field crews.

Local Plans and Policies

The Tuolumne County General Plan identifies long-range goals, policies, and implementation programs for the county's road network in the Transportation chapter.[144] The chapter includes qualitative measures of performance effectiveness for local roadway congestion, safety on roadways with an unusual number of motor vehicle transportation accidents, and improvements to accommodate long-range forecast traffic volumes and other travel modes. Caltrans, in its Transportation Concept Report for State Route 120, also identifies measures of performance effectiveness and addresses the minimum level of service tolerable for peak hour conditions (upgrading to an expressway through Tuolumne and Mariposa counties), and nonmotorized improvements consistent with those identified in the Tuolumne County Regional Transportation Plan.[145] This latter plan, adopted by the Tuolumne County Transportation Council, includes a set of rural sustainable strategies that seek to encourage smart growth and reduce greenhouse gas emissions, ten regional performance measures, and a chapter specifically dedicated to the highways that traverse and serve the county. The policies and measures in the regional transportation plan related to the proposed project concern road pavement conditions, safety, prioritizing infrastructure investments in the Big Oak Flat and Groveland/Pine Mountain Lake communities, and coordinating with Caltrans to prevent capacity deficiencies and to provide adequate levels of service on state highways (level of service D, or a high-density stable flow with motorists feeling noticeable congestion). All of the goals, policies, implementation programs, and performance measures in these planning documents address long-term operational considerations related to future development and growth in the region.

Automobile Trips and Circulation. As described above, the proposed project would generate as many as 132 truck trips per day plus 230 construction staff trips, assuming the overlap of a number of project-related construction activities. These trips would occur over the construction period from 2020 to 2026 but would not have a long-term effect. The long-term travel demand on local streets and Highway 120 are expected to be negligible, if there are any at all. Because the project's transportation effects after the construction period would be negligible, they would not conflict with the automobile-related performance measures in the relevant planning documents. Therefore, the project's effect on adopted measures of effectiveness for the performance of the street and highway system would be *less than significant*.

Public Transportation, Pedestrian, and Bicycle Circulation. Public transportation near the project site is limited and would not be affected by the proposed project. The Yosemite Area Regional Transportation System offers a public bus route that travels along Highway 120. Some project staging areas are adjacent

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144 Tuolumne County General Plan, Chapter 4 - Transportation, 2018, *https://www.tuolumnecounty.ca.gov/DocumentCenter/View/11752/Vol-I-Goals-Policies-Policies-Final*, accessed May 13, 2019. This discussion of transportation planning effects focuses on Tuolumne County where all but one of the improvement, construction, and staging areas are located. There is one staging area in neighboring Mariposa County, and only 2 miles of Highway 120 pass through Mariposa County.

145 Tuolumne County Transportation Council, Final Regional Transportation Plan, 2016, *https://docs.wixstatic.com/ugd/fe950e_c35135627b714de69e18b76eb4807156.pdf*, accessed May 13, 2019.

to Highway 120 and the Yosemite Area Regional Transportation System route; however, the volume of construction traffic would not interfere with bus route schedules or require alterations to the designated routes and stops for the Yosemite Area Regional Transportation System.

The proposed project is in an area that is generally not traversed by bicyclists and pedestrians. There are no designated pedestrian or bicycle lanes on the local roadways adjacent to or near the project site. Highway 120 is used by bicyclists and occasionally by pedestrians. Highway 120 is a Class III bicycle route that allows for shared use of the road with automobiles and pedestrians but does not provide designated space for bicycles or pedestrians.[146] Pedestrian volumes are very low due to the remote location of the proposed project and lack of designated pedestrian facilities. Implementation of traffic control measures, as described above, would also serve to reduce construction-related impacts on public transit and bicycle and pedestrian travel.

Therefore, project-related construction traffic would not substantially affect safety or multimodal performance measures for public transit, bicycle, or pedestrian travel. As stated above, project operation and maintenance trips would be few and infrequent and would not have a long-term effect on public transit and bicycle and pedestrian travel. The project's effect on adopted measures of effectiveness for the performance of the transit, bicycle, and pedestrian systems would be *less than significant*.

Impact TR-2. The project would not conflict with an applicable congestion management program, including but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways. (Less than Significant)

The Tuolumne County 2016 Regional Transportation Plan provides a blueprint to address the future transportation needs for the county over the next 25 years.[147] The regional transportation plan recommends increasing capacity for segments of the state highway system that are operating below the desired level of service, if feasible, and/or improving alternative modes of transportation.[148] Recent revisions to the CEQA Guidelines by the State Office of Planning and Research shift assessment of roadway impacts from the level of service significance threshold to other metrics, such as vehicle miles traveled per capita. In March 2016, the San Francisco Planning Department adopted the vehicle-miles-traveled metric and no longer uses level of service as a significance criterion. Nevertheless, because the proposed project is almost entirely in Tuolumne County, its guidance is used to assess the proposed project's effects on transportation. One section of Highway 120 passes through Mariposa County at Buck Meadows; Mariposa County's Regional Transportation Plan also uses level of service as a primary evaluation metric.[149]

The Tuolumne County 2016 Regional Transportation Plan presents road segment level of service based on the roadway segments' average annual daily traffic volumes.[150] As stated in the regional transportation plan, the traffic counts and the most recent Caltrans traffic counts were used as the base

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146 Caltrans, District 10 Bicycling Guide, December 2017, *http://www.dot.ca.gov/dist05/bike_ped/bikeguide/bikeguide.pdf*, accessed February 8, 2019.

147 Tuolumne County Transportation Council, Final Regional Transportation Plan, 2016, *https://docs.wixstatic.com/ugd/fe950e_c35135627b714de69e18b76eb4807156.pdf*, accessed August 22, 2018.

148 Tuolumne County Transportation Council, Final Regional Transportation Plan, 2016, *https://docs.wixstatic.com/ugd/fe950e_c35135627b714de69e18b76eb4807156.pdf*, accessed August 22, 2018.

149 Mariposa County Local Transportation Commission, 2012 Regional Transportation Plan, 2013, *http://www.mariposacounty.org/DocumentCenter/View/20141*, accessed October 7, 2018.

150 Tuolumne County Transportation Council, Final Regional Transportation Plan, 2016, *https://docs.wixstatic.com/ugd/fe950e_c35135627b714de69e18b76eb4807156.pdf*, accessed September 29, 2018.

year volume-to-capacity thresholds.[151] This regional transportation plan studied 162 roadway segments and 41 intersections in the Tuolumne County Traffic Study Report, and the report presents intersections and roadway segments that do not meet level of service standards in existing (2015) conditions and future year conditions. No intersections or roadway segments in the project area were identified as having level of service deficiencies. Mariposa County's Regional Transportation Plan did not identify level of service deficiencies for the segment of Highway 120 in the project area.[152] Similar to the standards, goals, and policies identified in the counties' circulation elements, the regional transportation plans address circulation impacts due to future development and area growth over the long term, and do not apply to construction projects.

As described under Impact TR-1, during construction, the project would result in short-term increases in traffic volumes in the project vicinity, and implementation of traffic control measures required by SFPUC Standard Construction Measure 4 (see Section A.6.11, SFPUC Standard Construction Measures and Other Avoidance/Minimization Measures Included as Part of the Project) would minimize impacts and reduce potential traffic conflicts on all roads affected by construction of the project. In addition, the SFPUC would implement the measures described in Section A.6.4, Site Access, at Old Big Oak Flat Road (related to traffic infrequently flowing against the one-way direction of traffic) and Forest Service Road 1N10/ Lumsden Road (related to temporary road closures) to avoid construction-related circulation conflicts (refer to Section A.6.4, Site Access, for more details). Trips associated with project operation and maintenance would be small in number and infrequent and would not have a long-term effect on traffic circulation to or in the vicinity of the proposed project. Therefore, the proposed project would not conflict with an applicable congestion management program, and the project's impacts on circulation would be *less than significant*.

Impact TR-3. The project would not substantially increase hazards due to design features (e.g., sharp curves or dangerous intersections) or incompatible uses. (Less than Significant)

As described in Section A.6.4, Site Access, the proposed project's construction activities would create temporary incompatible uses on Old Big Flat Road and Forest Service Road 1N10/Lumsden Road. These incompatibilities include the use of an approximately 300-foot-long segment of Old Big Oak Flat Road involving trucks driving against the flow of traffic, and the temporary closure of Forest Service Road 1N10/Lumsden Road on weekdays while road improvements occur in this area (refer to Section A.6.4, Site Access, for more details). Although these would be considered incompatible uses of these roads, these impacts would be temporary and the SFPUC would implement SFPUC Standard Construction Measure 4 with the additional measures described in Section A.6.4, and would coordinate with the U.S. Forest Service to prevent impacts and reduce potential traffic conflicts on all roads affected by project construction.

Tunnel access roadway widening and other improvements would be required to accommodate heavy trucks and construction equipment during construction. Road widening, slope stabilization/rebuilding, and drainage improvements would reduce stormwater erosion on the access roads when used during the critical winter shutdown windows associated with construction. The proposed access road improvements address long-term tunnel serviceability and construction needs in areas prone to slides and rock falls. Improvements along the adit access roads, such as the turnouts, widening (e.g., with new embankments

151 Tuolumne County Transportation Council, Final Regional Transportation Plan, 2016, *https://docs.wixstatic.com/ugd/fe950e_c35135627b714de69e18b76eb4807156.pdf*, accessed September 29, 2018.

152 Mariposa County Local Transportation Commission, 2012 Regional Transportation Plan, 2013, *http://www.mariposacounty.org/DocumentCenter/View/20141*, accessed October 7, 2018.

and cantilevered sections), graveling, and slope protection are proposed to increase overall safety and/or allow passage of vehicles in narrow sections of the roadways. None of the improvements would create any hazards due to design features, and improvements would be compatible with the existing use of the roadways.

Once the project is implemented, roadways to tunnel adits and facilities would be improved to enhance safety, facilitate maintenance, and reduce erosion and ground/slope instability for operation and maintenance trips for the project, as well as for members of the public who may use roadways that are publicly accessible.

Therefore, there would be a *less-than-significant* impact in regard to increasing hazards due to design features of the project.

Impact TR-4. The project would not result in inadequate emergency access. (Less than Significant)

During construction and operation of the proposed project, access for emergency vehicles would be maintained. As stated in SFPUC Standard Construction Measure 4 (see Section A.6.11, SFPUC Standard Construction Measures and Other Avoidance/Minimization Measures Included as Part of the Project), the SFPUC would coordinate with local emergency responders to maintain emergency access during the construction phase. As described in Section A.6.4, Site Access, the only temporary closure of a public road would occur during road-improvement activities on Forest Service Road 1N10/Lumsden Road. In consultation with the U.S. Forest Service, the SFPUC selected the timing of proposed road closures at Forest Service Road 1N10/Lumsden Road to avoid peak periods for recreational activities.

During controlled detonation events along Lumsden Road, when vehicular traffic could be restricted for short periods (approximately 2 to 3 hours), the public travelling along this road would not be exposed to hazards, because the SFPUC contractors would be required to adhere to safety procedures and measures, detailed in a blasting safety plan. The SFPUC must submit this plan to the U.S. Forest Service and obtain U.S. Forest Service approval prior to any controlled detonations on U.S. Forest Service lands or roads. Given the short duration and timing of the road closures for controlled detonations and the required adherence to safety measures, the proposed project would not likely impede emergency access along Lumsden Road.

In addition, construction activities would not significantly impact circulation or emergency access on Highway 120, the primary regional thoroughfare in the project area, because the project would not require any closures of Highway 120 that could impede emergency access.

Implementation of the proposed project would not result in changes to the existing circulation patterns or emergency access during the operational phase. The proposed project's road improvements described above in Impact TR-3 would not degrade, but improve, long-term maintenance access near the Mountain Tunnel adits compared to conditions without the project. Therefore, construction and operation of the project would have a *less-than-significant* impact on emergency vehicle access.

Impact TR-5. The project would not conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities. (Less than Significant)

As described above under Impact TR-1, project construction traffic would not substantially affect public transit, bicycle, or pedestrian travel; and project operation and maintenance trips would be few and infrequent and would not have a long-term effect on public transit, bicycle, and pedestrian travel. Because project-related trips are largely construction-related and would not affect local roads and Highway 120 continuously during the construction period of 2020 through 2026, the project would not conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities. Project impacts on alternative modes of transportation would therefore be *less than significant*.

Impact C-TR. The project, in combination with reasonably foreseeable future projects, would not result in a significant cumulative transportation and circulation impact. (Less than Significant)

The area for the analysis of cumulative traffic impacts includes the local roadways and Highway 120, generally from Highway 49 to the Yosemite National Park entrance, which would be used for short-term construction-related trips and infrequent vehicle trips for operation and maintenance for the proposed project.

Construction activities for the project would not be continuous throughout the entire project schedule. Some activities would occur during the initial phases of the project to prepare for subsequent phases, such as roadway improvements and preparation of staging areas; and some activities would only be conducted during planned shutdowns during winter months, such as internal tunnel repairs and invert paving. It is unlikely that simultaneous construction at all project improvement locations would occur during any stage of the project, due to the scope of the construction activities, the large project area, and the construction schedule. For operation and maintenance of the proposed project, a long-term transportation and circulation impact is not anticipated, because these activities are expected to generate approximately the same amount of traffic as existing operations and maintenance activities associated with the Mountain Tunnel.

The construction timeline for the proposed project could overlap with projects identified in the cumulative project list. These cumulative projects could increase traffic temporarily on the same roadways used to access the proposed project site. The projects listed in Table B-1, including, but not limited to, the Rim Fire Reforestation, Early Intake Dam Rehabilitation, Early Intake Bridge Rehabilitation, and Hazard Tree Settlement aim to improve existing site conditions. Although these projects could create an increase in short-term construction traffic, they would not cause a long-term increase in traffic, because they would not induce growth by adding permanent residents, housing, and/or employment to the area. As a result, the cumulative projects would not have a significant cumulative impact relative to conflicts with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, or an applicable congestion management program.

The proposed access road improvements address long-term tunnel serviceability and construction needs in areas prone to slides and rock falls. The proposed project would not have an impact on hazards due to a design feature or incompatible uses, and therefore would not contribute to a cumulative impact for this criterion.

As stated in Section A.6.11, the SFPUC has established Standard Construction Measures to be included in all construction contracts. The primary objective of these measures is to avoid and reduce impacts on existing resources, to the extent feasible. Almost half of the projects on the cumulative project list are also SFPUC projects, so these projects would also be expected to comply with SFPUC's Standard Construction Measure 4 to avoid and reduce impacts to transportation. As stated in the SFPUC Standard Construction Measure 4, all projects would implement traffic control measures sufficient to maintain traffic and pedestrian circulation during construction (as discussed in Impact TR-1, due to a lack of designated pedestrian facilities and the remote location of the project, pedestrian volumes are very low in the project vicinity). Traffic control measures may include, but are not limited to, flaggers, construction warning signage, scheduling truck trips during nonpeak hours to the extent feasible, maintaining access to driveways and private roads, and coordination with local emergency responders to maintain emergency access. For these reasons, significant cumulative traffic impacts would not occur.

E.6 Noise

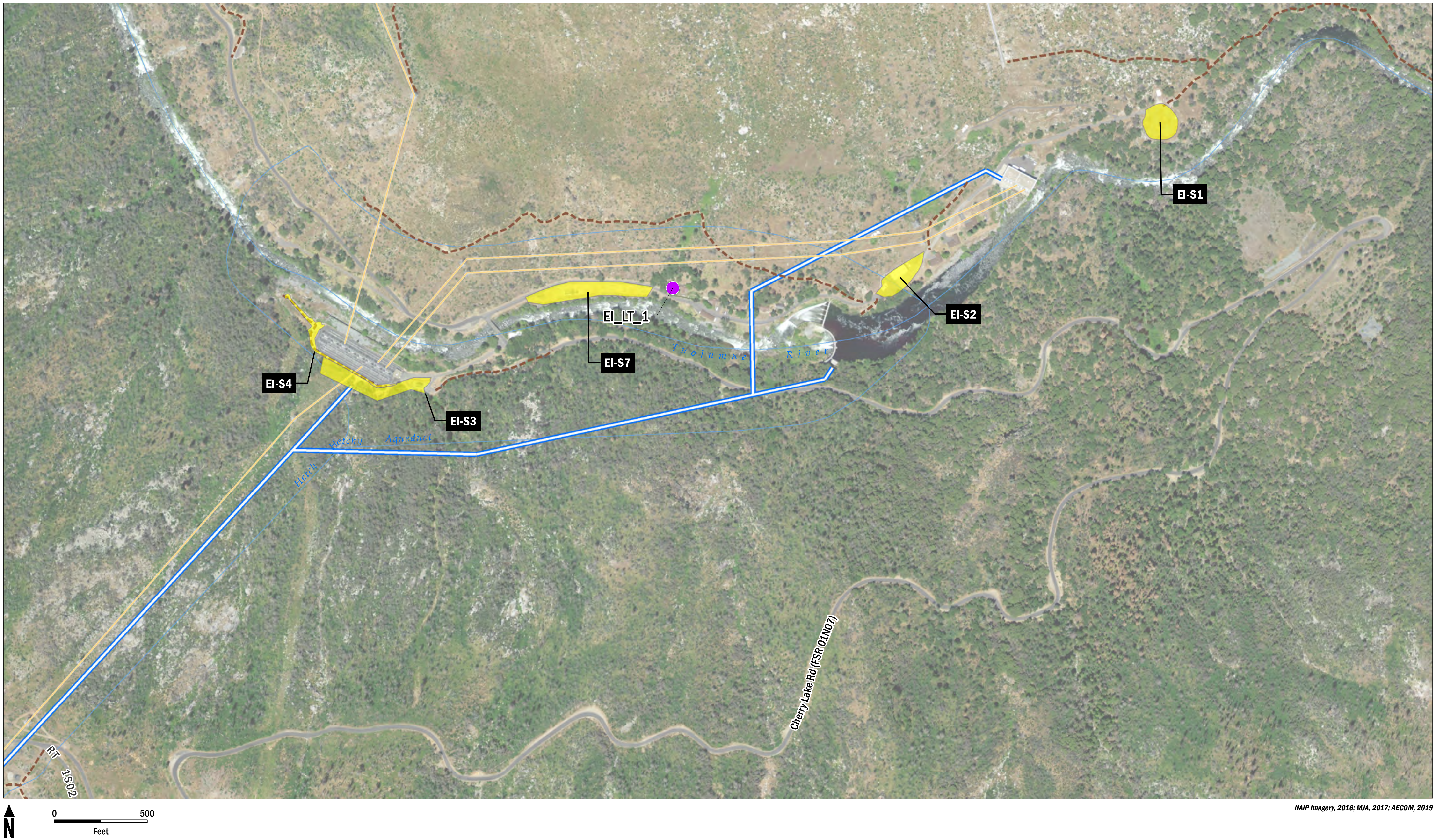
Topics:	*Potentially Significant Impact*	*Less than Significant with Mitigation Incorporated*	*Less-than-Significant Impact*	*No Impact*	*Not Applicable*
6. NOISE					
Would the project result in:					
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☒	☐	☐
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☒	☐	☐
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☒	☐	☐
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☒	☐	☐	☐
e) For a project located within an airport land use plan area, or, where such a plan has not been adopted, in an area within two miles of a public airport or public use airport, would the project expose people residing or working in the area to excessive noise levels?	☐	☐	☐	☐	☒
f) For a project located in the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☐	☒

The project is not within 2 miles of a public airport or private airstrip; therefore, significance criteria 6(e) and 6(f) are *not applicable* to this project and are not discussed further in this section.

Potential noise and vibration impacts on wildlife are addressed in Section E.13, Biological Resources under Impact BI-1.

Existing Noise Environment

The Mountain Tunnel is in the central Sierra Nevada Mountain Range in northern California near the town of Groveland in Tuolumne County. The surrounding land uses include rural residential, open space, commercial uses, and agricultural land. An ambient noise survey was conducted in the project area on February 18 and 19, 2019. The purpose of the survey was to establish existing noise conditions at the nearest sensitive receptors (i.e., areas where the occupants are susceptible to changes in the noise environment, such as residential areas, schools, and convalescent facilities) with the greatest exposure to project construction-related noise. Long-term measurements characterizing ambient nighttime noise levels were conducted at certain work areas where nighttime construction activities are proposed—specifically, Early Intake, Big Creek, and Second Garrote. Short-term ambient noise measurements were conducted near existing noise-sensitive uses that could be exposed to proposed daytime construction in the project area. In total, the survey included three long-term measurements and three short-term measurements, with the nearest sensitive receptors ranging from 225 feet to 1,450 feet from the noise source (Figures E.6-1 through E.6-5; Table E.6-1). The measurement locations represent the nearest resident with a "direct line of sight" to the noise source (in this instance, construction equipment).

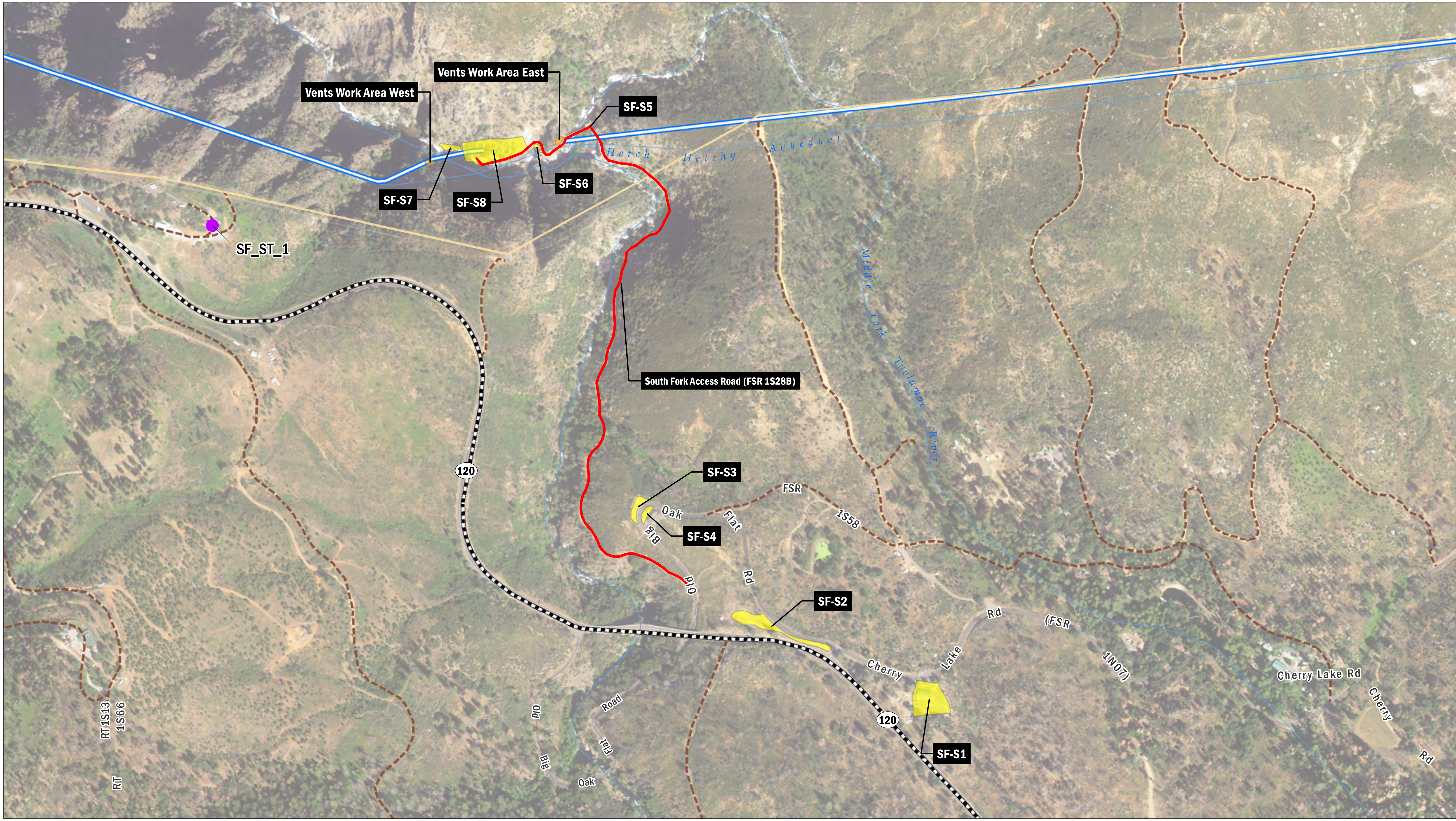


San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 3/15/2019

Ambient Noise Measurement Location
Mountain Tunnel Alignment
Power Lines
Unpaved Road/Trail

Project Features
Staging Area

FIGURE E.6-1
Ambient Noise Measurement Locations
Early Intake Area



NAIP Imagery, 2016; MJA, 2017; AECOM, 2019

San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 3/15/2019

Ambient Noise Measurement Location
Highway
Mountain Tunnel Alignment
Power Lines
Unpaved Road/Trail

Proposed Project Components
Proposed Road and Drainage Improvement

Project Features
Staging Area
Work Area

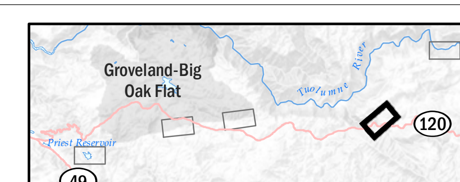
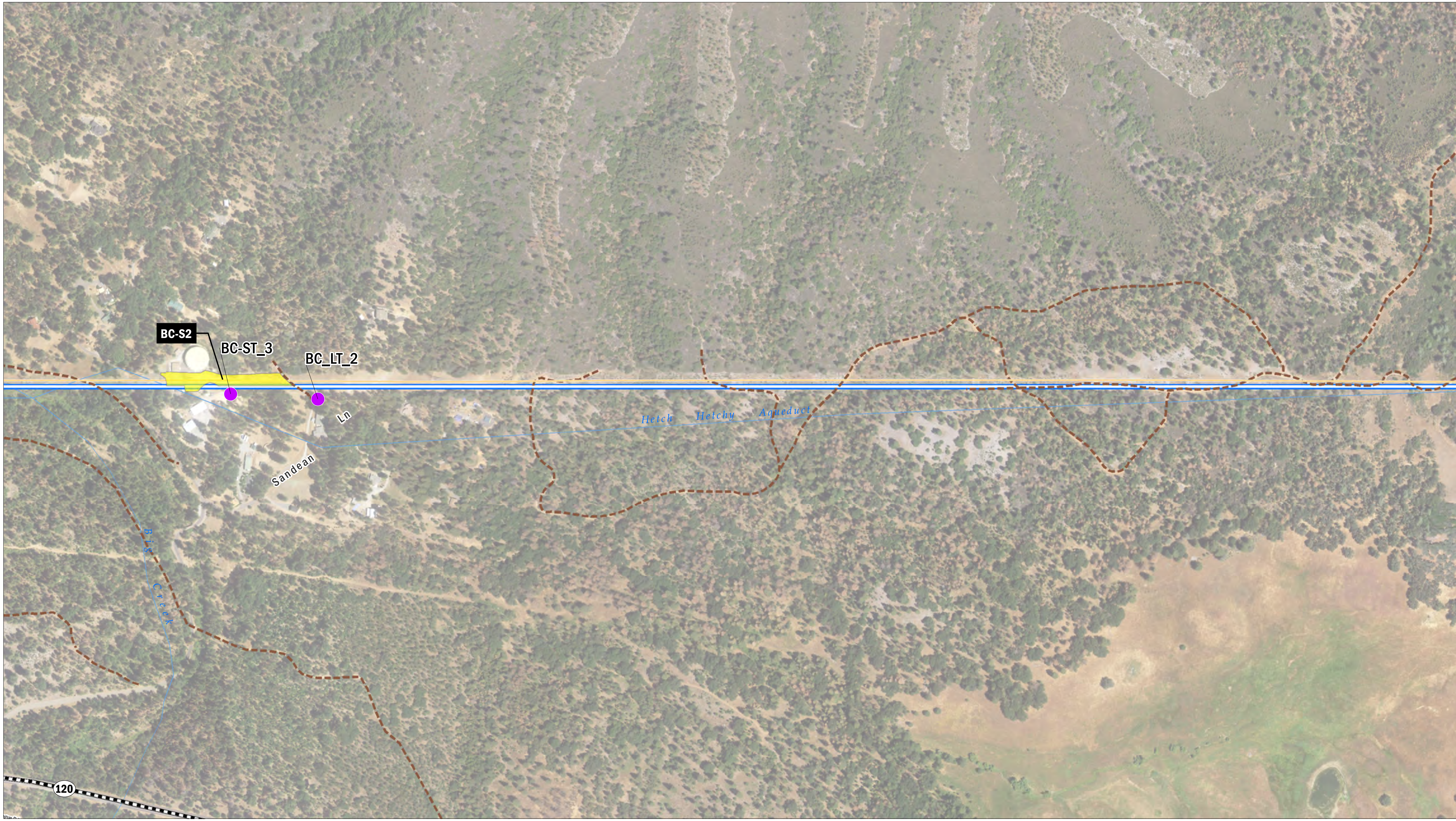


FIGURE E.6-2
Ambient Noise Measurement Locations
South Fork Siphon Area



N

0 500
Feet

NAIP Imagery, 2016; MJA, 2017; AECOM, 2019

San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 3/15/2019

Ambient Noise Measurement Location
Highway
Mountain Tunnel Alignment
Power Lines
Unpaved Road/Trail

Project Features
Staging Area

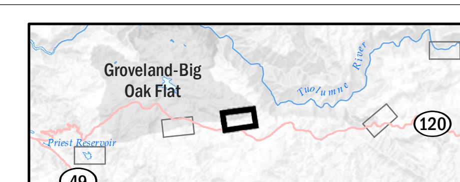
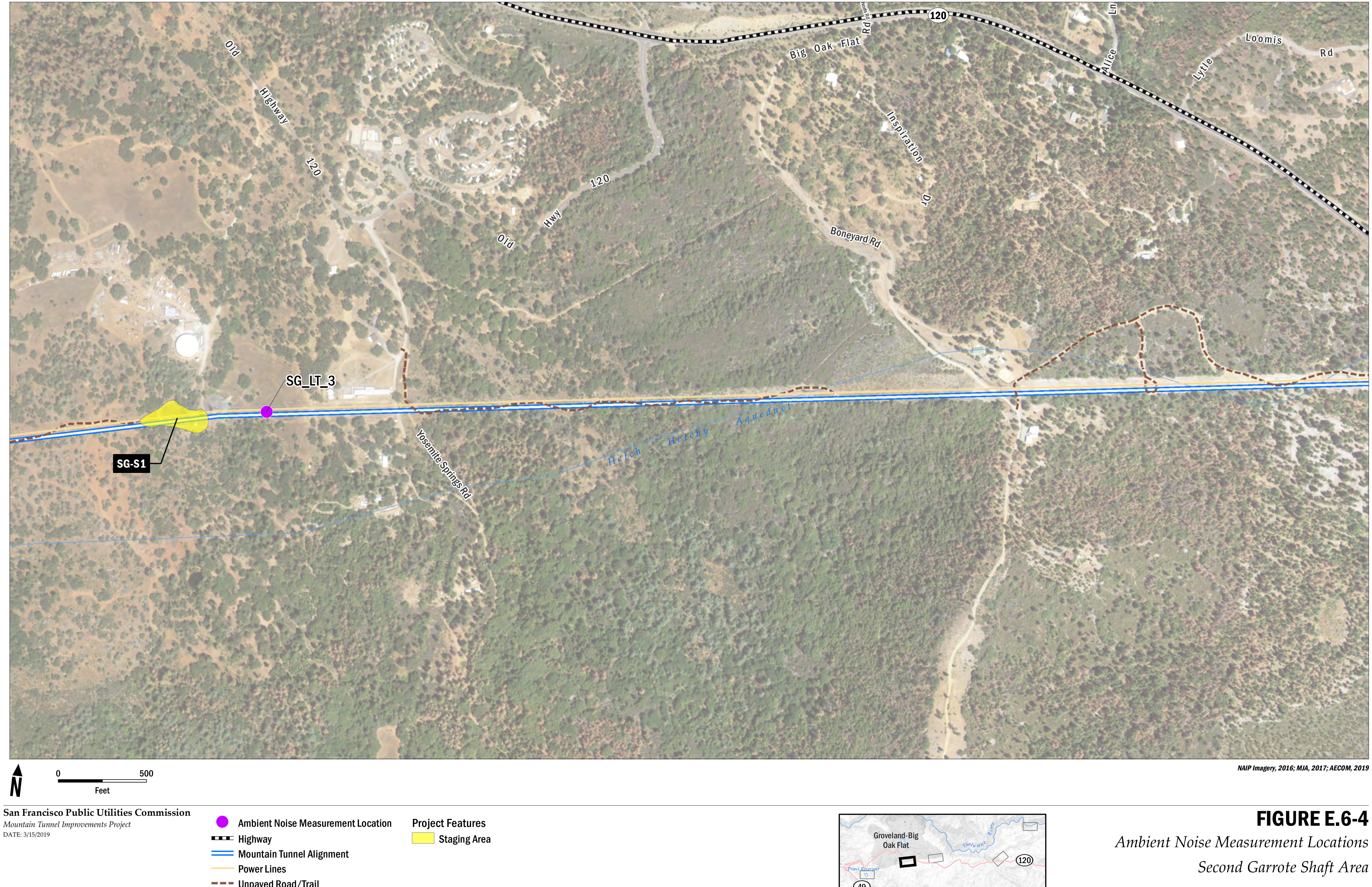
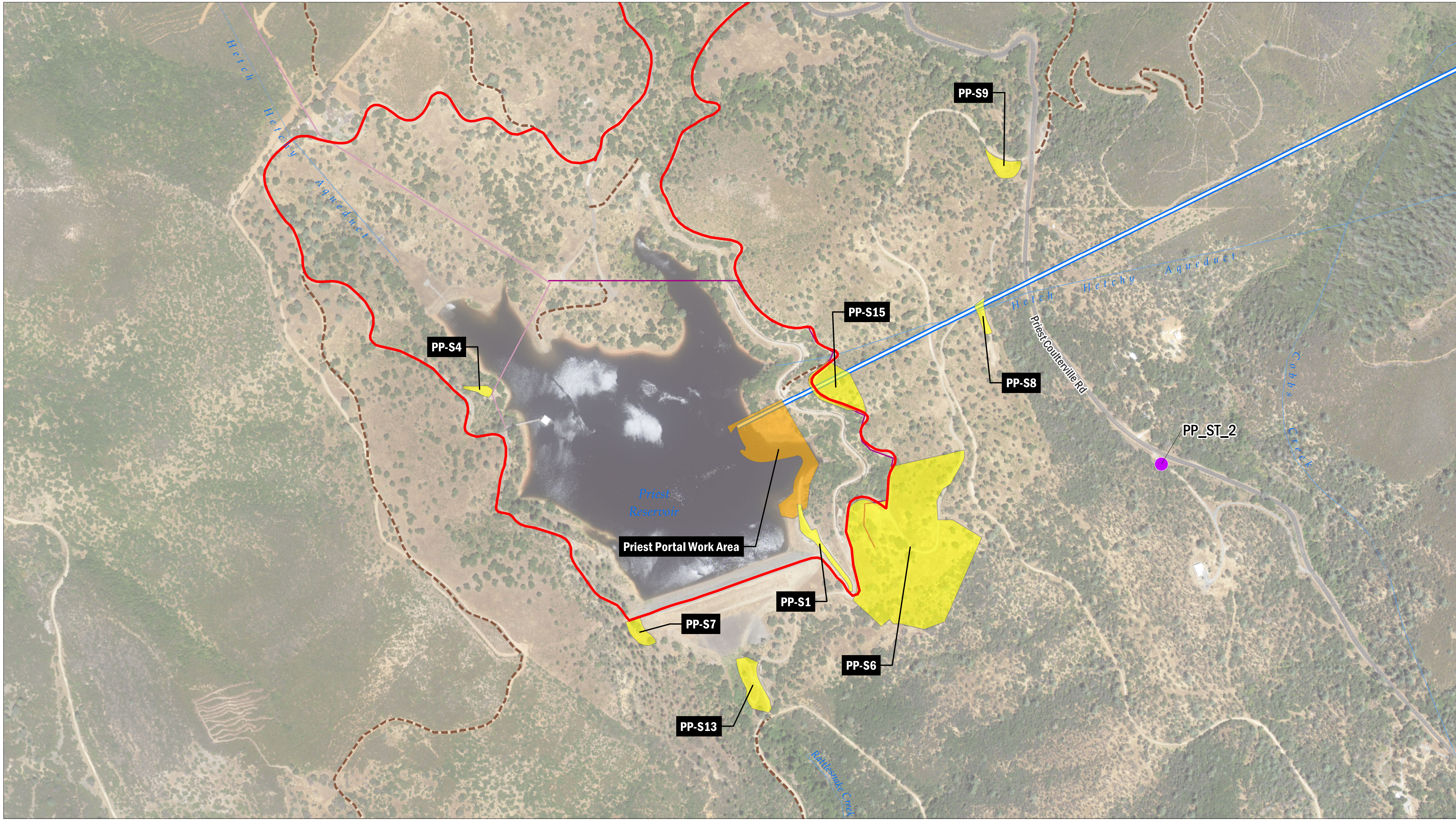


FIGURE E.6-3
Ambient Noise Measurement Locations
Big Creek Shaft Area



San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 3/15/2019

FIGURE E.6-4
Ambient Noise Measurement Locations
Second Garrote Shaft Area



NAIP Imagery, 2016; MJA, 2017; AECOM, 2019

N

0 500

Feet

San Francisco Public Utilities Commission

Mountain Tunnel Improvements Project

DATE: 5/22/2019

Ambient Noise Measurement Location

Proposed Power Distribution Alignment

Existing Power Distribution Alignment

Mountain Tunnel Alignment

Unpaved Road/Trail

Proposed Project Components

Proposed Road and Drainage Improvement

Project Features

Staging Area

Work Area

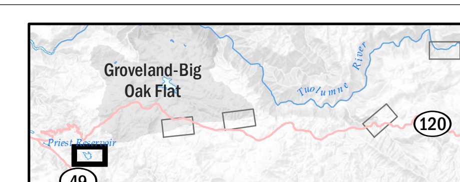


FIGURE E.6-5

Ambient Noise Measurement Locations

Priest Portal Area

Table E.6-1
Ambient Noise Levels at Closest Sensitive Receptors

Site	Date	Start Time	Duration	Approximate Distance (feet) to Nearest Receptor to Work Area	Daytime (7 a.m. – 10 p.m.)			Nighttime (10 p.m. – 7 a.m.)			
					L_{eq}	L_{max}	L_{50}	L_{eq}	L_{max}	L_{50}	L_{dn}
LT-01-L_{dn} **Early Intake**	18-Feb-2019	15:00	24 Hour	1,450	66	78	66	67	71	67	73
LT-02-L_{dn} **Big Creek**	18-Feb-2019	17:00	24 Hour	225	47	61	35	32	42	30	45
LT-03-L_{dn} **Second Garrote**	18-Feb-2019	18:00	24 Hour	750	37	55	32	32	46	29	39
ST_001 **South Fork**	19-Feb-2019	12:12	31:10.8	1,450	50	55	50	NA	NA	NA	NA
ST_002 **Priest Reservoir**	19-Feb-2019	13:48	0:20	1,250	51	71	39	NA	NA	NA	NA
ST_003 **Big Creek**	19-Feb-2019	16:07	0:15	225	42	54	40	NA	NA	NA	NA

Notes:

dBA = A-weighted decibel
L_{50} = sound level 50% of the measurement period
L_{eq} = equivalent sound level
L_{dn} =day night sound level accounting for calculated nighttime adjustments
L_{max} = instantaneous maximum sound level
LT = long-term measurement
ST = short-term measurement.

Noise-level measurements were completed using a Larson Davis Laboratories Model 824 precision integrating sound-level meter. The meter was calibrated before the measurements using a Larson Davis Laboratories Model CAL200 acoustical calibrator. The meter was programmed to record A-weighted sound levels using a “slow” response. The equipment used complies with all pertinent requirements of the American National Standards Institute for Class 1 sound-level meters (ANSI S1.4).

Source: AECOM 2019

There are proposed improvement, construction, and staging areas where residents are closer, but terrain or other physical features block the line of sight. In other areas, limited activities (e.g., parking or siting of a construction trailer) are proposed; residents at these locations would not be exposed to the same noise levels as other more distant residents who have direct line of sight. In addition, beyond 1,500 feet, the proposed improvement, construction, and staging areas would result in noise levels less than 50 A-weighted decibels (dBA) at the receptors, due to distance attenuation and natural ground absorption. At this noise level, project-related construction noise would be below Tuolumne County’s exterior stationary noise standard.[153] Recreational receptors are not considered sensitive, due to the transient nature of recreational activities in the area, the temporary nature of project noise, and the ability to relocate to other recreational areas.

The results of the noise survey in Table E.6-1 are typical of small communities and rural areas and consistent with general observations in the Tuolumne County General Plan Noise Element. Measurement Site LT-01-Ldn is an anomaly with unexpectedly high ambient noise levels, but the noise levels were due

153 County of Tuolumne, General Plan, Chapter 5: Noise, Tables 5.B and 5.C, 2018.

to the site's proximity to the Tuolumne River, and the noise generated by the rapids that are characteristic of this segment of river.

Impact NO-1. The project would not result in exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies. (Less than Significant)

This impact focuses on operational noise changes from project implementation. Construction noise impacts are described under Impact NO-4. The project has the potential to generate operational long-term noise increases; however, these levels would not exceed standards in the Noise Element of the Tuolumne County General Plan or the other applicable standards described below.

Policy 5.A.5 of Tuolumne County's General Plan Noise Element[154] specifies exterior and interior noise standards for noise sources during daytime and nighttime, respectively. For exterior noise exposures from nontransportation noise sources, noise levels must not exceed exterior levels of 50 dBA equivalent sound level (L_{eq}) and 70 dBA instantaneous maximum sound level (L_{max}) from 7 a.m. to 10 p.m.; and exterior levels of 45 dBA L_{eq} and 65 dBA L_{max} from 10 p.m. to 7 a.m. During nighttime, interior noise levels at residential uses shall not exceed 45 dBA L_{max} in living areas and 40 dBA L_{max} in sleeping areas from 10 p.m. to 7 a.m.

The portion of the proposed project that is in neighboring Mariposa County (Staging Area A5/6-S1) would not be used for long-term improvements and would not result in an operational noise source; it would be used for construction trailers and storage, with no excavation, tree removal, or heavy-duty ground-disturbing construction equipment. In addition, the nearest sensitive receiver would be guests at the Buck Meadows Lodge, about 2,300 feet to the west. Consequently, this area and Mariposa County's noise policies and ordinances are not discussed further in Impact NO-1.

Operation of most project components would not generate noise because they are not noise sources (e.g., new Priest Portal improvements and road improvements) or they would be located underground (e.g., Early Intake adit improvements, South Fork Siphon extension, and new Priest adit tunnel and flow control facility). Periodic maintenance of the tunnel and of these tunnel-related facilities could generate noise due to the type of equipment used (e.g., mechanical equipment to remove debris from the tunnel, cranes for lifting valves, generators for maintenance, or trucks to access project sites). This would generally occur during day shift hours from 7 a.m. to 7 p.m. The use of this equipment for maintenance would not result in noise increases that exceed the county noise limits, because they would occur underground at Priest Reservoir and South Fork; for the aboveground facilities in the Priest Reservoir area, equipment and maintenance would be distant from sensitive receptors in the hillsides to the east off Priest-Coulterville Road, and maintenance activities would occur during the less noise-sensitive daytime hours. Truck trips to access project sites for maintenance already occur and would not change substantially from existing travel to tunnel-related facilities. As described in Section A.7.2, Mountain Tunnel Maintenance, the tunnel inspection and maintenance activities would be infrequent, and other maintenance activities such as repairing roads, clearing trees and debris, and clearing drainageways would occur as needed. Based on the typical noise levels generated by maintenance activities and attenuation of these sources due to the distance of the nearest sensitive receptors (1,250 feet, as shown in Table E.6-1 above), project operation and maintenance would not exceed Tuolumne County exterior or interior noise standards. (The sensitive receptors at Big Creek and Second Garrote that are identified in Table E.6-1 as being closer than 1,250 feet are at locations that would be used during the construction

[154] County of Tuolumne, General Plan, Chapter 5: Noise, Tables 5.B and 5.C, 2018.

period only and would not be exposed to long-term operational or maintenance noise.) Therefore, no long-term permanent noise impact would occur, and the impact would be *less than significant*.

Impact NO-2. The project would not result in exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels. (Less than Significant)

Project construction activities may result in varying degrees of temporary groundborne noise and vibration, depending on the specific construction equipment used and activities involved.[155] Maximum groundborne noise and vibration levels would be associated with heavy equipment and controlled detonation activities. Both use of heavy equipment and controlled detonations are proposed for the Early Intake area (sensitive receptors are 1,450 feet away); along the Adit 5/6 and Adit 8/9 access roads (nearest sensitive receptor is more than 3,500 feet away); and at the South Fork and Priest Reservoir areas and along the access roads to these areas (nearest sensitive receivers are more than 1,250 feet away).

Tuolumne County does not have vibration criteria; however, Caltrans has developed criteria for potential structural damage to adjacent buildings and for human annoyance. Vibration impacts at the one staging area in Mariposa County are not addressed because this area would be used for construction trailers and storage, with no excavation, tree removal, or heavy-duty ground-disturbing construction equipment. To determine project vibration impacts for human annoyance and structural damage, the Caltrans standards are commonly applied as an industry standard. Caltrans recommends 0.5 inch per second peak particle velocity to avoid structural damage to buildings and 0.9 inch per second peak particle velocity to avoid human annoyance.[156]

Based on reference vibration levels, vibration levels associated with the use of a large bulldozer and controlled detonations are 0.089 and 1.13 inches per second peak particle velocity at 25 feet, respectively. Heavy equipment operation would not exceed the Caltrans-recommended level for avoidance of structural damage (0.5 inch per second peak particle velocity), even at a distance of 25 feet. However, controlled detonations could exceed this level within 80 feet of structures, based on Caltrans' recommended procedure for applying a propagation adjustment to these reference levels. With respect to prevention of human disturbance, heavy equipment operation and controlled detonations could exceed the Caltrans-recommended level of 0.9 inch per second peak particle velocity for human annoyance within 325 feet of the sensitive receivers.

Controlled detonations are proposed at Early Intake for the removal of tunnel entrance facilities, for excavations at South Fork for the new shaft and siphon, and for rock removal for the access road improvements. At Priest Reservoir, controlled detonations are proposed for the excavations of the flow control facility, portal, and adit, as well as for Rickson Road improvements. However, at these locations, the nearest sensitive receptors are more than 1,250 feet from sites where controlled detonations are proposed, and so would not be exposed to groundborne vibration or groundborne noise impacts (80 feet for structural damage and 325 feet for human annoyance). Therefore, controlled detonations would not result in generation of or exposure of persons to excessive groundborne vibration or groundborne noise levels.

155 Vibration amplitudes are commonly expressed in peak particle velocity or root-mean-square vibration velocity. Peak particle velocity is appropriate for evaluating the potential for building damage; however, a vibration level that causes annoyance can be well below the damage threshold for normal buildings. Vibration impacts on humans are evaluated in terms of root-mean-square vibration velocity, expressed in decibel notation as vibration decibels.

156 Caltrans, *Transportation and Construction Vibration Guidance Manual*, September 2013.

Table E.6-2 presents the projected vibration levels for the most intensive construction phases at the nearest sensitive receptors where heavy-duty construction equipment is proposed. The table presents information for construction activities at the two project work areas with the closest sensitive receptors: Big Creek and Second Garrote. As shown in Table E.6-2, project construction vibration levels from heavy-duty construction equipment would not exceed vibration criteria for human annoyance or structural damage at the receptors nearest to the construction activities at these two locations. Improvement, construction, and staging areas at Early Intake, South Fork, Adit 5/6, Adit 8/9, and Priest Reservoir are farther than any of the distances identified in Table E.6-2 for the project construction activity areas associated with Big Creek and Second Garrote. As a result, for sensitive receivers in the vicinity of the improvement, construction, and staging areas for these more distant project components, vibration impacts would likewise be less than significant.

Table E.6-2
Project Construction Vibration Levels from Heavy-Duty Construction Equipment at Closest Sensitive Receptors[1]

Construction Activity	Approximate Distance (feet) from Acoustical Center between Noise-Sensitive Receiver Locations and Proposed Construction Areas	Vibration Level at Sensitive Receiver with Project Construction, Vibration Levels PPV	Exceeds Caltrans Threshold	
			Structural Damage, 0.5 in/sec PPV	Human Annoyance, 0.9 in/sec PPV
Big Creek – tunnel lining repairs	225	0.03	No	No
Second Garrote – tunnel lining repairs	750	0.001	No	No

Notes:

1 Improvement, construction, and staging areas at other project components are farther than any of the distances identified in this table for the project construction activity areas above. As a result, sensitive receivers around the improvement, construction, and staging areas for those project components would not experience vibration impacts.

in/sec =inches per second
PPV = peak particle velocity

Source: Modeled by AECOM 2019

The long-term operational vibration effects of the new facilities would be similar to the vibration effects of the existing facilities and would result from flowing water, which is not a significant source of vibration. Although pumps in the flow control facility shaft and use of the crane at this facility to service the flow control valves would result in some vibration, the nearest vibration sensitive receptors in the Priest Reservoir area are more than 1,250 feet away, a sufficient distance to attenuate and dampen potential groundborne vibration and groundborne noise impacts.

Short-term construction or long-term operation of the project would not result in the exposure of persons to or generation of excessive groundborne noise or vibration levels. Therefore, the impact would be *less than significant*.

Impact NO-3. The project would not result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project. (Less than Significant)

The long-term operational effects of the new above-ground facilities, which would be at the Priest Reservoir area only, would be similar to the effects of the existing facilities and would result from flowing water, which is not a significant source of noise. Although pumps in the flow control facility shaft and use of the crane at this facility would result in some noise generation, the nearest noise-sensitive receptors in the Priest Reservoir area are more than 1,250 feet away, a sufficient distance to attenuate and dampen potential noise so that it would not represent a substantial permanent increase above the ambient levels. In addition, generators would be needed but would likewise be distant from sensitive receivers and would be operated infrequently: every 3 months for less than a day to exercise the pumps and once every 20 years for 3 days to dewater the tunnel prior to planned outages. Maintenance of the flow control facility that could result in noise would involve monthly routine maintenance and more extensive maintenance and replacement of equipment every 5 years. Details regarding maintenance are presented in Section A.6.2, Mountain Tunnel Maintenance, and Section A.6.3, Flow Control Facility Operations and Maintenance. There would be no permanent staffing, changes in land use activities, or modification to existing functions that could result in substantial increases in ambient noise levels near the identified noise-sensitive receptors, as measured and described earlier in Table E.6-1.

For routine maintenance and inspections, a minimal number of vehicle trips would occur each month. In general, a doubling of existing traffic volumes would result in a +3 dBA increase, a change in ambient conditions that would be the minimum change detectable with human hearing in outside environments.[157] The project may slightly increase vehicle trips to the sites for maintenance; however, this increase in trips would not amount to a doubling of traffic volumes and would be expected to result in a less than 1 dBA increase in ambient noise levels in the project vicinity.

Based on the assessment above, noise from project operations and maintenance would not result in the exposure of persons to or generation of noise levels in excess of county noise standards, or a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project. The impact of the project on ambient noise levels in the project vicinity would, therefore, be *less than significant*.

Impact NO-4. The project could result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project. (Less than Significant with Mitigation)

Periodic increases in ambient noise levels would occur during the construction period as a result of additional truck trips and equipment use at improvement, construction, and staging areas, particularly at nighttime when ambient levels are lower (see long-term measurements reported in Table E.6-1).

The proposed project would result in the addition of disposal and material hauling truck trips on nearby roadways, including Highway 120, which would be dispersed onto the various access roads, as reported in Table A-8 and Table A-9 in Section A, Project Description, and discussed in Section E.5, Transportation. Construction-related truck trips (for materials delivery and spoils disposal) and construction personnel travel to and from the work areas would increase existing traffic volumes along Highway 120 by less than 10 percent. This change in traffic volumes would increase traffic noise levels by less than 1 dBA, which is an incremental difference that is not perceptible to the human ear. Typically, a doubling of vehicle traffic is required for a noticeable increase, 3 dBA or greater, in roadway traffic noise levels.[158]

In addition to traffic on the local roads and Highway 120, the project would generate construction-related, short-term noise increases at the various work locations. Tuolumne County does not have construction noise exemption hours. However, pursuant to Policy 5.A.5 of the county's noise element,

[157] Caltrans, Technical Noise Supplement to Traffic Noise Analysis Protocol, Sacramento, California, September 2013.
[158] Caltrans, Technical Noise Supplement to Traffic Noise Analysis Protocol, Sacramento, California, September 2013.

interior noise levels at residential uses from construction shall not exceed 45 dBA L_{max} in living areas and 40 dBA L_{max} in sleeping areas from 10 p.m. to 7 a.m. These are the more sensitive times when project construction impacts could have the greatest effect on sensitive receptors. Various state and federal agencies specify construction noise level criteria or noise level standards that could be applied to the project. For example, Caltrans uses a maximum noise limit standard for construction equipment of 86 dBA L_{max} at 50 feet from the job site activities from 9 p.m. to 6 a.m.[159] The Federal Transit Administration applies daytime and nighttime construction noise level criteria of 80 dBA L_{eq} and 70 dBA L_{eq}, respectively.[160]

Although these other standards are useful metrics, this assessment uses the county's nighttime construction interior noise standard for residential receptors of 45 dBA in living spaces and 40 dBA in sleeping spaces, because it is specific to the project location, it addresses the low ambient noise levels in proposed project work areas (as documented by the noise measurements reported in Table E.6-1), and it accounts for noise that could occur during the nighttime hours. Normal building construction reduces noise on the exterior of a residence by about 15 to 25 dBA, depending on whether windows of the residence are open.[161] If the noise level outside a residence were 60 dBA, for example, interior noise levels would be 35 dBA with the windows closed and 45 dBA with the windows open.

As described in Section A.6.3, Construction Equipment and Controlled Detonation, typical construction equipment for the proposed project includes excavators; front-end loaders (track and wheeled); dozers/graders; cranes; dump trucks; multi-passenger all-terrain tunnel utility vehicles; drilling equipment; concreting equipment for shotcreting, grouting, and pouring (grout plant); air and electric power tools; compressors; generators; water pumps; water treatment facilities; and water trucks. Hours of operation for construction activities at most improvement, construction, and staging areas would be Monday through Friday during the daytime hours. The primary exceptions, when work shifts would be longer, would be when work would occur along Lumsden Road during the night; and when construction activities involving the tunnel interior improvements would occur 7 days a week during all hours for the duration of the 60- to 100-day shutdowns. Twenty-four-hour construction would occur at the following staging areas: all Early Intake staging areas, with the concentration of work occurring at EI-S3; South Fork staging areas, with the concentration of work occurring at SF-S7 and SF-S8; A5/6-S2, with office support and supplies taken from A5/6-S1; A8/9-S1 and A8/9-S4, with office support and supplies taken from A8/9-S6 or A8/9-S3; BC-S2; SG-S1; and Priest Reservoir staging areas, with the concentration of work occurring at PP-S6, PP-S13, and PP-S15.

Project-generated construction noise levels are based on the project equipment list for each work area as provided by the SFPUC, and on Federal Highway Administration reference noise levels and methodology for evaluating the five noisiest pieces of construction equipment for each area. The simultaneous operation of onsite construction equipment associated with the proposed project, as identified above, could result in combined noise levels of up to approximately 85 dBA L_{eq} at 50 feet from the center of construction activity, and maximum noise levels of 94 dBA L_{max} at 50 feet from operation of heavy-duty equipment and controlled detonations.

Table E.6-3 shows the estimated project construction noise levels at the closest receptor to project construction areas. The construction areas presented in Table E.6-3 were selected for evaluation based on

[159] Caltrans, Technical Noise Supplement to Traffic Noise Analysis Protocol, Section 14-8, Sacramento, California, September 2013.
[160] Federal Transit Administration, Table 7-2, General Assessment Construction Noise Criteria, Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration Report No. 0123, September 2018.
[161] Egan, M.D., *Concepts in Architectural Acoustics*, McGraw-Hill, Inc., 1972.

their proximity to sensitive receptors. Adit 5/6 and Adit 8/9 are even farther from sensitive receptors than areas shown in Table E.6-3, which would result in lower construction noise levels than shown. Noise levels resulting from grouting activities associated with nighttime tunnel repair—and from daytime construction activities for shaft, adit, and portal construction and roadway modifications—are shown in Table E.6-3. Refer to Appendix A for a complete list of modeling inputs and results.

Table E.6-3
Estimated Project Construction Noise Levels at Closest Sensitive Receptors

Construction Activity	Approximate Distance (feet) between Noise-Sensitive Receptor Locations and Proposed Work Areas	Exterior Noise Level at Noise-Sensitive Receptor with Project Construction Noise		Interior Noise Level, dBA L_{eq}	Exceed Nighttime Interior Noise Level of 40 dBA
		dBA L_{eq} [162,163]	dBA L_{max}		
Early Intake – tunnel access improvements	1,450	49	53	38	No
Big Creek – tunnel lining repairs	225	65	69	54	Yes
Second Garrote – tunnel lining repairs	750	53	58	43	Yes
Priest Portal – installation of new facilities, spoils disposal, and access road improvements	1,250	48	54	39	No

Notes:

Refer to Appendix A for modeling input parameters and output results.

dBA = A-weighted decibel
L_{eq} =equivalent sound level
L_{max} = instantaneous maximum noise level

Source: Modeled by AECOM 2019

Based on the equipment noise levels, usage factors, and a typical noise-attenuation rate of 7.5 dBA per doubling of distance,[164] Table E.6-3 shows that exterior noise levels at the closest noise-sensitive receptors to project construction (within 225 feet) could be as high as 65 dBA L_{eq} and 69 dBA L_{max}. This estimated noise level at the Big Creek Shaft area exceeds the exterior threshold of 50 dBA and would result in an exceedance of the nighttime construction interior standard of 40 dBA. Table E.6-3 also shows that the same impacts would be expected in the Second Garrote area even with sensitive receptors approximately 750 feet away.

[162] Federal Highway Administration and United States Department of Transportation, Roadway Construction Noise Model User's Guide, FHWA-HEP-05-054, Washington, DC, January 2006.

[163] Federal Transit Administration, Transit Noise and Vibration Impact Assessment, FTA-VA-90-1003-06, Office of Planning and Environment, Washington, DC, May 2006.

[164] Doubling of distance from source to receptor refers to a 7.5-dBA noise attenuation with each doubling of distance. For instance, a noise level of 70 dBA at 50 feet would attenuate to 62.5 at 100 feet, to 55 dBA at 200 feet, and so forth.

Construction activities at the Big Creek Shaft and Second Garrote areas are associated with repairing the tunnel lining by injecting grout from the surface to inside the tunnel. The pieces of equipment that would contribute to the noise impact are a generator, compressor, and mobile grout unit. The SFPUC would enclose these mobile grout plants in large shipping containers (see Section A.6.7, Temporary Grout Plants). A Haeny MCM 5500 mobile grout plant has been measured at 64 dBA L_{max} at 50 feet, attenuated to 51 dBA L_{max} at 225 feet, during full operation with container doors shut.[165] Even with the mobile grout unit operating in a closed container, nighttime construction noise is predicted to exceed the nighttime construction interior standard at the nearest receptors at the Big Creek Shaft and Second Garrote areas, primarily due to auxiliary compressors and generators operating without enclosures during scheduled 24-hour operation (see Table E.6-3). These noise levels would be a significant impact, but can be mitigated with implementation of **Mitigation Measure M-NO-4**.

Construction noise would also occur for roadway modification construction activities during the daytime hours; however, construction activities would progress sequentially along the road and are therefore considered more short term than construction activities that remain in a fixed construction area. Exterior noise levels at the nearest noise-sensitive rural residential land uses, within 500 feet of road and drainage improvement construction activities at Second Garrote, would be about 60 dBA L_{eq} during intermittent periods of scheduled construction activities. Sensitive receptors near the improvement, construction, and staging along other roads, including the South Fork, Adit 5/6, Adit 8/9, and Priest Reservoir access roads, are further away and would not be affected by daytime or nighttime road and drainage construction activities. For example, roadway modifications on Adit 8/9 Access Road (Forest Service Road 1N10/ Lumsden Road) would require nighttime construction work; however, Adit 8/9 construction areas are deep in the canyon and more than 3,500 feet from the nearest receptor. Therefore, nighttime construction in this location would not result in significant noise impacts.

Implementation of **Mitigation Measure M-NO-4** would reduce the temporary short-term construction noise impacts resulting from proposed project activities by requiring the SFPUC to include in its contract specifications a noise control plan that would attain the county's interior nighttime standards by implementing various noise control methods, including the use of noise enclosures for stationary equipment operating during daytime and nighttime hours at the Big Creek Shaft staging area (BC-S2) and the Second Garrote staging area (SG-S1). Therefore, the proposed project would not result in a substantial temporary or periodic increase of ambient interior noise levels at nearby sensitive receptors in the project vicinity. This impact would be *less than significant with mitigation*.

Mitigation Measure M-NO-4: Implement Noise Control Measures for Construction Activities at the Big Creek Shaft and Second Garrote Areas

The SFPUC shall include in its construction contract specifications a requirement that at least 28 days before the start of nighttime construction at Big Creek and Second Garrote, the contractor submit to the SFPUC for review and approval a noise control plan prepared by a qualified noise consultant. SFPUC shall require the qualified noise consultant to be a board-certified Institute of Noise Control Engineering member or other qualified consultant or engineer approved by the SFPUC Project Construction Manager. The SFPUC will verify that the noise control plan contains at least the following elements:

[165] Goff, Larry, personal communication between Larry Goff, General Manager North America for Haeny, Inc., and Chris Shields, AECOM, 2018.

- Written notification of construction activities shall be provided to all noise-sensitive receptors within 1,500 feet of construction activities at the Big Creek Shaft and Second Garrote areas. Notification shall include the dates and hours during which construction activities are anticipated to occur and contact information, including a telephone number, for the project representative to be contacted in the event that noise levels are deemed excessive. Recommendations for assisting noise-sensitive land uses in reducing interior noise levels (e.g., closing windows and doors) shall also be included in the notification.
- A detailed list of noise control methods to achieve the Tuolumne County General Plan Noise Element interior standards of 40 dBA L_{max} in sleeping areas and 45 dBA L_{max} in other rooms at noise-sensitive receptors within 1,500 feet of nighttime construction. A number of feasible methods exist and could include a combination of the following or others as identified by the qualified noise consultant:
  - Enclose stationary noise sources, such as pumps, compressors, and generators in shipping containers or other types of enclosures that are solid and block the line of sight between the construction equipment and sensitive receptors.
  - Locate noise-attenuating buffers such as structures, truck trailers, or spoil piles between noise sources and sensitive receptors to block the line of sight between the construction equipment and sensitive receptors.
  - Properly maintain all construction equipment and equip it with noise-reduction intake and exhaust mufflers and engine shrouds, in accordance with manufacturers' recommendations. Equipment engine shrouds shall be closed during equipment operation.
  - Shut down all motorized construction equipment when not in use, to prevent idling.
  - Use the best available noise control techniques on equipment and trucks.
- The noise control measures that are anticipated to be performed shall be listed.
- The proposed staging and scheduling of noise control measures shall be included.
- The schedule and plan to document baseline noise levels at residential property lines within 1,500 feet of work areas shall be included. The baseline 1-hour L_{eq} during nighttime hours (10:00 p.m. to 7:00 a.m.) at the exterior areas of nearby noise-sensitive receptors will be documented for at least a 1-week period before construction begins.
- The number and location of monitoring locations in relation to work areas at Big Creek and Second Garotte shall be noted.
- The schedule for tests to confirm the construction noise levels and effectiveness of noise control measures prior to continuous construction activity at Big Creek and Second Garrote shall be included.
- The schedule for ongoing monitoring and reporting of construction noise levels to meet the Tuolumne County General Plan Noise Element standards shall be included. Monitoring will occur at least weekly, or more often if needed in response to complaints.
- In the event that thresholds are exceeded, the contractor will provide information to the SFPUC within 48 hours of the exceedance, identifying the source of the exceedance and corrective actions to reduce the noise.

- If noise complaints are received due to tunnel repair construction noise, the SFPUC and the contractor will meet to discuss other options that can further reduce noise levels at the sensitive receptor. One option may be acoustic barriers (e.g., lead curtains or sound barriers) that could be installed on the receptor's property. When installed properly, acoustic barriers can reduce construction noise levels by approximately 5 dBA.[166]

Impact C-NO. The project, in combination with reasonably foreseeable future projects, would not result in a significant noise and vibration impact. (Less than Significant)

The geographic scope of potential cumulative noise impacts encompasses the project site, adjacent land uses, and areas next to proposed haul routes. Reasonably foreseeable future projects, considered in combination with the proposed project, would not result in cumulatively significant temporary noise impacts, because these projects would not cumulatively double existing traffic volumes along roadways adjacent to sensitive receptors. A doubling of traffic volumes would result in an increase in noise levels of 3 decibels, which would be perceptible. Additionally, based on the distance of these projects relative to each other (more than 1 mile apart), the intervening distance to the closest possible receptors, and the reduction in noise levels with increased distance, significant cumulative noise and vibration impacts during construction would not occur.

Operational noise associated with the cumulative projects would be minimal, based on the rural nature of these projects, the varying terrain, and the geographical distances (more than 1 mile) from cumulative project work areas. Similarly, the proposed project improvement, construction, and staging areas are spread out over about 19 miles in hilly terrain. As a result, the cumulative projects in Table B-1 would be expected to affect different sensitive receptors, so that significant cumulative noise and vibration impacts would not occur.

[166] Caltrans, *Transportation and Construction Vibration Guidance Manual*, September 2013.

E.7 Air Quality

Topics:	*Potentially Significant Impact*	*Less than Significant with Mitigation Incorporated*	*Less-than-Significant Impact*	*No Impact*	*Not Applicable*
7. AIR QUALITY					
Would the project:					
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☒	☐	☐
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☐	☒	☐	☐
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal, state, or regional ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	☐	☒	☐	☐
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☒	☐	☐	☐
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☒	☐	☐

Overview

The proposed project is entirely within Tuolumne County, with the exception of one construction staging area in Mariposa County. Both Tuolumne County and Mariposa County are in the Mountain Counties Air Basin, and under the jurisdictions of the Tuolumne County Air Pollution Control District and Mariposa County Air Pollution Control District, respectively.

The air districts are responsible for attaining and maintaining air quality under the federal air quality standards of the federal Clean Air Act, and under the state air quality standards of the California Clean Air Act. These standards have been identified by the United States Environmental Protection Agency (U.S. EPA) and the California Air Resources Board for six criteria air pollutants that affect ambient air quality: ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, and particulate matter. Particulate matter is subdivided into two classes based on particle size: particulate matter equal to or less than 10 microns in diameter (PM_{10}), and particulate matter equal to or less than 2.5 microns in diameter ($PM_{2.5}$). Counties or regions that are designated as federal nonattainment areas for one or more criteria air pollutants must prepare a plan that demonstrates how the area will achieve attainment of the standards by the federally mandated deadlines. In addition, those areas that have been redesignated as attainment prepare maintenance plans that demonstrate how the area will maintain the standard. These regional plans, prepared by local air districts, go into the State Implementation Plan, which is compiled by the California Air Resources Board and eventually approved by the U.S. EPA.

In addition to criteria air pollutants, the U.S. EPA and the California Air Resources Board regulate hazardous air pollutants, also known as toxic air contaminants. Toxic air contaminants may be emitted by stationary, area, or mobile sources. Common stationary sources of toxic air contaminant emissions include gasoline stations, dry cleaners, and diesel backup generators, which are subject to the requirements of local air districts' permits. The other, often more substantial, sources of toxic air contaminant emissions are motor vehicles on freeways, on high-volume roadways, or in other areas with high numbers of diesel vehicles, such as distribution centers. Off-road mobile sources are also major contributors of toxic air contaminant emissions and include construction equipment, ships, and trains.

Toxic air contaminants collectively refer to a diverse group of air pollutants that are capable of causing chronic (i.e., long-duration) and acute (i.e., severe but short-term) adverse effects on human health, including carcinogenic effects. Human health effects of toxic air contaminants include birth defects, neurological damage, cancer, and mortality. There are hundreds of different types of toxic air contaminants with varying degrees of toxicity. The health risks of individual toxic air contaminants vary greatly; at a given level of exposure, one toxic air contaminant may pose a hazard that is many times greater than another.

Toxic air contaminants can be separated into carcinogens and noncarcinogens based on the nature of the effects associated with exposure to the pollutant. For regulatory purposes, carcinogens are assumed to have no safe threshold below which health impacts would not occur. Any exposure to a carcinogen poses some risk of contracting cancer. Noncarcinogens differ in that there is generally assumed to be a safe level of exposure below which no negative health impact is believed to occur. These levels are determined on a pollutant-by-pollutant basis.

Tuolumne County Air Pollution Control District

The Tuolumne County Air Pollution Control District is the air district responsible for attaining and maintaining air quality in Tuolumne County. Tuolumne County is designated as unclassified or attainment for all criteria pollutants except ozone under the federal air quality standards. Under the state air quality standards, Tuolumne County is designated as nonattainment for ozone (marginal);[167] attainment for nitrogen dioxide, sulfur dioxide, and carbon monoxide; and unclassified for $PM_{2.5}$ and PM_{10}. The California Air Resources Board has determined that the ozone levels in Tuolumne County are caused by "overwhelming transport" from the San Joaquin Valley.[168] In addition, 40 CFR Part 51 (effective February 4, 2019) does not require nonattainment areas classified as "marginal" to submit plans demonstrating how they will meet the ozone standard; therefore, the Tuolumne County Air Pollution Control District is relieved from preparing an attainment plan for ozone.

Mariposa County Air Pollution Control District

The Mariposa County Air Pollution Control District is the air district responsible for attaining and maintaining air quality in Mariposa County. Mariposa County is designated as nonattainment for ozone (marginal), and unclassified or attainment for $PM_{2.5}$, PM_{10}, carbon monoxide, nitrogen dioxide, and sulfur dioxide under the federal air quality standards. Under the state air quality standards, Mariposa County is designated as nonattainment for ozone; attainment for nitrogen dioxide and sulfur dioxide; and unclassified for $PM_{2.5}$, PM_{10}, and carbon monoxide. Similar to Tuolumne County, U.S. EPA has determined that the greatest contribution to the ozone violations is "overwhelming transport" from the San Joaquin Valley.[169] Like the Tuolumne County Air Pollution Control District, the Mariposa County Air Pollution Control District is relieved from preparing an attainment plan for ozone.

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[167] Ozone nonattainment areas are classified by the severity of their air quality problem based on air quality monitoring data, with classifications ranging from "Marginal" to "Extreme." U.S. EPA (United States Environmental Protection Agency), 40 CFR part 51, *https://www.govinfo.gov/content/pkg/FR-2018-12-06/pdf/2018-25424.pdf*, accessed May 2019.

[168] CAPCOA (California Air Pollution Control Officers' Association), California's Progress toward Clean Air, 2015, *https://www.co.shasta.ca.us/docs/libraries/resource-management-docs/aq-docs/progress_report_2015.pdf?sfvrsn=ca23ee89_2*, accessed September 2018.

[169] U.S. EPA (United States Environmental Protection Agency), Technical Support Document for 2008 Ozone NAAQS Designations: Technical Analysis for Mariposa County, 2017, *https://19january2017snapshot.epa.gov/www3/region9/air/ozone/pdf/R9_CA_Mariposa_FINAL.pdf*, accessed September 2018.

Significance Thresholds

The Tuolumne County Air Pollution Control District most recently developed air quality thresholds of significance in 1993 and issued a minor amendment to these thresholds in 2001 as part of its CEQA Guidelines.[170] The Mariposa County Air Pollution Control District has established CEQA thresholds based on that air district's Rule 419, Nonattainment Pollutant Air Quality Analysis; and Rule 420, Exemptions to Rule 419.[171] The proposed project is evaluated using both the Tuolumne County Air Pollution Control District and Mariposa County Air Pollution Control District thresholds of significance.

In general, the Mountain Counties Air Basin experiences low concentrations of most pollutants when compared to federal or state standards. By its very nature, regional air pollution is largely a cumulative impact, in that no single project is sufficient in size by itself to result in nonattainment of air quality standards. Instead, a project's individual emissions contribute to existing cumulative air quality impacts. If a project's contribution to cumulative air quality impacts is considerable, then the project's impact on air quality would be considered significant.

The proposed project would emit regional criteria air pollutants during the construction and operational phases of the project. The Tuolumne County Air Pollution Control District thresholds of significance applicable to construction and operations are 1,000 pounds per day or 100 tons per year of reactive organic gases, nitrogen oxides, carbon monoxide, and PM_{10}.[172] The Mariposa County Air Pollution Control District thresholds of significance applicable to this project are 100 tons per year of nitrogen oxides, carbon monoxide, and PM_{10}.[173] Projects that would result in criteria air pollutant emissions below these significance thresholds would not violate an air quality standard, contribute substantially to an air quality violation, or result in a cumulatively considerable net increase in criteria air pollutants in the Mountain Counties Air Basin. Because regional air quality standards have been established for these criteria pollutants to protect the public with a margin of safety from adverse health impacts due to exposure to criteria air pollutants, these significance thresholds can also be used to assess project emissions and inform the proposed project's impacts to regional air quality and health risk from criteria pollutants under CEQA.

Tuolumne County Air Pollution Control District and Mariposa County Air Pollution Control District have not adopted thresholds of significance to evaluate localized health risk and hazard impacts from toxic air contaminants. Therefore, the thresholds of significance for local community risk and hazard impacts were based on the Bay Area Air Quality Management District thresholds.[174] As denoted in the Bay Area Air Quality Management District's CEQA Air Quality Guidelines, if emissions of toxic air contaminants or $PM_{2.5}$ would cause an excess cancer risk level of more than 10 in one million or an incremental increase of greater than 0.3 microgram per cubic meter annual average $PM_{2.5}$, the proposed project would result in a significant impact to sensitive receptors.

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[170] TCAPCD (Tuolumne County Air Pollution Control District), CEQA Thresholds of Significance, 2001, *https://www.tuolumnecounty.ca.gov/DocumentCenter/View/1072/TCAPCD_Significance_Thresholds__2_?bidId=*, accessed September 2018.

[171] Mariposa County, General Plan Air Quality, 2005, *http://www.mariposacounty.org/DocumentCenter/View/59902*, accessed September 2018.

[172] TCAPCD (Tuolumne County Air Pollution Control District), CEQA Thresholds of Significance, 2001, *https://www.tuolumnecounty.ca.gov/DocumentCenter/View/1072/TCAPCD_Significance_Thresholds__2_?bidId=*, accessed September 2018.

[173] Mariposa County, General Plan Air Quality, 2005, *http://www.mariposacounty.org/DocumentCenter/View/59902*, accessed September 2018.

[174] Bay Area Air Quality Management District, California Environmental Quality Act Air Quality Guidelines, 2017, *http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf?la=en*, accessed March 2019.

Approach to Analysis

Total construction emissions were estimated for the proposed project using emission factors from the California Air Resources Board's OFFROAD 2017[175] and EMFAC 2017[176] inventory models. Construction emissions from the operation of diesel-fueled off-road equipment were estimated by multiplying total days of construction by the equipment-specific emissions factors, based on aggregate model years and horsepower provided in OFFROAD 2017. Emissions from on-road motor vehicles were estimated using vehicle trips, vehicle miles traveled, and EMFAC 2017 mobile source emission factors. The emission factors represent the fleet-wide average emission factors in Tuolumne County. Fugitive dust emissions were estimated using the U.S. EPA Compilation of Air Pollutant Factors (AP-42) and are based on material loading, vehicle miles traveled, and earthwork quantities. Additional details are provided in Appendix B.

Construction of the project is expected to begin in 2020 and to last approximately seven years in total. Construction activities would not be continuous through the entire project schedule. Some activities would occur during the initial phases of the project to prepare for subsequent phases, such as tree removal, roadway improvements, and preparation of staging areas; and some activities would only be conducted during planned shutdowns during winter months, such as internal tunnel repairs and invert[177] paving. To present emissions associated with construction activities for comparison to the Tuolumne County Air Pollution Control District's maximum daily thresholds, four maximum daily emissions scenarios were evaluated based on the anticipated construction schedule. The construction activities where the schedule identifies concurrent or overlapping work include (1) construction activities associated with the Adit 5/6, Adit 8/9, and Priest Reservoir components; (2) construction activities associated with the Early Intake and South Fork components; and (3) construction activities associated with the South Fork and Second Garrote components. In addition, to present the worst-case maximum daily emissions, each scenario assumes that the maximum daily emissions of the construction activities at each component occurs concurrently (i.e., regardless of shutdown versus nonshutdown periods). The fourth scenario only includes the emissions associated with repaving of the western branch of Rickson Road that is anticipated to occur at the end of the project construction period (i.e., in the seventh year). Construction equipment use was based on a project-specific construction equipment list provided by the SFPUC's design engineers.[178] To compare the proposed project's emissions to the annual thresholds adopted by Mariposa County Air Pollution Control District and Tuolumne County Air Pollution Control District, this analysis also presents annual emissions for each year of construction.

The analysis includes emissions associated with vehicle trips for construction worker commutes consistent with the maximum number of laborers per project component, as shown in Section A, Project Description, Table A-2. Based on prior construction projects for the SFPUC in the vicinity, the analysis assumed that the construction workforce would consist of approximately 80 percent local workers (shorter vehicle trips), with 20 percent of the workforce driving longer distances. In addition, the construction emissions analysis relied on project-specific earthwork quantities, haul trips, and material delivery trips (see Tables A-6, A-7, A-8,

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[175] OFFROAD2017 is a California Air Resources Board's emissions inventory database for off-road diesel engines, used to quantify the amount of pollutants from thousands of engines in equipment used in industrial applications, agriculture, construction, mining, oil drilling, power generation, and many other industries. OFFROAD2017 was used to generate emission factors for the different types of equipment anticipated to be used by the project.

[176] EMFAC2017 is California Air Resources Board's database of on-road vehicle activity data (e.g., emissions rates, vehicle population, vehicle miles traveled, etc.) for different regions throughout California (e.g., at the air basin, air district, county, or statewide level). Emission factors were developed using EMFAC2017 to generate emissions rates (in grams per mile) for Tuolumne County. EMFAC2017 has not been approved by U.S. EPA; however, it is the latest model of EMFAC released by the California Air Resources Board.

[177] The invert is the floor or bottom of the tunnel.

[178] MJA, 2019. Construction equipment spreadsheet.

and A-9 in Section A, Project Description). The analysis assumed that tree removal would take place before construction activities commence at a given site. As described in Section A.6.2, Construction Staging, equipment and removal methods associated with tree removal would depend on vegetation removal needs, operational feasibility, safety, and cost efficiency. The analysis therefore considered the maximum emissions potentially generated by two options for tree removal: removal and hauling of large logs; and removal, chipping, and hauling away of chipped materials. The SFPUC's preferred method is to cut the trees and leave them at the staging areas for collection by the public and by SFPUC workers for their personal use. To present worst-case emissions for tree removal, the emission estimates assumed that trees would be removed and hauled as large logs to the Cal Sierra Earth Resource Facility, approximately 30 miles from the project site. However, if trees are instead chipped, fewer truck trips would be necessary, and emissions would likely be less than shown in Table E.7-1. Similarly, if trees are placed at the staging areas instead of the Cal Sierra Earth Resource Facility, haul truck trip lengths would be shorter, and emissions would be less than shown in Table E.7-1. In addition, the emission estimates include emissions associated with the controlled detonations that would be required for construction of both surface and underground components, as denoted in Table A-5 in Section A, Project Description. Emissions associated with controlled detonations were based on U.S. EPA AP-42 Fugitive Dust and Explosives Detonation Emission Factors.[179]

The SFPUC has developed standard construction measures to be included in all construction contracts. Standard Construction Measure 2 (see Section A.6.11) contains specific provisions for protection of air quality, including the implementation of best management practices. These best management practices include controls to minimize vehicle tracking of dirt onto public roads and watering exposed areas for dust control as needed to help minimize fugitive dust emissions. Additional construction assumptions and details are available in Appendix B.

Impact AQ-1. The project's construction activities would generate fugitive dust and criteria air pollutants, but would not violate an air quality standard, contribute substantially to an existing or projected air quality violation, or result in a cumulatively considerable net increase in criteria air pollutants. (Less than Significant)

Construction

Construction activities for the project would generate temporary emissions of reactive organic gases, nitrogen oxides, carbon monoxide, sulfur oxides, PM_{10}, and $PM_{2.5}$. Reactive organic gases, nitrogen oxides, and carbon monoxide emissions are associated primarily with mobile equipment exhaust, including off-road construction equipment and on-road motor vehicles. Fugitive dust emissions (PM_{10} and $PM_{2.5}$) are associated primarily with ground disturbance and fill removal and vary as a function of parameters such as soil silt content, soil moisture, wind speed, acreage of disturbance area, and miles traveled by construction vehicles. Emissions would vary day to day, depending on the level of activity; the specific type of construction activity occurring; and, for fugitive dust, prevailing weather conditions.

Table E.7-1 presents the maximum daily emissions associated with construction of the project for the different project components and the three potential overlapping periods of construction activities and repaving of the western side of Rickson Road, for comparison with Tuolumne County Air Pollution Control District's daily thresholds of significance. Table E.7-2 presents average annual emissions associated with construction of the project for the different project components and total annual emissions, for comparison with Tuolumne County Air Pollution Control District's and Mariposa County Air Pollution Control District's annual thresholds of significance.

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[179] U.S. EPA, Explosives Detonation, 1980, *https://www3.epa.gov/ttn/chief/ap42/ch13/index.html*, accessed March 2019.

Table E.7-1
Maximum Daily Construction-Related Emissions

Project Component Work Area	ROG (lbs/day)	NO_X (lbs/day)	CO (lbs/day)	PM_{10} [1] (lbs/day)	$PM_{2.5}$ [1] (lbs/day)
Tree Removal	5.24	70.57	40.04	297.41	26.65
Early Intake	11.03	114.18	88.82	5.73	4.82
South Fork	17.47	194.86	159.04	20.86	14.17
Big Creek	13.12	130.39	78.45	6.37	5.63
Adit 5/6	20.88	225.95	136.11	298.05	38.45
Adit 8/9	17.73	190.92	126.45	273.89	34.94
Second Garrote	21.74	217.92	123.20	45.67	18.88
Priest Reservoir Area	25.62	393.52	571.70	26.98	18.55
Rickson Road Improvements (West)	4.22	37.79	23.37	1.67	1.40
Maximum Daily Emissions – Scenario 1 [2]	**64.23**	**810.39**	**834.25**	**869.35**	**100.03**
Maximum Daily Emissions – Scenario 2 [3]	**28.51**	**309.04**	**247.85**	**26.59**	**18.99**
Maximum Daily Emissions – Scenario 3 [4]	**39.21**	**412.48**	**282.24**	**66.53**	**33.06**
Maximum Daily Emissions – Scenario 4 [5]	**4.22**	**37.79**	**23.37**	**1.67**	**1.40**
TCAPCD Threshold of Significance (lbs/day)[6]	1,000	1,000	1,000	1,000	N/A[7]
Significant Impact?	No	No	No	No	No

Source: Modeled by AECOM in 2019. See Appendix B for additional details.

Notes:

1 The calculations to derive project construction emissions for particulate matter did not assume watering the construction sites; however, watering is a typical best management practice used by the SFPUC on its construction projects to suppress fugitive dust and would further reduce the less-than-significant impact for particulate matter.

2 Maximum Daily Emissions – Scenario 1 presents the maximum daily emissions associated with the potential overlap of activities at Adit 5/6, Adit 8/9, and Priest Reservoir.

3 Maximum Daily Emissions – Scenario 2 presents the maximum daily emissions associated with the potential overlap of activities at Early Intake and South Fork.

4 Maximum Daily Emissions – Scenario 3 presents the maximum daily emissions associated with the potential overlap of activities at South Fork and Second Garrote.

5 Maximum Daily Emissions – Scenario 4 presents the maximum daily emissions associated with repaving of the western branch of Rickson Road at the end of the project construction period. It is also anticipated that the western branch of Rickson Road would have limited, periodic repairs, as needed, during the six years of construction, concurrent with construction at the other project components. It is estimated that construction equipment and trucks for the repairs would be minor and occur intermittently, and would not result in exceedances of the emissions presented in the table.

6 Maximum daily emission thresholds are presented only for the Tuolumne County Air Pollution Control District; Mariposa County Air Pollution Control District does not have maximum daily emission thresholds, but does have thresholds in tons per year, which are presented in Table E.7-2.

7 $PM_{2.5}$ is designated as Unclassified/Attainment in Tuolumne County. For this reason, the Tuolumne County Air Pollution Control District has not developed a threshold for $PM_{2.5}$.

CO = carbon monoxide
lbs/day = pounds per day
N/A = not applicable, a threshold has not been established
NO_X = nitrogen oxides
PM_{10} = suspended particulate matter
$PM_{2.5}$ = fine particulate matter
ROG = reactive organic gases
TCAPCD = Tuolumne County Air Pollution Control District

Table E.7-2
Annual Construction Emissions

Project Component Work Area	Year of Activity[1]	ROG (tons/year)	NO_X (tons/year)	CO (tons/year)	PM_{10} [2] (tons/year)	$PM_{2.5}$ [2] (tons/year)
Tree Removal	Years 1 and 2	0.06	0.57	0.44	1.48	0.14
Early Intake	Year 3	0.44	4.47	3.10	0.23	0.20
South Fork	Years 3, 4, and 5	1.35	14.90	9.21	2.51	1.59
Big Creek	Years 3, 4, 5, and 6	0.65	6.37	3.90	0.31	0.28
Adit 5/6	Years 1 and 2	0.20	3.18	1.19	20.08	2.56
Adit 8/9	Years 1 and 2	0.88	10.54	5.69	17.14	2.52
Second Garrote	Years 3, 4, 5, and 6	0.96	9.42	5.65	0.98	0.56
Priest Reservoir Area	Years 1 and 2	0.29	4.47	4.66	4.59	2.46
Rickson Road Improvements (West)	Year 7	0.05	0.42	0.26	0.02	0.02
Year 1		**1.42**	**18.76**	**11.98**	**43.29**	**7.68**
Year 2		**1.42**	**18.76**	**11.98**	**43.29**	**7.68**
Year 3		**3.41**	**35.16**	**21.87**	**4.02**	**2.62**
Year 4		**2.96**	**30.69**	**18.77**	**3.79**	**2.42**
Year 5		**2.96**	**30.69**	**18.77**	**3.79**	**2.42**
Year 6		**1.62**	**15.79**	**9.55**	**1.29**	**0.84**
Year 7		**0.05**	**0.42**	**0.26**	**0.02**	**0.02**
TCAPCD Threshold of Significance (tons/year)		100	100	100	100	N/A [3]
MCAPCD Threshold of Significance (tons/year)		N/A	100	100	100	N/A [4]
Significant Impact?		No	No	No	No	No

Source: Modeled by AECOM in 2019. See Appendix B for additional details.

Notes:

1 The "Year of Activity" refers to the year(s) in which construction of each project component work area is anticipated to take place. Although construction that occurs over multiple years would not necessarily have the same emissions year by year, any overlapping activities that *could* take place within those years would be the same; therefore, maximum potential emissions were the same for each year. Accordingly, the emissions presented for each work area are stated for each individual year and are not a sum.

2 The calculations to derive project construction emissions for particulate matter did not assume watering the construction sites; however, watering is a typical best management practice used by the SFPUC on its construction projects to suppress fugitive dust and would further reduce the less-than-significant impact for particulate matter.

3 $PM_{2.5}$ is designated as Unclassified/Attainment in Tuolumne County. For this reason, the Tuolumne County Air Pollution Control District has not developed a threshold for $PM_{2.5}$.

4 $PM_{2.5}$ is designated as Unclassified/Attainment in Mariposa County. For this reason, the Mariposa County Air Pollution Control District has not developed a threshold for $PM_{2.5}$.

CO = carbon monoxide
MCAPCD = Mariposa County Air Pollution Control District
N/A = not applicable, a threshold has not been established
NO_X = nitrogen oxides
PM_{10} = suspended particulate matter
$PM_{2.5}$ = fine particulate matter
ROG = reactive organic gases
TCAPCD = Tuolumne County Air Pollution Control District; MCAPCD = Mariposa County Air Pollution Control District

As shown in Tables E.7-1 and E.7-2 above, all criteria pollutant emissions would be below the applicable significance thresholds. With respect to maximum daily emissions, the potential overlap of construction activities at Adit 5/6, Adit 8/9, and Priest Reservoir would result in the greatest amount of daily emissions, but would be below the 1,000 pounds per day used by Tuolumne County Air Pollution Control District as a threshold of significance. With respect to maximum annual emissions, the potential overlap of construction activities in Year 3 at Early Intake, South Fork, Big Creek, and Second Garrote would result in the greatest amount of annual emissions, but would be far below the 100 tons per year used by Tuolumne County Air Pollution Control District and Mariposa County Air Pollution Control District as a threshold of significance. Because emissions associated with construction would be below applicable daily and annual significance thresholds, the project would not violate applicable air quality standards, and impacts due to violations of state and federal air quality standards would be *less than significant*.

Operations

Currently, operations and maintenance for the Mountain Tunnel and related facilities are conducted on an as-needed basis. Following rehabilitation of the tunnel, operational and maintenance activities would include regular inspections, removal of debris, and repair of lining defects, on a 10- to 20-year basis. Inspections and maintenance are anticipated to occur on a daily and monthly basis for the flow control facility and on an annual, 5-year, and 40-year basis for the valves. Maintenance of the access roads would be on an as-needed basis; to remove debris that has fallen to the ground, or to repair drainage facilities if damaged. Routine inspections would be conducted by existing staff. Operational and maintenance activities associated with the project would therefore be of short duration (e.g., for daily and monthly inspections) or infrequent (e.g., an annual to 40-year basis). Because emissions associated with operations and maintenance would be minimal, and of short duration or infrequent, the project would not violate applicable air quality standards, and impacts due to violations of state and federal air quality standards would be *less than significant*.

Impact AQ-2. The project's construction activities could generate toxic air contaminants, including diesel particulate matter, but would not expose sensitive receptors to substantial pollutant concentrations. (Less than Significant with Mitigation)

As discussed above under Impact AQ-1, the majority of the project's emissions are those associated with project construction. As shown in Tables E.7-1 and E.7-2, construction activities would result in emissions of criteria air pollutants, but at levels that would not exceed the applicable thresholds of significance. The thresholds of significance were designed to identify those projects that would result in significant levels of air pollution and to assist the region in attaining the applicable state and federal ambient air quality standards, which were established using health-based criteria to protect the public with a margin of safety from adverse health impacts resulting from exposure to air pollution. The construction-related criteria air pollutant emissions associated with the proposed project would not expose sensitive receptors to substantial pollutant concentrations.

In addition to criteria air pollutants, construction of the proposed project would generate toxic air contaminant emissions. The greatest potential for toxic air contaminant emissions would be related to diesel particulate matter emissions associated with operation of heavy-duty construction equipment. The Office of Environmental Health Hazard Assessment developed a Guidance Manual for the Preparation of

Health Risk Assessments.[180] According to Office of Environmental Health Hazard Assessment methodology, health effects from carcinogenic toxic air contaminants are usually described in terms of individual cancer risk, which is based on a 30-year lifetime exposure, beginning in the last trimester of pregnancy and progresses through the exposure duration.

Some members of the population are especially sensitive to air pollutant emissions and are given special consideration when projects' air quality impacts are evaluated. These groups include children, older adults, and persons with preexisting respiratory or cardiovascular illness. Sensitive receptors include residences, schools, child care centers, long-term health care facilities, rehabilitation centers, convalescent centers, and retirement homes. Sensitive receptors exist at varying locations along the project alignment. Consistent with guidance from San Francisco Environmental Planning and Bay Area Air Quality Management District 2017 CEQA Guidelines,[181] the health risk and hazard impacts of construction emissions have been evaluated for their effects on existing offsite sensitive receptors within 1,000 feet of project construction areas.[182] The project components with sensitive receptors within the 1,000-foot boundary are the Big Creek and Second Garrote areas; primary construction activities at these locations would involve injecting grout to repair the interior lining of the Mountain Tunnel. Given the low number of sensitive receptors at each site and some residential dwelling units existing just beyond the 1,000-foot boundary, additional surrounding sensitive receptors were included in the modeling. The Big Creek construction area is surrounded by several dwellings, with the nearest sensitive receptor approximately 120 feet from the proposed construction site boundary. At the Second Garrote construction area, there are five residential dwellings within or just beyond the 1,000-foot boundary, with the nearest sensitive receptor approximately 690 feet from the construction site boundary. The remaining project construction areas do not have sensitive receptors within 1,000 feet of the construction boundaries; therefore, a quantitative health risk assessment is not necessary for the other project components. Studies by Zhu et al. (2002)[183] have found that concentrations of particulate matter tend to be reduced substantially at a distance 1,000 feet from emission sources (e.g., freeways or large distribution centers). Because the surrounding sensitive receptors at the other project components are farther than 1,000 feet from the construction areas, it can be reasonably assumed that the health risk impacts at those receptors would be less than the effects analyzed for Big Creek and Second Garrote.

The American Meteorological Society/U.S. EPA Regulatory Model (AERMOD) dispersion model (Version 18081) was used to estimate pollutant concentrations at specific distances from project emission sources, using hourly meteorological data from the Buck Meadows meteorological station. The meteorological data required for input to AERMOD was generated using U.S. EPA regulatory-approved models such as AERMET (18081)[184] and AERSURFACE (Version 13016).[185]

Emissions from off-road construction equipment, excavation, and grading were assumed to cover the footprint of the proposed project construction sites at Big Creek and Second Garrote. The health risk analysis also included emissions associated with the generator that would be used during construction at

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180 Office of Environmental Health Hazard Assessment, Hot Spots Guidance Manual, 2015, *https://oehha.ca.gov/air/crnr/notice-adoption-air-toxics-hot-spots-program-guidance-manual-preparation-health-risk-0*, accessed September 2018.

181 Bay Area Air Quality Management District, California Environmental Quality Act Air Quality Guidelines, 2017, *http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf?la=en*, accessed March 2019.

182 AECOM, Mountain Tunnel Improvements Project Health Risk Assessment, 2019.

183 Zhu, Y., et al. Study of Ultra-Fine Particles Near A Major Highway With Heavy-Duty Diesel Traffic, Atmospheric Environment. 2002, 36:4323-4335.

184 AERMET is a meteorological data preprocessor for AERMOD.

185 AERSURFACE is used to estimate the surface characteristics for input to AERMET.

Big Creek and Second Garrote. The California Air Resources Board created the HARP2 software to assist in the development of emissions inventories, dispersion modeling, and risk assessment. For this project, HARP2 was used solely to estimate cancer risk via HARP2's Air Dispersion Modeling and Risk Tool, Version 19044. This tool was developed to encompass the exposure factors and guidance of the 2015 Office of Environmental Health Hazard Assessment Health Risk Assessment.[186]

On-road emissions from construction-worker vehicles, haul trucks, material delivery trucks, and onsite work trucks traveling to and from the project site were modeled as adjacent emission sources at the anticipated travel paths and routes. Pre-construction and grouting activities are anticipated to last up to 100 days total per outage and only occur in the winter season during the months of November, December, January, and February. The generator was assumed to operate for 24 hours a day; the analysis incorporated conservative assumptions for the equipment and onsite activities, recognizing the limited availability of time to perform tunnel lining repairs at Big Creek and Second Garrote. The analysis also considered that the proposed work would occur during tunnel shutdowns and require nighttime construction activities. As described in Section A.6.3, Construction Equipment and Controlled Detonation (see "Shaft, Adit, and Portal Excavation Equipment"), the generators would be sited to avoid impacts to nearby residences: at Big Creek, the generator would be in Staging Area BC-S2, at least 170 feet from the water tank; at Second Garrote, the generator would be in Staging Area SF-S1 at least 100 feet from the water tank. In addition, construction would occur on both paved and unpaved surfaces and vehicle travel is anticipated to occur on paved and unpaved roadways; therefore, fugitive dust is included as part of the health risk analysis.

Table E.7-3 presents the results of the annual average $PM_{2.5}$ concentration associated with construction activities at the Big Creek and Second Garrote areas.

Table E.7-3
Unmitigated Modeled Annual Average $PM_{2.5}$ Concentration at the Maximally Exposed Individual Receptor

Terrain	X (UTM)	Y (UTM)	Maximum $PM_{2.5}$ Concentration Resulting from Proposed Project (μg/m³)	Significance Threshold (μg/m³)	Exceed Threshold?
Big Creek					
Flat	751,130.26	4,190,419.27	0.46	0.3	Yes
Second Garrote					
Flat	746,770.86	4,189,763.85	0.11	0.3	No

Source: Compiled by AECOM in 2019.

Notes:

$\mu g/m^3$ = micrograms per cubic meter
$PM_{2.5}$ = fine particulate matter
Terrain = elevation taken from National Elevation Dataset
UTM = Universal Transverse Mercator

[186] U.S. EPA, Explosives Detonation, 1980, *https://www3.epa.gov/ttn/chief/ap42/ch13/index.html*, accessed March 2019.

As shown in Table E.7-3, construction activities at Second Garrote would not exceed the threshold of annual average $PM_{2.5}$; however, construction activities at Big Creek would exceed the annual average $PM_{2.5}$ threshold of 0.3 microgram per cubic meter.

In addition to estimating the annual average $PM_{2.5}$ concentrations at the maximally exposed individual receptors at Big Creek and Second Garrote, AECOM, on behalf of the San Francisco Planning Department, also calculated the excess cancer risks to existing offsite receptors assuming exposure during the entire construction period. Table E.7-4 presents the excess cancer risk at the existing offsite residential receptors. As shown in Table E.7-4, construction activities at Second Garrote would not exceed the threshold of significance; however, construction activities at Big Creek would exceed the excess cancer risk threshold of 10 in a million.

Table E.7-4
Maximum Uncontrolled Excess Cancer Risk at Existing Offsite Residential Receptors

Proposed Project Site	Excess Cancer Risk (in a million)[3]	Significance Threshold (excess cancer risks in a million)	Exceed Threshold?
Big Creek[1]	20.5	10	Yes
Second Garrote[2]	2.8	10	No

Source: Compiled by AECOM in 2019.

Notes:

[1] Receptor location: X (UTM) = 751,130.26, Y (UTM) = 4,190,419.27.
[2] Receptor location: X (UTM) = 746,770.86, Y (UTM) = 4,189,763.85.
[3] Values rounded to nearest tenth.

UTM = Universal Transverse Mercator

Because construction activities at Big Creek would exceed the significance thresholds for annual average $PM_{2.5}$ and excess cancer risk, the impact to sensitive receptors would be potentially significant; implementation of **Mitigation Measure M-AQ-2, Minimize Off-Road Construction Equipment Emissions at the Big Creek Shaft Area**, would be required to reduce annual $PM_{2.5}$ concentrations and cancer risk. As shown in Tables E.7-5 and E.7-6 below, these impacts would be *less than significant with mitigation*. Standard watering of construction areas (see Section A.6.11) would help minimize emissions that would otherwise occur during the construction period.

Mitigation Measure M-AQ-2: Minimize Off-Road Construction Equipment Emissions at the Big Creek Shaft Area

For construction activities at Big Creek, the SFPUC shall require in its contract specifications that the compressor trailer have an engine that meets either U.S. EPA or California Air Resources Board Tier 4 Final off-road emission standards.

Tables E.7-5 and E.7-6 show the annual average $PM_{2.5}$ concentration and excess cancer risk, respectively, associated with construction activities with implementation of Mitigation Measure M-AQ-2 at Big Creek.

Table E.7-5
Mitigated Modeled Annual Average $PM_{2.5}$ Concentration at the Maximally Exposed Individual Receptor

Terrain	X (UTM)	Y (UTM)	Maximum $PM_{2.5}$ Concentration Resulting from Proposed Project (μg/m³)	Significance Threshold	Exceed Threshold?
Big Creek					
Flat	751,130.26	4,190,419.27	0.22	0.3	No

Source: Compiled by AECOM in 2019.

Notes:

μg/m³ = micrograms per cubic meter
$PM_{2.5}$ = fine particulate matter
Terrain Elevated = elevation taken from National Elevation Dataset
UTM = Universal Transverse Mercator

Table E.7-6
Mitigated Modeled Excess Cancer Risk at Existing Offsite Residential Receptors

Proposed Project Site	Excess Cancer Risk (in a million)[3]	Significance Threshold	Exceed Threshold?
Big Creek[1]	8.49	10	No

Source: Compiled by AECOM in 2019.

Notes:

[1] Receptor location: X (UTM) = 751,130.26, Y (UTM) = 4,190,419.27.
[2] Values rounded to nearest tenth.

As shown in Tables E.7-5 and E.7-6, implementation of **Mitigation Measure M-AQ-2** would reduce impacts to sensitive receptors at Big Creek to below the significance thresholds.

Operation of the project would involve infrequent maintenance activities of short duration that are expected to occur on a daily to 40-year basis. It is anticipated that routine inspections and/or daily maintenance activities would be conducted by existing staff and would not require the extensive use of off-road equipment. Due to the short duration and/or infrequent basis of maintenance activities, operational activities are not anticipated to expose sensitive receptors to substantial pollutant concentrations beyond existing conditions, and this impact would be *less than significant*.

Impact AQ-3. The project would not conflict with or obstruct implementation of the applicable air quality plan. (Less than Significant)

Tuolumne County Air Pollution Control District

Although the Tuolumne County Air Pollution Control District is not required to prepare an air quality attainment plan to achieve the federal attainment standards, the district was mandated to submit a State Implementation Plan to the U.S. EPA to meet the state air quality standards. The State Implementation Plan submitted to the U.S. EPA consists of the district's rules and regulations that were adopted to meet the state emissions requirements. The project would be required to adhere to all of the district's rules for all activities that occur within the Tuolumne County Air Pollution Control District's jurisdiction, including but not limited to the following Tuolumne County Air Pollution Control District Rules:

Rule 202 – Visible Emissions; Rule 205 – Nuisance; Rule 207 – Particulate Matter; Rule 211 – Process Weight Per Hour/Atmospheric Discharge; and Rule 422 – Architectural Coatings.

Because the SFPUC and its contractor(s) would adhere to the above rules, as stipulated in the SFPUC's Standard Construction Measure 2 (Air Quality), which requires that all projects outside the City of San Francisco comply with applicable local and state dust control regulations, the project would not conflict with the implementation of the Tuolumne County Air Pollution Control District air quality plan, and impacts would be *less than significant*.

Mariposa County Air Pollution Control District

Although the Mariposa County Air Pollution Control District is not required to prepare an air quality attainment plan to achieve the federal attainment standards, the district was mandated to submit a State Implementation Plan to the U.S. EPA to meet the state air quality standards. The State Implementation Plan submitted to the U.S. EPA consists of the district's rules and regulations that were adopted to meet the state emissions requirements. The project would be required to adhere to all of the district's rules for all activities that occur within the district's jurisdiction, including but not limited to the following Mariposa County Air Pollution Control District Rules: Rule 202 – Visible Emissions; Rule 205 – Nuisance; Rule 207 – Particulate Matter; and Rule 211 – Process Weight Per Hour/Atmospheric Discharge.

Because the SFPUC and its contractor(s) would adhere to the above rules, as stipulated in the SFPUC's Standard Construction Measure 2 (Air Quality), which requires that all projects outside of the City of San Francisco comply with applicable local and state dust control regulations, the project would not conflict with the implementation of the Mariposa County Air Pollution Control District air quality plan, and impacts would be *less than significant*.

Impact AQ-4. The project would not create objectionable odors affecting a substantial number of people. (Less than Significant)

The occurrence and severity of odor impacts depends on factors including the nature, frequency, and intensity of the source, and the sensitivity of nearby receptors. Typical odor sources of concern include wastewater treatment plants, sanitary landfills, transfer stations, composting facilities, petroleum refineries, asphalt batch plants, chemical manufacturing facilities, fiberglass manufacturing facilities, automobile body shops, rendering plants, and coffee roasting facilities. The project would not include these types of facilities or operations and, as described under Impact AQ-2, there are relatively few receptors near the project improvement, construction, and staging areas.

Potential sources that may emit odors during construction activities include the application of coatings such as concrete pavement, paints, and solvents, and emissions from diesel equipment. However, because of the number and types of equipment, the temporary nature of these emissions, and the highly diffusive properties of diesel exhaust, nearby receptors would not be affected by odors associated with project construction. Additionally, construction-related odors would not persist upon project completion. Due to the temporary nature of construction and the fact the project would not create a significant source of new odors, the project would not result in objectionable odors affecting a substantial amount of people. Therefore, project odor impacts would be *less than significant*.

Impact C-AQ. The project, in combination with reasonably foreseeable future development in the project area, would not result in a significant cumulative air quality impact. (Less than Significant)

By its very nature, regional air pollution is largely a cumulative impact. Past, present, and future development projects contribute to the region's adverse air quality impacts on a cumulative basis. No single project is sufficient in size by itself to result in nonattainment of ambient air quality standards.

Instead, a project's individual emissions contribute to existing cumulatively significant adverse air quality impacts.

In developing thresholds of significance for air pollutants, Tuolumne County Air Pollution Control District and Mariposa County Air Pollution Control District considered the emission levels for which a project's individual emissions would be cumulatively considerable. As discussed above under Impact AQ-1, the project would result in the generation of criteria air pollutant emissions, but at levels that do not exceed any of the Tuolumne County Air Pollution Control District or Mariposa County Air Pollution Control District thresholds. If a project exceeds the identified significance thresholds, its emissions would be cumulatively considerable, resulting in significant adverse air quality impacts to the region's existing air quality conditions. Because the proposed project would not exceed the identified significance thresholds, the project would not result in a cumulatively considerable contribution to regional air quality impacts.

Similarly, construction activities associated with the proposed project would have a cumulatively considerable impact to sensitive receptors if the aggregate total of foreseeable future sources within a 1,000-foot radius from the fence line of a source plus the contribution from the project would exceed the recommended thresholds of significance identified for cumulative impacts in the Bay Area Air Quality Management District CEQA guidelines.[187] Only one of the cumulative projects listed in Table B-1 would be within 1,000 feet of either the Big Creek or Second Garrote construction areas. The SFPUC Reliable Power Project involves vegetation management along the transmission line right-of-way and culvert repairs/replacements along the access roads to the transmission line. Although there is no specific time frame identified in the project's final mitigated negative declaration,[188] vegetation management would be ongoing over the 50-mile corridor, of which a portion passes through the proposed project staging areas at Big Creek (BC-S2) and Second Garrote (SG-S1). The timing of vegetation control treatments is at the discretion of the SFPUC right-of-way manager, and activities to promote compatible vegetation structure (such as shrubs and grasses) would be part of ongoing implementation of the SFPUC's Integrated Management Policy. Big Creek Shaft Road and Second Garrote Shaft Road both provide access to the transmission line and may be targeted for culvert repairs/replacement. The corridor includes more than 1,000 culvert crossings of transmission line access roads. The SFPUC anticipates performing approximately 12 replacements per year, and the duration of the construction would generally take one to three days to complete. It is conceivable that vegetation management, culvert repairs/replacement, and proposed project construction at Big Creek and Second Garrote could occur concurrently and result in cumulative health or cancer risk impacts. However, because the activities associated with the Reliable Power Project are of very short duration (i.e., no more than three days) and the SFPUC can adjust the schedule for Reliable Power Project implementation, there would be no cumulative health or cancer risk impacts.

[187] Bay Area Air Quality Management District, California Environmental Quality Act Air Quality Guidelines, *http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf?la=en*, accessed March 2019.

[188] San Francisco Planning Department, SFPUC Reliable Power Project Mitigated Negative Declaration, March 21, 2019. Case No.: 2016-006868ENV.

E.8 Greenhouse Gas Emissions

Topics:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Not Applicable
8. GREENHOUSE GAS EMISSIONS					
Would the project:					
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☐	☒	☐	☐
b) Conflict with any applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☒	☐	☐

Greenhouse gas (GHG) emissions and global climate change are cumulative impacts. GHG emissions cumulatively contribute to the significant adverse environmental impacts of global climate change. No single project could generate enough GHG emissions to noticeably change the global average temperature; instead, the combination of GHG emissions from past, present, and future projects have contributed to and will contribute to global climate change and its associated environmental impacts.

The following analysis of the proposed project's impact on climate change focuses on the project's contribution to cumulatively significant GHG emissions. Given that the analysis is in a cumulative context, this section does not include an individual project-specific impact analysis or significance statement.

Impact C-GG-1. The project would not generate greenhouse gas emissions, either directly or indirectly, at levels that would result in a significant impact on the environment. (Less than Significant)

Construction-related GHG emissions associated with the project would be generated by sources such as off-road diesel equipment, employee travel, and material-delivery truck trips. Total construction-related GHG emissions were estimated using the same methodology discussed earlier in Section E.7, Air Quality, Impact AQ-1.

The Tuolumne County Air Pollution Control District and the Mariposa County Air Pollution Control District have not adopted quantitative thresholds of significance for construction-related GHG emissions. To establish additional context in which to consider the project's GHG emissions, this analysis reviewed guidelines used by other experts and public agencies. The Sacramento Metropolitan Air Quality Management District has adopted a significance threshold for GHG emissions of 1,100 metric tons of carbon dioxide equivalents (CO_2e) per year that applies to construction and operational emissions.[189] The Bay Area Air Quality Management District has adopted a significance threshold for GHG emissions of 1,100 metric tons of CO_2e per year that applies to operational emissions; the Bay Area Air Quality Management District does not have a significance threshold for GHG emissions from construction.[190] The Sacramento Metropolitan Air Quality Management District recommends that construction emissions be

[189] SMAQMD (Sacramento Metropolitan Air Quality Management District), Greenhouse Gas Emissions, 2018, *http://www.airquality.org/LandUseTransportation/Documents/Ch6GHGFinal5-2018.pdf*, accessed September 2018.

[190] Bay Area Air Quality Management District, California Environmental Quality Act Air Quality Guidelines, 2017, *http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf?la=en*, accessed March 2, 2019.

amortized over the lifetime of the project. These significance thresholds were developed to assess the consistency of a project's emissions with the statewide framework for reducing GHG emissions. As described above in Section A.2, Project Purpose, the purpose of the project is to implement tunnel improvements to provide a minimum service life of 100 years. Accordingly, construction-related emissions amortized over 100 years were compared to the Sacramento Metropolitan Air Quality Management District's threshold of 1,100 metric tons of CO_2e per year. It is not the intent of the San Francisco Planning Department to adopt this threshold for this or other projects, but rather to provide this additional information to put the project-generated GHG emissions in the appropriate statewide context.

Total GHG emissions associated with construction of the project were estimated to be 10,495 metric tons of CO_2e (see Appendix B). Construction emissions amortized over the assumed lifetime of the project (i.e., 100 years) would be approximately 105 metric tons of CO_2e per year. Because these amortized GHG emissions are considerably less than the Sacramento Metropolitan Air Quality Management District's annual threshold of 1,100 metric tons of CO_2e, project impacts related to GHG emissions from construction would be *less than significant*.

Operation of the project would generate GHG emissions associated with operational and maintenance activities. Currently, operations and maintenance are conducted on an as-needed basis, except for daily and monthly routine inspections of SFPUC assets in the Priest Portal area. Following rehabilitation of the tunnel, operational and maintenance activities would include regular inspections, removal of debris, repair of lining defects, and maintenance along access roadways on a 10- to 20-year basis. As described in Section A.7.3, the flow control facility in the Priest Portal area would be inspected daily. Maintenance of the flow control facility would occur on a monthly, annual, 5-year, and 40-year basis. Routine inspections would be conducted by existing staff. Maintenance activities associated with the project would therefore be infrequent, occurring on a monthly annual to 40-year basis. Therefore, emissions associated with operations and maintenance would be minimal, infrequent, and similar to existing conditions. Therefore, impacts related to GHG emissions from operations would be *less than significant*.

Impact C-GG-2. The project would not conflict with any applicable plan, policy, or regulation adopted for the purpose of reducing greenhouse gas emissions. (Less than Significant)

In December 2008, the California Air Resources Board adopted the Climate Change Scoping Plan, which contains the main strategies California will implement to achieve the required GHG reductions required by Assembly Bill 32.[191] The California Air Resources Board approved the first update to the scoping plan, "First Update to the Climate Change Scoping Plan: Building on the Framework," in June 2014.[192] The scoping plan update includes a status of the 2008 Scoping Plan measures and other federal, state, and local efforts to reduce GHG emissions in California, as well as potential actions to further reduce GHG emissions by 2020. In response to Senate Bill 32 and the companion legislation of Assembly Bill 197, the California Air Resources Board approved the "Final Proposed 2017 Scoping Plan Update: The Strategy for Achieving California's 2030 GHG Target" in November 2017.[193] The 2017 Scoping Plan draws from the previous plans to present strategies to reach California's 2030 GHG reduction target. None of these

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191 ARB (California Air Resources Board), Climate Change Scoping Plan, 2008, *https://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf*, accessed September 2018.

192 ARB (California Air Resources Board), First Update to the Climate Change Scoping Plan: Building on the Framework, Pursuant to AB 32, the California Global Warming Solutions Act of 2006, 2014, *https://www.arb.ca.gov/cc/scopingplan/2013_update/first_update_climate_change_scoping_plan.pdf*, accessed September 2018.

193 ARB (California Air Resources Board), California's 2017 Climate Change Scoping Plan, 2017, *https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf*, accessed September 2018.

statewide plans or policies constitutes a regulation to adopt or implement a regional or local plan for reduction or mitigation of GHG emissions. Although the scoping plan updates include measures that would indirectly address GHG emissions levels associated with construction activity, including the phasing in of cleaner technology for diesel engine fleets and the development of a low carbon fuel standard, implementation of these measures will predominantly depend on the development of future laws and policies at the state level, rather than separate actions by individual agencies or local governments. Therefore, it is assumed that any requirements formulated under the mandate of Assembly Bill 32 and Senate Bill 32 that are applicable to construction-related activities, either directly or indirectly, would be implemented during construction of the project if those policies and laws are developed before the commencement of project construction. Therefore, it is assumed that project construction would not conflict with the scoping plan updates.

Tuolumne County has not adopted plans for the purpose of reducing GHG emissions. In 2015, Mariposa County adopted its Energy Action Plan. The Mariposa County Energy Action Plan serves as a roadmap for expanding energy-efficiency, water-efficiency, and renewable-energy efforts in the county. The Mariposa County Energy Action Plan does not include any specific GHG emission reduction requirements for construction activities that would be directly applicable to the project.

In 2004, the SFPUC and the San Francisco Department of Environment published the Climate Action Plan for San Francisco. The climate action plan outlines citywide actions to reduce GHG emissions in the energy, transportation, and solid waste sectors. In 2008, the San Francisco Board of Supervisors established citywide GHG reduction limits through Ordinance 0081-08 and required each city department to annually report GHG emissions and climate protection initiatives. SFPUC's most recent departmental climate action report was published in March 2014 for the 2012-2013 fiscal year. The SFPUC Climate Action Report summarizes the GHG emissions associated with electricity, natural gas, and fleet fuels consumed by SFPUC operations, and highlights SFPUC's activities to reduce GHG emissions. Section 3b, Water, of the SFPUC Climate Action Report identifies Water Efficiency and Conservation as a GHG Emissions and Reduction Strategy.[194] In July 2017, the San Francisco Planning Department released a GHG Reduction Strategy Update to the policies, plans, and codes that San Francisco and the Planning Department have implemented to assist in achieving the city's ambitious climate action goals of the 2004 Climate Action Plan and 2010 and 2013 GHG Reduction Strategy.[195] The 2017 GHG Reduction Strategy Update is organized around six sectors of emissions: energy use in buildings; transportation and land use; zero waste; water efficiency; municipal operations; and ecological sustainability and conservation. Implementation action categories in the water efficiency sector include increasing local and sustainable sources of water, and reducing consumption and increasing efficiency through fixture and system upgrades. One of the primary objectives of the project is to provide SFPUC with flexibility to respond to operational factors related to water conservation, water supply, and power generation. The project would provide a means for SFPUC to improve water efficiency and reduce associated indirect GHG emissions. Furthermore, SFPUC has an aggressive alternative fuel program; its goal is for 90 percent of all new purchases for nonemergency vehicles to be made up of alternative fuel or high-efficiency vehicles, and to convert existing diesel vehicles for out-of-city divisions.[196] Additionally, the 2017 GHG Reduction

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[194] SFPUC (San Francisco Public Utilities Commission), Departmental Climate Action Plan: Annual Report, Fiscal Year 2012-2013, March 18, 2014, *https://sfwater.org/modules/showdocument.aspx?documentid=4138*, accessed September 2018.

[195] San Francisco Planning Department, Greenhouse Gas Reduction Strategy Update, July 2017, *http://sfmea.sfplanning.org/GHG/GHG_Strategy_October2017.pdf*, accessed May 2019.

[196] SFPUC (San Francisco Public Utilities Commission), Departmental Climate Action Plan: Annual Report, Fiscal Year 2012-2013, March 18, 2014, *https://sfwater.org/modules/showdocument.aspx?documentid=4138*. accessed September 2018.

Strategy Update included a Compliance Checklist Table for GHG Analysis for new public and private development projects. Most of the strategies are not relevant for the proposed project, because it is not a new building or building addition in the city and involves the construction and operation of water tunnel-related facilities.[197] Nevertheless, the proposed project would implement several strategies (e.g., preparation of a Construction and Demolition Debris Management Plan to demonstrate how targets in the city's Construction and Demolition Ordinance could be satisfied) and would not conflict with the regulations and requirements applicable to municipal projects.

Based on the preceding assessment, the project would not conflict with the scoping plan updates, the county's Climate Action Plan, Ordinance 0081-08, or the SFPUC's GHG Emissions and Reduction Strategy. As discussed earlier under Impact C-GG-1, the project would not generate GHG emissions that would have a significant impact on the environment. The project would not conflict with any applicable plan, policy, or regulation for the purpose of reducing GHG emissions. The project would result in *less-than-significant* project-specific and cumulative impacts with respect to GHG emissions.

[197] SFPUC, San Francisco Planning Department Compliance Checklist Table for Greenhouse Gas Analysis: Table 2, Municipal Projects, 2019.

E.9 Wind and Shadow

Topics:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Not Applicable
9. WIND AND SHADOW					
Would the project:					
a) Alter wind in a manner that substantially affects public areas?	☐	☐	☐	☒	☐
b) Create new shadow in a manner that substantially affects outdoor recreation facilities or other public areas?	☐	☐	☐	☒	☐

Impact WS-1. The project would not alter wind in a manner that substantially affects public areas. (No Impact)

A project's wind impacts are directly related to its height, orientation, design, location, and surrounding development. Projects that alter localized wind patterns may negatively affect the public's use and enjoyment of outdoor recreation facilities or other public areas. There are no outdoor recreation facilities at any of the proposed project improvement, construction, or staging areas, except Staging Area EI-S1 at the Preston Falls Trailhead parking area. General staging activities at this site would be limited to paved areas and would serve multiple purposes, including but not limited to parking, staging for small equipment, and temporary storage for materials. These activities would not alter wind patterns or speeds in the area and therefore would not affect the Preston Falls Trail.

There are public trails and public facilities near some of the proposed staging areas and road improvement locations. The proposed project would not substantially alter the wind at these public and outdoor recreational areas, because construction at the nearby staging areas and road improvement locations would involve only the temporary use or occupation by construction equipment, grout plants, or water treatment facilities that would be at ground level and would be of a scale, mass, and height that would not change wind directions or speeds. Therefore, construction activities at these locations would not have a potential to affect wind patterns.

Most project components would be located underground or at ground level, such as the proposed internal tunnel improvements, the South Fork Siphon Extension, and road and drainage improvements along the access roads to tunnel adits and shafts. The only proposed aboveground project features are the flow control facility building (30 feet tall), the spoil disposal area (up to about 40 feet above the base of the disposal area), new power poles (approximately 40 feet tall), and appurtenant features such as fencing or generators less than 8 feet tall, all in the Priest Reservoir area, which is not publicly accessible for public or outdoor uses. Due to their relatively low height, the small footprint of the flow control facility building and the power poles and lines, and the contoured slopes of the disposal area, these permanent improvements would not substantially alter wind patterns or affect public areas. For these reasons, the project would have *no impact* on wind in public areas.

Impact WS-2. The project would not create new shadow in a manner that substantially affects outdoor recreation facilities or other public areas. (No Impact)

As described above under Impact WS-1, Staging Area EI-S1 is the only project construction or staging area at an outdoor recreation facility, the Preston Falls Trailhead parking area. General staging activities at this location would include parking, staging small equipment, and temporary materials storage. None of these staging activities would create new shadow and would not affect the Preston Falls Trail. There are public trails and associated parking areas near some of the staging areas and road improvement locations. However, because no permanent structures would be constructed as a result of road improvements or staging activities, these staging activities would have no shadow impacts.

The proposed improvements in the Priest Reservoir area (i.e., the flow control facility building, the spoil disposal area, the power line and poles, and appurtenant features) would not create significant new shadow, due to their size, limited footprints, and location (away from any outdoor recreation or other public areas). For these reasons, the project would have *no impact* on shadow in public areas.

Impact C-WS. The project, in combination with reasonably foreseeable future projects in the vicinity, would not result in a significant cumulative wind or shadow impact. (No Impact)

Because the proposed project would have no wind or shadow impacts, it would not combine with other cumulative projects listed in Table B-1 to cause cumulative impacts. Therefore, the project would not result in cumulative impacts related to wind or shadow.

E.10 Recreation

Topics:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Not Applicable
10. RECREATION					
Would the project:					
a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facilities would occur or be accelerated?	☐	☐	☐	☒	☐
b) Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?	☐	☐	☐	☒	☐

This impact analysis discusses the proposed project's potential to increase the use of existing recreational facilities such that substantial physical deterioration of the facilities would occur or be accelerated, or to include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment. Temporary disruptions to recreationists in the project vicinity do not, in and of themselves, indicate a significant physical environmental effect within the meaning of CEQA. The potential impacts pertaining to recreationists would be considered a socioeconomic issue rather than an effect on the physical environment, and therefore do not fall under the CEQA checklist criteria for recreation. However, due to public interest related to recreation in the project vicinity, the project's potential effects on recreationists are discussed at the end of this section.

Impact RE-1. The proposed project would not increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facilities would occur or be accelerated. (No Impact)

The proposed project is a water infrastructure capital improvement project that would not draw people to the area or increase the use of existing recreational facilities.

On any given day during the duration of construction, approximately 30 to 115 construction workers would be working onsite. As described in Section E.3, Population and Housing (under Impact PH-1), it is anticipated that the regional labor force would meet the construction workforce demand for this project. The project does not propose the construction of housing or other features that would result in an increase in the use of existing recreational facilities. Once the Mountain Tunnel has been rehabilitated, the SFPUC would not need to hire new permanent employees to operate or maintain the tunnel. Therefore, the proposed project would not cause an increase in the use of existing parks or other recreational facilities such that substantial physical deterioration of the facilities would occur. For these reasons, the project would have *no impact* on increasing the use of recreation facilities.

Impact RE-2. The proposed project would not require the construction of new recreational facilities, or the expansion of existing recreational facilities, that may have an adverse physical effect on the environment. (No Impact)

As discussed under Section E.3, Population and Housing (under Impact PH-1), the project would not induce growth. The proposed project would not create the need for new recreational facilities during construction or operations or increase demand on the existing parks and recreational facilities in the area.

The project would have *no impact* related to the construction of new recreational facilities or the expansion of existing facilities.

Impact C-RE. The proposed project, in combination with reasonably foreseeable future projects in the vicinity of the project sites, would not result in a significant cumulative impact related to recreation. (No Impact)

Because the proposed project would not increase the use of existing recreational facilities nor would it require the construction or expansion of recreational facilities, the proposed project would not combine with other cumulative projects listed in Table B-1 to cause cumulative impacts. Therefore, the project would not result in, nor contribute to, significant cumulative impacts related to recreation.

Additional Discussion Provided for Informational Purposes

Pursuant to CEQA, a proposed project would have a significant effect on recreational resources if it would:

- increase the use of existing neighborhood and regional parks or other recreational facilities in such a way that substantial physical deterioration of the facility would occur or be accelerated, or
- include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment.

As described above, the proposed project would not increase the use of existing recreational facilities, would not include recreational facilities, and would not require the construction or expansion of recreational facilities. The Upper Tuolumne River is well known and visited for its recreational opportunities, including whitewater rafting. Although temporary disruptions to recreationists in the project vicinity do not, in and of themselves, indicate a significant physical environmental effect within the meaning of CEQA, in light of demonstrated interest in these recreational opportunities from the public and local stakeholders, a discussion of the potential effects on recreationists from project construction and operation is provided below. This information is provided solely for informational purposes and is not used to determine the significance of the environmental impacts of the project under CEQA.

Project Construction

There are 15 staging areas (ranging from 0.1 to 1.1 acres each) that would be located on U.S. Forest Service-owned land in the Stanislaus National Forest. Most of these staging areas are existing sections of road or parking areas that have been used for other SFPUC or Caltrans projects. The portion of the Stanislaus National Forest in the project vicinity along Highway 120 provides year-round access to the Central Sierra Nevada Mountains. In this area, there are many recreational facilities, including areas to hike, mountain bike, camp, boat, raft, fish, and picnic.

Access to recreational features in the vicinity of the project area would be temporarily disrupted during construction of the project, specifically for users of the Preston Falls trailhead, individual kayakers, rafting companies that access the launch for the Tuolumne River from Forest Service Road 1N10/ Lumsden Road, anglers who access Tuolumne River from Forest Service Road 1N10/Lumsden Road, and recreationists at Rainbow Pool on the South Fork of the Tuolumne River.

Although the Preston Falls trail would remain open throughout the construction duration, project construction would temporarily affect availability of public parking spaces near the trailhead when the SFPUC would use EI-S1 as a staging area. At EI-S1, a few parking spaces would be kept open for public use to ensure that access to the Preston Falls trail is maintained.

One mountain biking route on national forest system lands—the Buck Meadows, Lumsden Bridge, and Tuolumne River Trail—would be temporarily closed due to construction for proposed road improvements on the Adit 5/6 and Adit 8/9 access roads. Construction-related disruptions to the use of the Buck Meadows, Lumsden Bridge, and Tuolumne River Trail would be temporary. Additionally, given the number of recreational resources in the area, there are many other mountain bike routes and trails that recreationists could use while access to this route is temporarily disrupted.

As described in Section A.6.4, Site Access, the Adit 8/9 Access Road improvements would require the periodic closure of Forest Service Road 1N10/Lumsden Road. To minimize impacts on public use of this road during the construction period, the SFPUC coordinated with the U.S. Forest Service to determine a road closure arrangement that would be acceptable to complete the required construction activities while allowing the U.S. Forest Service permittees to use the road during peak recreation periods. This closure schedule would provide access for a portion of the day for recreationists on weekdays and every weekend during the primary rafting season (May 1 through Labor Day) and would include full closure outside of the primary rafting season in the first and second years of construction. There would be a temporary increase in traffic along Forest Service Road 1N10/Lumsden Road during the construction period; this would not restrict recreationists' access during non-road closure periods.

Recreationists at Rainbow Pool may experience a temporary increase in traffic during the construction period as well as periodic traffic delays. As detailed in Section A.6.4, Site Access, construction access to the South Fork area would occur following the normal one-way flow of traffic from Highway 120 past Rainbow Pool along Old Big Oak Flat Road, or against the flow of traffic for an approximately 300-foot segment of Old Big Oak Flat Road between Forest Service Road 1S28B/South Fork Access Road and Staging Areas SF-S3 and SF-S4. Traffic control (e.g., flaggers, cones, and signage) would be implemented near the Old Big Oak Flat Road/South Fork Access Road intersection and at the end of the one-way road south of the staging areas (SF-S3 and SF-S4) during Rainbow Pool open season (April 15 through December 15), to reduce conflicts with recreationists and non-construction-related vehicles. Large equipment deliveries would be completed prior to 8 a.m. to avoid peak recreational use hours. Over holiday weekends between April 15 and October 31, SFPUC would restrict work and avoid these days, including the Friday before if the holiday falls on a Monday.

To further minimize impacts to recreationists on both Forest Service Road 1N10/Lumsden Road and in the Rainbow Pool area, SFPUC would provide advance notice of construction activities so that the U.S. Forest Service could post notices on its website to alert recreationists of upcoming construction work in the area.

In addition to the abovementioned recreational destinations that have vehicular access, recreationists who hike or bicycle along Forest Service Road 1S28B/South Fork Access Road and Forest Service Road 1S01/Adit 5/6 Access Road would experience restrictions during construction for public safety, as described in Section A.6.3, Construction Equipment and Controlled Detonation, and Section A.6.4, Site Access.

Project Operation

The commercial and recreational whitewater season on the Upper Tuolumne River is typically from March through October for the Tuolumne (Meral's Pool to Ward's Ferry) and for the Cherry Creek section. For one- to three-day trips, the Tuolumne is accessed at Meral's Pool, from Forest Service Road 1N10/Lumsden Road, 18 miles down to Ward's Ferry take-out where the river flows into Don Pedro Reservoir. For one-day trips, the Cherry Creek section is accessed just below Holm Powerhouse from Cherry Lake Road but above the confluence with the Kirkwood Reach of the Tuolumne River, 9 miles to the Lumsden Road take-out at Meral's pool. Recommended river levels for the Tuolumne are 600 cubic feet per second to 10,000 cubic feet per second; and for the Cherry Creek section, 600 cubic feet per second to 2,000 cubic feet per second.[198] Releases from Holm Powerhouse into Cherry Creek provide whitewater recreational users with river flows during the summer months after the snowmelt runoff season; the proposed project would have no effect on releases from Holm. Whitewater recreation users rely primarily on Holm Powerhouse flows when running the two sections of the Tuolumne River; flows from Kirkwood Powerhouse augment the flow from Holm Powerhouse below the confluence with Cherry Creek but are not sufficient to support whitewater recreation in the absence of flows from Holm Powerhouse. The Kirkwood Reach is not used for whitewater recreation, because this stretch of the Tuolumne River typically has flows too low for safe river running and river access.

As described under Impact HY-1 in Section E.15, Hydrology, under certain operating conditions the proposed project would result in reduction of Tuolumne River flows of up to 8 cubic feet per second between Kirkwood Powerhouse and Don Pedro Reservoir. The potential effects of flow changes on the whitewater recreation experience on the two river whitewater sections described above were analyzed by reviewing data outputs from the Hetch Hetchy Local Simulation Model (refer to Section E.15, Hydrology). The potential 8-cubic-foot-per-second reduction in Tuolumne River flows below the Cherry Creek confluence would represent less than half a percent change in flows for the two recreational whitewater sections throughout the whitewater season.[199] The maximum decrease of 8 cubic feet per second in flow would primarily occur during snowmelt runoff months (May and June), when river flows are also the highest (more than 4,000 cubic feet per second), and the decrease resulting from the project would be negligible in terms of flow rates and likely undetectable by recreationists;[200] these effects would not require the construction of new or expansion of existing recreational facilities. Furthermore, Holm Powerhouse operations for recreational releases and required releases from Lake Eleanor, Cherry Reservoir, or Hetch Hetchy Reservoir would not change due to the project.

The restoration of Mountain Tunnel hydraulic capacity would have limited effects on flows in the Upper Tuolumne River, a popular destination for recreational fishing. The effect on fish due to changes in river flows, particularly trout, is discussed in Section E.13, Biological Resources.

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[198] Cassidy, Cross, Calhoun, *Western Whitewater from the Rockies to the Pacific*, Tuolumne River: pp. 344-351, 1994.

[199] SFPUC and San Francisco Planning Department, Environmental Planning Division, Mountain Tunnel Improvements Project: Operational Flow Effects on the Tuolumne River Environment, prepared by AECOM, 2019.

[200] SFPUC and San Francisco Planning Department, Environmental Planning Division, Mountain Tunnel Improvements Project: Operational Flow Effects on the Tuolumne River Environment, prepared by AECOM, 2019.

E.11 Utilities and Service Systems

Topics:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Not Applicable
11. UTILITIES AND SERVICE SYSTEMS					
Would the project:					
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☒	☐
b) 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?	☐	☐	☐	☒	☐
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☐	☒
d) Have sufficient water supply available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☐	☐	☒
e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has inadequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☒	☐	☐
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☒	☐	☐
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☒	☐	☐

The drainage improvements included as part of the proposed project are intended to convey stormwater runoff away from Mountain Tunnel facilities (e.g., the adits and shafts) or to collect and dispose of stormwater in a manner that reduces the potential for soil erosion and slope instability (e.g., the water bars that would be installed along segments of the access roads to Mountain Tunnel). These drainage facilities and improvements are not part of a larger utility-managed stormwater network and would not contribute to the construction of new or expanded stormwater management system facilities. The purpose of the proposed project is to make needed repairs to Mountain Tunnel so that the SFPUC can continue to reliably deliver high-quality water; the proposed project would not generate demand for a new water supply, and no new or expanded water entitlements would be needed for project operation, maintenance, or construction. Therefore, significance criteria 11(c) and 11(d) are *not applicable* to the proposed project and are not discussed further in this section.

Please refer to Impact HY-1 in Section E.15, Hydrology and Water Quality for discussion of effects related to discharge of stormwater and water discharges from construction and maintenance activities.

Impact UT-1. The proposed project would not exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board. (No Impact)

As stated in Section A, Project Description, the Mountain Tunnel has deficiencies that diminish the tunnel's ability to reliably convey water to the regional water system and that increase the difficulty of performing maintenance in the tunnel. The proposed project would address the documented deficiencies in the tunnel and ensure that the Mountain Tunnel can reliably convey water to its customers in the Sierra Foothills and the San Francisco Bay Area. The project would enable water transmission through this portion of the system to occur more efficiently and would have no effect on wastewater generation, treatment, or disposal. As described in Section E.3, Population and Housing, not all of the water in this system is delivered to the Bay Area. The volume of water that is transported to the Bay Area is limited by the capacity of the Foothill Tunnel and San Joaquin Pipeline system; additionally, water delivery to the Bay Area is constrained by the Water System Improvement Program requirements that limit annual average watershed deliveries to 265 million gallons per day.[201] The proposed project would not directly or indirectly increase the population in the project area or in the San Francisco Bay area, and therefore would not result in an increase in wastewater from induced growth. As a result, the proposed project would not affect wastewater treatment requirements of the Central Valley Regional Water Quality Control Board or the San Francisco Bay Regional Water Quality Control Board that concern sanitary sewer discharges or industrial effluent discharges, and would have *no impact* relative to exceeding wastewater treatment requirements of the Central Valley Regional Water Quality Control Board or the San Francisco Bay Regional Water Quality Control Board.

Impact UT-2. The proposed project would not require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities. (No Impact)

As described under Impact UT-1, the proposed project would not be constructed to support new growth and, as described earlier in Section E.3, Population and Housing (Impact PH-1), the proposed project would not induce new growth. As a result, the project would not create or induce a demand for new or expanded water or wastewater infrastructure.

The project would install a flow control facility at Priest Reservoir to maintain the tunnel in full flow (pressurized) conditions during normal tunnel operations. This improvement would protect the existing, aged, concrete lining from erosive effects of turbulence and surge during transitions from low flow to high flow, by maintaining the tunnel full of water. Although this facility would also provide isolation features to allow the Priest Reservoir to remain high and thus store an additional water source during long system shutdowns, including water supply to Moccasin Camp or the California Department of Fish and Wildlife Moccasin Creek Fish Hatchery operations, its primary function would be to provide operational flexibility in maintaining reliable water supply through an existing conveyance system; it would neither serve nor create an increased demand for water supply. The proposed project would not require or result in the construction of permanent new water or wastewater treatment facilities or expansion of existing facilities to serve an increased demand for these utilities. As a result, there would be *no impact* relative to this criterion.

[201] San Francisco Planning Department, Final Program Environmental Impact Report for the San Francisco Public Utilities Commission's Water System Improvement Program, October 30, 2008, accessed January 14, 2019.

Impact UT-3. The proposed project would not result in a determination by the wastewater treatment provider which serves or may serve the project that it has inadequate capacity to serve the project's projected demand in addition to the provider's existing commitments. (Less than Significant)

The project would not necessitate a new connection to permanent wastewater facilities. Groveland Community Services District is responsible for wastewater collection for approximately 1,500 nearby residents in the Groveland and Big Oak Flat communities.[202] The proposed project would not directly or indirectly result in the construction of new homes or new jobs (as described earlier in Section E.3, Population and Housing, particularly Impact PH-1) that would increase wastewater flows in the Groveland Community Services District.

During construction, portable toilet facilities would be provided at staging areas for worker use. A portion of the construction workforce, with up to approximately 115 people at any one time, can be expected to commute from greater distances and may seek temporary housing accommodations near the project site. The housing would already be served by septic systems or tied into local public wastewater treatment facilities within the planned service capacity of the Groveland Community Services District. As a result, the incremental demand during construction, given the minimal number of personnel and existing facilities, would not cause so great an increase in wastewater flows that new or expanded treatment facilities would be needed. Therefore, impacts to wastewater treatment facilities would be *less than significant*.

Impact UT-4. The proposed project would be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs. (Less than Significant)

The maximum number of laborers working concurrently on the project would range from 30 to 115. This number of laborers would not contribute a significant increase in solid waste disposal needs. Based on waste generation rates reported in in the Tuolumne County General Plan Update Environmental Impact Report, the amount of solid waste generated by employees in unincorporated Tuolumne County was approximately 16.9 pounds per day per employee.[203] Using this waste generation factor, at the peak of construction, the proposed project's construction workers would generate approximately 1,900 pounds of solid waste per day. In addition, the construction phase would contribute nonhazardous solid waste (aside from soils), such as vegetation, empty containers, packaging waste from construction materials, and miscellaneous wastes generated by workers onsite. Project-generated spoils would be used for project road improvements or disposed of at Staging Area PP-S6. Hazardous waste generated during construction would be transported and hauled in accordance with federal, state, and local regulations, as described in Section E.16, Hazards and Hazardous Materials. Maintenance activities during project operation would not involve a large staff. Nonhazardous waste materials, similar to those generated during construction, would also be generated during routine maintenance.

Project-generated solid waste would likely be hauled to the Big Oak Flat Transfer Station in Groveland or the Cal Sierra Transfer Station in Sonora, for ultimate disposal at the Highway 59 Disposal Site Landfill, which is operated by the Merced County Regional Waste Management Authority. This landfill would have adequate capacity to accommodate the solid waste disposal needs of the project. Its permitted capacity is 30.01 million cubic yards, and the most recent estimate of remaining capacity is 28.03 million

[202] Groveland Community Services District, Wastewater, 2018, *https://www.gcsd.org/wastewater*, accessed August 26, 2018.

[203] Tuolumne County, Tuolumne County Draft Recirculated EIR for the Tuolumne County General Plan Update Project, August 2018a, *https://www.tuolumnecounty.ca.gov/DocumentCenter/View/11308/Tuolumne-County-GPU-Recirculated-DEIR-full-report*, accessed October 16, 2018.

cubic yards (in 2005). It is projected to be able to operate until 2065.[204] This landfill would have adequate capacity to accommodate the solid waste disposal needs of the project. Therefore, the project's impact with respect to solid waste disposal would be *less than significant*.

Impact UT-5. The proposed project would comply with federal, state, and local statutes and regulations related to solid waste. (Less than Significant)

As stated above under Impact UT-4, the small volume of solid waste generated during project construction and maintenance would be accommodated by landfills and transfer stations. In Tuolumne County, the Environmental Health Division administers the Local Enforcement Agency program and is responsible for ensuring that solid waste is transported and disposed of in a manner that will have the least amount of impact on the environment, health, and safety.[205]

The California Integrated Waste Management Act of 1989, promulgated by Assembly Bill 939, established an integrated waste management hierarchy to guide local agencies in implementation of source reduction, recycling, composting, and environmentally safe transformation and land disposal.[206] This act established a comprehensive statewide system of permitting, inspections, enforcement, and maintenance for solid waste facilities; and standards for solid waste handling and disposal.[207] The act requires CalRecycle (formally known as the California Integrated Waste Management Board) to conduct at least one inspection per year of each solid waste facility in the state.[208] The Tuolumne County Environmental Health Division's Local Enforcement Agency also conducts inspections of landfills and transfer stations in the county. State and local program oversight would ensure that project-generated waste transported for disposal at licensed landfill and transfer stations would be handled and disposed of in compliance with federal, state, and local statutes and regulations related to solid waste. Most solid waste generation associated with the proposed project would occur during construction, and the SFPUC adheres to its sustainability principles and strategies, which include actions to divert waste from landfills such as complying with the city's Construction and Demolition Ordinance—even though this ordinance, which is part of the city's Green Building Requirements, is not applicable to the project.[209] Therefore, the project would not conflict with applicable regulations related to solid waste management, and impacts would be *less than significant*.

Impact C-UT. The proposed project, in combination with reasonably foreseeable future projects in the vicinity, would not result in a significant cumulative impact on utilities and service systems. (Less than Significant)

The scope of the cumulative impact analysis for utilities includes the service areas for the regional utility providers and regional service providers. The project would not directly or indirectly result in the construction of new homes or new jobs that would induce growth and increase demand for utilities. The

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[204] CalRecycle, SWIS Facility/Site Search, 2018a, *https://www2.calrecycle.ca.gov/swfacilities/Directory/*, accessed October 17, 2018.

[205] Tuolumne County, Solid Waste and Landfills, 2018b, *https://www.tuolumnecounty.ca.gov/249/Solid-Waste-Landfills*, accessed September 26, 2018.

[206] CalRecycle, History of California Solid Waste Law, 1985-1989, 2018b, *https://www.calrecycle.ca.gov/Laws/Legislation/CalHist/1985to1989/*, accessed September 26, 2018.

[207] CalRecycle, History of California Solid Waste Law, 1985-1989, 2018b, *https://www.calrecycle.ca.gov/Laws/Legislation/CalHist/1985to1989/*, accessed September 26, 2018.

[208] CalRecycle, History of California Solid Waste Law, 1985-1989, 2018b, *https://www.calrecycle.ca.gov/Laws/Legislation/CalHist/1985to1989/*, accessed September 26, 2018.

[209] The city's Green Building Requirements—contained in the San Francisco Environment Code, chapter 7, section 706—apply to city buildings and require city-owned facilities and leaseholds to prepare a construction and demolition debris management plan to divert waste materials from the landfill.

project would not create a long-term need for new or expanded water supply, wastewater treatment facilities, or solid waste facilities.

None of the cumulative projects listed in Table B-1 would be anticipated to add new permanent residents, housing, and/or employment to the area. Most of the cumulative projects involve either rehabilitation of existing SFPUC facilities, or vegetation and habitat management projects that would not be expected to require permanent new or expanded utility systems. As a result, there would be no long-term permanent increased demand for utilities. There could be a small increase in temporary employment and residents during the overlapping construction periods of the projects, but given the nature of the projects and the small increase in workers, there would not be a substantial new cumulative demand on regional utility providers or regional service providers.

Therefore, the proposed project, in combination with reasonably foreseeable future projects in the project vicinity, would not result in significant cumulative impacts on utilities and service systems.

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E.12 Public Services

Topics:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Not Applicable
12. PUBLIC SERVICES Would the project:					
a) Would the project 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 of the public services such as fire protection, police protection, schools, parks, or other public facilities?	☐	☐	☒	☐	☐

Impact PS-1. The project would not result in substantial adverse physical impacts associated with the provision of, or the need for, new or physically altered governmental facilities. (Less than Significant)

As described in Section E.3, Population and Housing, the proposed project would not cause a permanent increase in the local population. Therefore, there would be no need to expand governmental facilities, including schools and parks, in Tuolumne or Mariposa counties.

It is anticipated that the total personnel working concurrently at any one time during the construction duration would range between 30 and 115 workers. The potential exists for project personnel to make calls for public service assistance or response during construction; however, it is expected that the demand for such services would be limited and infrequent, given the relatively small workforce, and therefore could be accommodated by existing local service providers without the need to physically alter or expand their facilities.

During operation, there would be no need to hire additional permanent SFPUC staff; therefore, there would be no permanent increased demand on government services or facilities. Operations and maintenance would comply with the SFPUC's adopted performance standards for this project, which include a tunnel inspection every 10 years and maintenance every 20 years. Other minor maintenance activities would be conducted daily to annually. Similar to the construction phase, the potential exists for calls for public service assistance or response during maintenance; however, it is expected that the demand for such services would be limited and infrequent, and could be accommodated by existing local service providers.

Construction, operation, and maintenance of this project are not anticipated to permanently or substantially increase the demand on local fire protection, police protection, or other government services. As a result, the project would not affect the service ratios, response times, or other performance objectives for any public services, and therefore would not require the construction of new or physically altered facilities to maintain service. Consequently, there would be a *less-than-significant impact* related to the potential need for new or expanded public services facilities.

Impact C-PS. The project, in combination with reasonably foreseeable future projects in the vicinity, would not result in a significant cumulative public services impact. (Less than Significant)

The geographic scope for potential cumulative public service impacts encompasses projects in Tuolumne County, where almost the entirety of the project is located. According to the 2018 Tuolumne County General Plan Update Project, fire protection services in unincorporated Tuolumne County are provided by the Tuolumne County Fire Department, the California Department of Forestry and Fire Protection, seven fire protection districts, and the United States Department of Agriculture in the Stanislaus National Forest. The Tuolumne County Ambulance Service provides emergency and nonemergency medical transport services for Tuolumne County. The Tuolumne County Sheriff's Office provides law enforcement services to all unincorporated areas of the county and staffs the county jail; the California Highway Patrol Central Division provides additional traffic enforcement along state highways and county roadways.[210]

Cumulative development in these service areas could incrementally increase the demand for public services, if the projects listed in Table B-1 were to contribute to a permanent increase in the local population large enough to affect service ratios, response times, or other performance objectives for regional public services. As explained in Impact C-PH, workers may relocate temporarily to the communities of Groveland, Sonora, and Oakdale during the construction period for these cumulative projects. However, these increases would be temporary; and because the construction schedules for these projects are varied, the projects on the list would not all occur simultaneously. It is also expected that the operation of the projects listed in Table B-1 would predominantly be staffed by current SFPUC, U.S. Forest Service, and Caltrans employees. Therefore, the impacts of the proposed project, in combination with reasonably foreseeable projects, would not combine to result in a significant cumulative public service impact.

[210] Tuolumne County, Draft Recirculated Environmental Impact Report for the Tuolumne County General Plan Update Project, Section 3.14, Public Services, August 2018, *https://www.tuolumnecounty.ca.gov/DocumentCenter/View/11305/Section-311-to-314*. Final Environmental Impact Report certified in December 2018.

E.13 Biological Resources

Topics:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Not Applicable
13. BIOLOGICAL RESOURCES Would the project:					
a) 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?	☐	☒	☐	☐	☐
b) 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 California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☒	☐	☐	☐
c) 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?	☐	☐	☒	☐	☐
d) 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?	☐	☐	☐	☒	☐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☒	☐	☐	☐
f) 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

Baseline conditions for biological resources at each proposed project improvement, construction, and staging area are documented in the project's biological resources assessment[211] and noxious weed assessment,[212] and are summarized in this section. The project site comprises all improvement, construction, and staging areas, including cut and fill locations, new project components, and access roads planned for improvement. The project area is defined as a 0.5-mile buffer extending from the boundary of the project site. A 0.5-mile buffer was used to define the project area because it represents a conservative estimate of the outer limits[213] of where construction of the project may result in a direct or indirect impact to biological and hydrologic resources. The description of baseline biological conditions

[211] SFPUC, Biological Resources Assessment for the Mountain Tunnel Improvements Project, prepared by AECOM, 2019. The Biological Resources Assessment for the Mountain Tunnel Improvements Project is available for review at the City of San Francisco Environmental Planning Office.

[212] SFPUC, Noxious Weed Risk Assessment for the Mountain Tunnel Improvements Project, prepared by AECOM, 2019. The Noxious Weed Report is available for review at the City of San Francisco Environmental Planning Office.

[213] The farthest potential impact of the project is that related to disturbance to nesting California spotted owls from construction noise, which is commonly assessed out to 0.5 mile.

in the project site and project area was compiled through background research of available literature and data, a general biological field investigation of each project component (staging area, access road, spoils disposal area, etc.), protocol-level surveys for rare plants, a preliminary jurisdictional delineation of wetlands and waters of the United States (waters of the U.S.) (wetland delineation), and a tree inventory.

The following data sources were used to generate a list of special-status plants, special-status wildlife, and sensitive natural communities with the potential to occur in the project area:

- U.S. Fish and Wildlife Service Sacramento Field Office website:[214] official list of federal candidate, proposed, threatened, and endangered plant and wildlife species
- California Natural Diversity Database: a list of known plant occurrences, wildlife occurrences, and California Department of Fish and Wildlife-designated sensitive natural communities for the project site and a 5-mile buffer[215,216]
- California Native Plant Society Online Inventory of Rare and Endangered Plants of California[217]
- Stanislaus National Forest Sensitive Plant and Wildlife Species List[218]
- Bureau of Land Management Mother Lode Field Office list of sensitive species[219]
- Federal Register for selected species, including listing status and critical habitat
- Recovery plans for selected species to determine species' current and historical ranges
- Previous biological surveys and studies in the project vicinity provided by the SFPUC
- Opportunities and Constraints Report for the Mountain Tunnel Improvements Project[220]
- Biological Resources Assessment for the Mountain Tunnel Improvements Project[221]

Special-Status Plants

Special-status plant species were defined as those designated as one or more of the following:

- California Native Plant Society's California Rare Plant Rank of 1B, 2A, or 2B
- U.S. Forest Service sensitive species (as designated by Stanislaus National Forest)
- Bureau of Land Management sensitive species (as designated by the Mother Lode Field Office)
- Listed as or a candidate for listing as a threatened or endangered species under the federal Endangered Species Act
- Listed as or a candidate for listing as a threatened or endangered species under the California Endangered Species Act

214 U.S. Fish and Wildlife Service Sacramento Field Office, Mountain Tunnel Improvements Project: list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project, July 2018.

215 California Department of Fish and Wildlife, California Natural Diversity Database, Biogeographic Data Branch, California Department of Fish and Wildlife, Commercial Version, July 5, 2018.

216 California Department of Fish and Wildlife, California Sensitive Natural Communities List, 2018, *https://www.wildlife.ca.gov/Data/VegCAMP/Natural-Communities*, accessed July 9, 2018.

217 California Native Plant Society, Rare Plant Program. Inventory of Rare and Endangered Plants of California (online edition), 2018, *http://www.rareplants.cnps.org*, accessed July 5, 2018.

218 United States Forest Service, Stanislaus National Forest Sensitive Plant and Wildlife Species List, 2013.

219 Bureau of Land Management, Special-Status Plants under the Jurisdiction of the Mother Lode Field Office as of April 30, 2015.

220 AECOM, Opportunities and Constraints Report for the Mountain Tunnel Improvements Project, prepared for the San Francisco Public Utilities Commission, July 2017.

221 SFPUC, Biological Resources Assessment for the Mountain Tunnel Improvements Project, prepared by AECOM, 2019.

Based on these database searches, floristic surveys of the project area were conducted over the spring and summer of 2017 and 2018 by AECOM biologists on behalf of the San Francisco Planning Department. The botanical survey team performed floristic surveys during three survey replicates in the spring and summer of 2017 and 2018. Two special-status species were identified, as presented in Table E.13-1.

Table E.13-1
Special-Status Plant Species Observed in the Floristic Survey Area

Common and Scientific Name	Listing Status	General Habitat Description	Locations Observed
Mariposa clarkia *Clarkia biloba* ssp. *australis*	CRPR 1B.2 USFS:S BLM:S	Found in chaparral and foothill woodland. Elevation: 980 to 4,790 feet Blooming period: May through July	Observed at EI-S1, EI-S7, road widening points near Early Intake, EI-S3/EI-S4, South Fork access road, SF-S8, Adit 5/6 access road (Forest Route 1S01), Adit 8/9 access road (Forest Route 1N10/Lumsden Road), A8/9-S3, A8/9-S4, road-widening area along the northeastern portions of Rickson Road (Priest Reservoir).
Small's southern clarkia *Clarkia australis*	CRPR 1B.2 USFS:S BLM:S	Found in foothill woodland and yellow pine forest. Elevation: 2,625 to 6,800 feet Blooming period: May through August	Observed at the Adit 5/6 access road. This species is outside the project site, along a section of road that is not planned for improvement.

Notes:

BLM = Bureau of Land Management
CRPR = California Rare Plant Rank
USFS = United States Forest Service

Listing Status Definitions:

BLM:S Bureau of Land Management Sensitive – Mother Lode Field Office
CRPR 1B.2 Rare or Endangered in California and elsewhere – moderately threatened in California (20 to 80 percent of occurrences threatened)
USFS:S United States Forest Service Sensitive – Stanislaus National Forest

Special-Status Wildlife

Special-status wildlife species were defined as those designated as one or more of the following:

- Species listed as or proposed for listing as threatened or endangered under the federal or California Endangered Species Acts
- Species identified by the California Department of Fish and Wildlife as a California Species of Special Concern
- Animals fully protected in California under the California Fish and Game Code
- Bald and golden eagles protected by the federal Bald and Golden Eagle Protection Act
- Species that meet the definitions of rare or endangered species under CEQA Guidelines section 15380

Based on the database searches, 28 special-status wildlife species were identified and assessed for their potential to occur in the project area. The 28 species, their protection status, general habitat requirements, and potential to occur in the project area are listed in the biological resources assessment.[222]

On behalf of the San Francisco Planning Department, AECOM biologists performed reconnaissance-level habitat suitability surveys and vegetation cover surveys from March 7 through 10, 2017, and on March 28, 2017, to assess habitat potentially used by special-status wildlife species. During the surveys, vegetation communities and hydrologic features in and near the project area were mapped and characterized. Of the 28 species initially identified by the literature search, seven were determined to have a moderate potential to occur in the project area, and five were determined to have a high potential to occur in the project area, as presented in Table E.13-2.

Critical Habitat

The Federal Register was consulted for federally designated critical habitat in the project area. No designated critical habitat occurs in the vicinity of the project area.

Sensitive Natural Communities

The California Natural Diversity Database was referenced to determine whether any California Department of Fish and Wildlife-designated sensitive natural communities were previously documented in the project area.[223] One California Department of Fish and Wildlife-designated sensitive natural community—riparian scrub/forest (white alder groves)—was identified in the floristic survey area. Riparian scrub/forest is found along the Tuolumne River and South Fork Tuolumne River (at Early Intake and South Fork Crossing), as well as in Lower Rattlesnake Creek south of Priest Reservoir and west of PP-S13.

In addition to communities designated by the California Department of Fish and Wildlife, Public Resources Code section 21083.4),[224] as incorporated into the California Environmental Quality Act under section 21083.4, establishes specific protections for oak woodlands. Oak woodlands are defined, in A Manual of California Vegetation[225] and for purposes of this document, as habitat areas dominated by a tree canopy of native oak trees (genus *Quercus*) larger than 5 inches in diameter at breast height. A tree survey was conducted in the project site from April 3 to May 4, on May 18, and on June 28, 2018; during this inventory, all native oak trees (*Quercus* spp.) with a diameter at breast height of 5 inches or greater were measured and mapped with a GPS device. The dominant oak species documented in the project site include interior live oak (*Quercus wislizeni*) and canyon live oak (*Quercus chrysolepis*), with scattered blue oaks. Black oak (*Quercus kelloggii*) were observed at higher elevations, and several large valley oak (*Quercus lobata*) were observed at Second Garrote. Tree survey data are provided in Appendix E of the biological resources assessment.[226] Approximately 6.5 acres of oak woodlands are present in project areas requiring tree removal at Priest Reservoir. Dominant oak woodland communities in the project site include mixed valley oak-black oak woodlands and mixed canyon live oak-blue oak woodlands. The largest areas of oak woodland were mapped at Staging Area PP-S6 (4.6 acres), near Priest Reservoir, and along Rickson Road (1.4 acres).[227]

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[222] SFPUC, Biological Resources Assessment for the Mountain Tunnel Improvements Project, prepared by AECOM, 2019.

[223] California Department of Fish and Wildlife, California Sensitive Natural Communities List, 2018, *https://www.wildlife.ca.gov/Data/VegCAMP/Natural-Communities*, accessed July 9, 2018.

[224] California Public Resources Code, section 21083.4, 2005, *https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?sectionNum=21083.4.&lawCode=PRC*, accessed February 2019.

[225] Sawyer, J.O., T. Keeler-Wolf, and J. Evans, A Manual of California Vegetation, Second Edition, California Native Plant Society, Sacramento, California, 2009.

[226] SFPUC, Biological Resources Assessment for the Mountain Tunnel Improvements Project, prepared by AECOM, 2019.

[227] McMillen Jacobs Associates, CAD File "MT_All_Potential_Tree_Removal (2-5-19)," 2019.

Table E.13-2
Special-Status Wildlife Species with a Moderate or Higher Potential to Occur in the Project Area

Common and Scientific Name	Listing Status	Habitat Description	Potential to Occur
Foothill yellow-legged frog *Rana boylii*	SSC, Candidate for State Listing under CESA	Found in partially shaded, shallow streams with rocky substrates in woodland, chaparral, and forest. Needs some cobble-sized rocks as a substrate for egg laying. Requires water for 15 weeks for larval transformation.	Five CNDDB occurrences of this species have been recorded within 5 miles of the project site. Suitable habitat for this species occurs in the Tuolumne River at Early Intake and downstream of Kirkwood Powerhouse. A breeding population of foothill yellow-legged frogs is known to occur in the Tuolumne River approximately 1 mile upstream of Early Intake. **Moderate Potential**
Golden eagle *Aquila chrysaetos*	FP, USFS:S, BGEPA	Forages in shrub lands, grasslands, and oak woodlands. Prefers large trees or cliffs for nesting.	No CNDDB occurrences of this species are within 5 miles of the project area. Observed nest location within 0.5 mile of the project area. **High Potential**
American peregrine falcon *Falco peregrinus anatum*	FP	Occurs in woodland, forest, and coastal habitats. Nests on high cliffs near wetlands, lakes, rivers, or other water. Also found in urban areas and uses tall buildings and bridges for resting and breeding sites. Nests consist of a scrape on a depression or ledge in an open site.	One CNDDB occurrence of this species has been recorded within 5 miles of the project site. However, this occurrence is not site-specific and refers to an occurrence in a USGS quad that is within 5 miles. Suitable habitat for this species is present in rock cliffs. **Moderate Potential**

Table E.13-2
Special-Status Wildlife Species with a Moderate or Higher Potential to Occur in the Project Area (Continued)

Common and Scientific Name	Listing Status	Habitat Description	Potential to Occur
California spotted owl *Strix occidentalis occidentalis*	SSC, USFS:S, BLM:S (under review for listing under the ESA)	Breeds and roosts in forests and woodlands with large old trees and snags, dense canopies with multiple layers, and downed woody debris. Large, old trees are the key component.	A total of 404 occurrences of spotted owl are documented within 5 miles of the project site. Although the project area generally lacks dense canopy and old growth forest for nesting, the number of occurrences of this species in the project area indicates that this species has a moderate potential to fly through or forage in the project area. Due to the lack of protected activity centers or home range core areas that overlap the project area, this species is unlikely to nest in the project area.[228] **Moderate Potential**
Pallid bat *Antrozous pallidus*	SSC, USFS:S, BLM:S	Inhabits low-elevation (6,000-foot) rocky arid deserts and canyonlands, shrub-steppe grasslands, karst formations, and higher-elevation (7,000-foot) coniferous forests.	Five CNDDB occurrences of this species have been recorded within 5 miles of the project site. Suitable roosting habitat for this species is present in the project site and includes adits (access tunnels) and structures. **High Potential**
Townsend's big-eared bat *Corynorhinus townsendii*	SSC, BLM:S	Occurs throughout California in mesic habitats characterized by coniferous and deciduous forests, but also occupies a broad range of habitats. In California, it is known to occupy limestone caves, lava tubes, hollow trees or tree cavities, and human-made structures in coastal lowlands, cultivated valleys, and nearby hills covered with mixed vegetation. Most mating occurs from November to February; births occur in May and June, peaking in late May.	Seven CNDDB occurrences of this species have been recorded within 5 miles of the project site. Suitable roosting habitat for this species is present, and includes adits (access tunnels) and structures. **High Potential**

[228] All known nest sites are associated with a protected activity center, all protected activity centers are associated with a known nest site, and home range core areas are associated with most protected activity centers.

Table E.13-2
Special-Status Wildlife Species with a Moderate or Higher Potential to Occur in the Project Area (Continued)

Common and Scientific Name	Listing Status	Habitat Description	Potential to Occur
Spotted Bat *Euderma maculatum*	SSC, BLM:S	Found in the foothills, mountains, and desert of southern California. This species inhabits a wide variety of habitats, from arid deserts and grasslands through mixed conifer forest. This species can be found from sea level to 9,800 feet above mean sea level; it roosts in rock crevices, ideally in cliffs, and is occasionally found in buildings and caves.	One CNDDB occurrence of this species was recorded within 5 miles of the project site. Habitat is available for the species, and there is an extant population northeast of Early Intake in the Tuolumne River canyon at Poopenaut Valley. **Moderate Potential**
Western mastiff bat *Eumops perotis californicus*	SSC, BLM:S	Resident of low elevations in the coastal basins of California, inhabiting arid and semi-arid lowlands. It is primarily a cliff-dwelling species and is most frequently encountered in broad, open areas. The bat's foraging habitat includes dry desert washes, floodplains, chaparral, oak woodland, grassland, and agricultural areas.	Five CNDDB occurrences of this species have been recorded within 5 miles of the project site. Suitable roosting habitat for this species is present in tree crevices in coniferous forest. **High Potential**
Western red bat *Lasiurus blossevillii*	SSC	Found throughout the Central Valley and coastal California. It is associated with riparian habitats, particularly mature stands of cottonwood and sycamore, at elevations ranging from sea level to approximately 6,000 feet. It roosts primarily in trees in riparian areas that are protected from above and open below (often willows as well as cottonwoods). Breeding typically occurs from August through October, but fertilization occurs in the spring.	One CNDDB occurrence of this species has been recorded within 5 miles of the project site. Suitable roosting habitat for this species is present, and includes buildings, tree crevices, and adits. **Moderate Potential**
Long-eared myotis *Myotis evotis*	BLM:S	Inhabits predominately coniferous forest, typical only at higher elevations from 7,000 to 8,500 feet.	Two CNDDB occurrences of this species have been recorded within 5 miles of the project site. Suitable roosting habitat for this species is present and includes tree crevices in coniferous forest. **Moderate Potential**

Table E.13-2
Special-Status Wildlife Species with a Moderate or Higher Potential to Occur in the Project Area (Continued)

Common and Scientific Name	Listing Status	Habitat Description	Potential to Occur
Fringed myotis *Myotis thysanodes*	USFS:S, BLM:S	Found in a variety of habitats from sea level to 9,350 feet. Optimal habitats for this species include pinyon-juniper, valley foothill hardwood, and hardwood conifer. It roosts in caves, mines, buildings, and crevices and uses open habitats in early successional stages near streams, lakes, and ponds for foraging habitat.	Two CNDDB occurrences of this species have been recorded within 5 miles of the project site. Suitable roosting habitat for this species is present and includes crevices in hardwood conifer forest. **Moderate Potential**
Yuma myotis *Myotis yumanensis*	BLM:S	Year-round residents in riparian, agricultural, urban, mines, and scrub habitats from Canada to central Mexico. This bat is strongly associated with water.	Four CNDDB occurrences of this species have been recorded within 5 miles of the project site. Suitable roosting habitat for this species is present, and includes buildings, tree crevices, and adits. **High Potential**

Notes:

BGEPA = Bald and Golden Eagle Protection Act
BLM:S = Bureau of Land Management Sensitive
CESA = California Endangered Species Act
CNDDB = California Natural Diversity Database
ESA = federal Endangered Species Act
FP = fully protected
SSC = Species of Special Concern
USFS:S = U.S. Forest Service Sensitive – Stanislaus National Forest
USGS = United States Geological Survey

Wetlands and Waters

The National Wetlands Inventory was reviewed for potential wetlands occurring in the project area, and the National Hydrography Dataset was reviewed for drainage features and their directional flow.[229] Satellite images of the project area were also examined to identify potential wetland or water features to investigate during field surveys.

Based on the above desktop analysis, AECOM biologists conducted a preliminary jurisdictional delineation of wetlands and waters of the U.S. and waters of the state in the wetland delineation survey area from April 30 to May 4, on May 18, and on June 28, 2018. Areas suspected of being wetlands were delineated in accordance with the routine onsite methodology described in the U.S. Army Corps of Engineers Wetlands Delineation Manual; the Western Mountains, Valley, and Coast Region Supplement; and the Updated Datasheet for the Identification of the Ordinary High Water Mark in the Arid West Region of the Western United States.

Altogether, 4.50 acres of potential waters of the U.S. were identified, including 0.44 acre of potential jurisdictional wetlands (freshwater marsh and seasonal wetland), 4.00 acres of other waters of the U.S. (ephemeral drainages, intermittent drainages, perennial drainage, and reservoirs), and 0.06 acre of culverted waters of the U.S.[230] These features are displayed on Figure E.13-1. These areas of waters and wetlands in the project area were verified by the U.S. Army Corps of Engineers during a site visit on October 29 and 30, 2018.

Protected Trees

Individual, native oak trees in Tuolumne County (as separate from oak woodland habitat, discussed above) are protected from "premature removal" under the Tuolumne County Oak Tree Ordinance (Ordinance 2903).[231] This ordinance, adopted by the County Board of Supervisors on April 1, 2008, is described in Tuolumne County Ordinance Code, chapter 9.24 – Premature Removal of Oak Trees and is referred to in the Natural Resources element of the Tuolumne General Plan adopted in 2019. Chapter 9.24 of the code defines "premature removal" as: (a) removal of native oak trees resulting in a 10 percent or more (>10 percent) average decrease in native oak canopy cover in an oak woodland; (b) removal of any old growth oak trees;[232] (c) removal of any valley oak measuring 5 inches or greater in diameter at breast height.[233] Application of the terms of the ordinance is encouraged in Chapter 16: Natural Resources, of the Tuolumne General Plan, which recommends that the ordinance be applied as an implementation program to encourage the protection of native trees and other vegetation in the county.[234]

A tree inventory identified approximately 1,000 native oak trees more than 5 inches in diameter at breast height in the project area. Subsequent review of these results using aerial imagery and GIS software revealed that approximately 377 of these oak trees in the project site require removal, and that about 38 of these are in the Stanislaus National Forest.[235,236]

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229 U.S. Geological Survey, National Hydrography Dataset and Watershed Boundary Dataset, 2018, *http://nhd.usgs.gov/*, accessed June 4, 2018.

230 SFPUC, Revised Preliminary Jurisdictional Delineation of Waters of the United States for the Mountain Tunnel Improvements Project, prepared by AECOM, 2018.

231 Mariposa County does not have a similar tree ordinance.

232 Old growth oak trees are defined as native oak trees measuring 24 inches or more in diameter at breast height.

233 Tuolumne County Ordinance Code, section 9.24.030.

234 Tuolumne County, Tuolumne County General Plan, Chapter 16: Natural Resources, 2018, *https://www.tuolumnecounty.ca.gov/DocumentCenter/View/11752/Vol-I-Goals-Policies-Policies-Final*, accessed May 7, 2019.

235 SFPUC, Biological Resources Assessment for the Mountain Tunnel Improvements Project, prepared by AECOM, 2019.

236 McMillen Jacobs Associates, CAD File "MT_All_Potential_Tree_Removal (2-5-19)," 2019.

AECOM Oakland CA 3/15/2019 USER caitlin.jensen PATH L:\Projects\GIS\Projects\SFPUC_CS258\MtTunnel\02_Maps\02_Map_Production_and_Reports\Phase2\IS-MND\FigE13-1_Biological_Resource_Surveys.mxd

N

0 500

Feet

1 inch = 375 feet
1:4,500

Source:
AECOM, 2019;
NAIP Imagery, 2016

AECOM
San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project

- Clarkia biloba ssp. australis
- Project Component
- Adit
- Mountain Tunnel Alignment
- Culverted Waters of the U.S. (0.06 acre)
- Contour Line
- Staging Area
- Other Waters (4.00 acres)
- Riparian Scrub and Forest
- Clarkia biloba ssp. australis

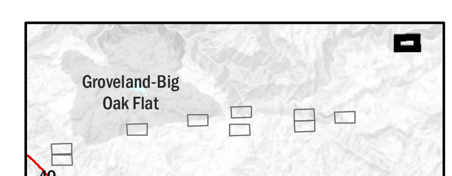
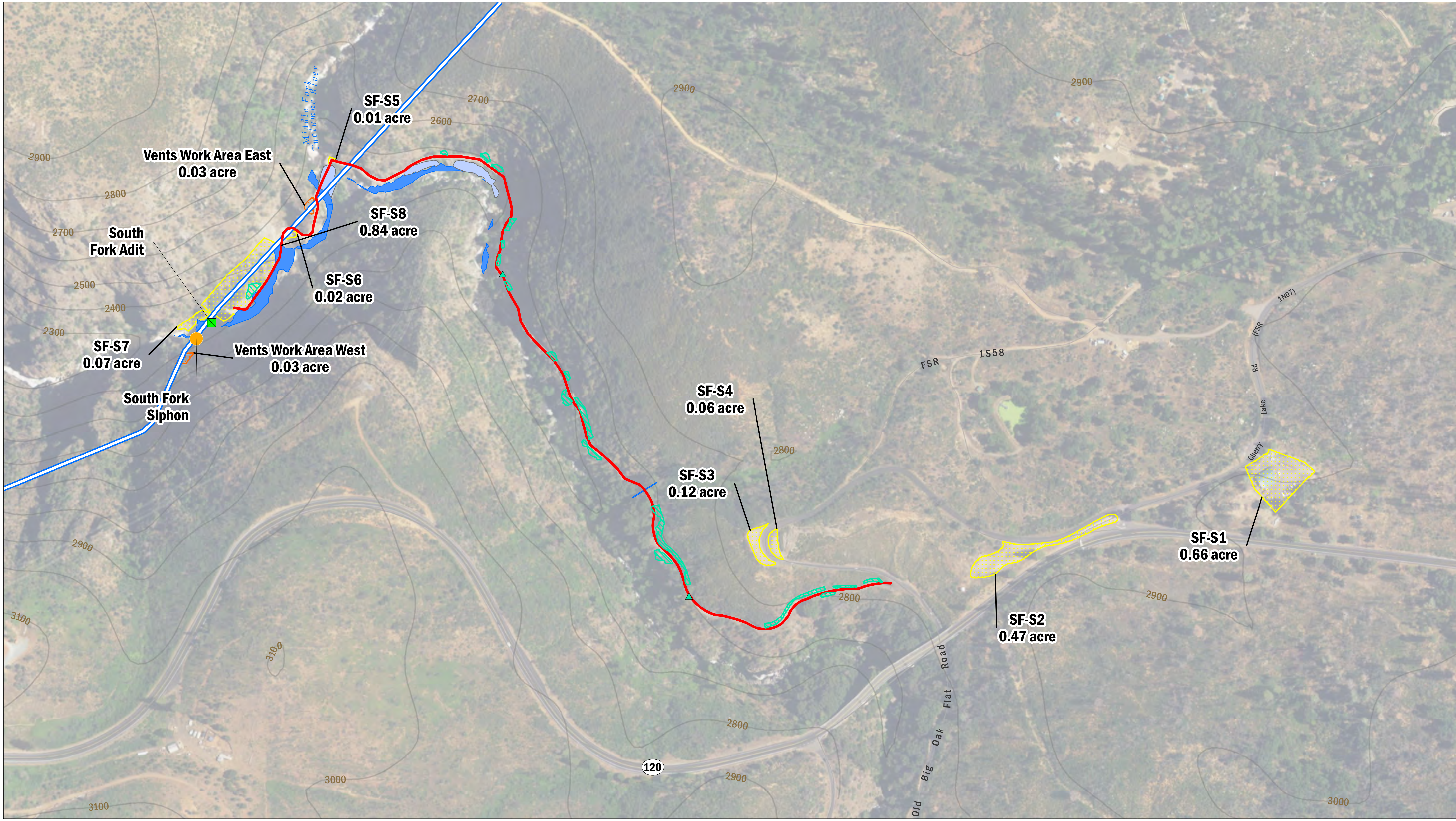


FIGURE E.13-1

Biological Resource Survey Findings

AECOM Oakland CA 3/15/2019 USER caitlin.jensen PATH L:\Projects\GIS\Projects\SFPUC_CS258\MtTunnel\02_Maps\02_Map_Production_and_Reports\Phase2\IS-MND\FigE13-1_Biological_Resource_Surveys.mxd



N

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Feet

1 inch = 333 feet

1:4,000

Source:
AECOM, 2019;
NAIP Imagery, 2016

AECOM

San Francisco Public Utilities Commission

Mountain Tunnel Improvements Project

- Clarkia biloba ssp. australis
- Project Component
- Adit
- Mountain Tunnel Alignment
- Contour Line
- Road - Proposed Modifications
- Staging Area
- Work Area
- Other Waters (4.00 acres)
- Riparian Scrub and Forest
- Clarkia biloba ssp. australis

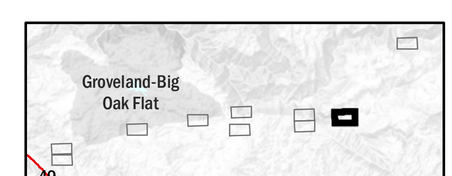

FIGURE E.13-1

Biological Resource Survey Findings

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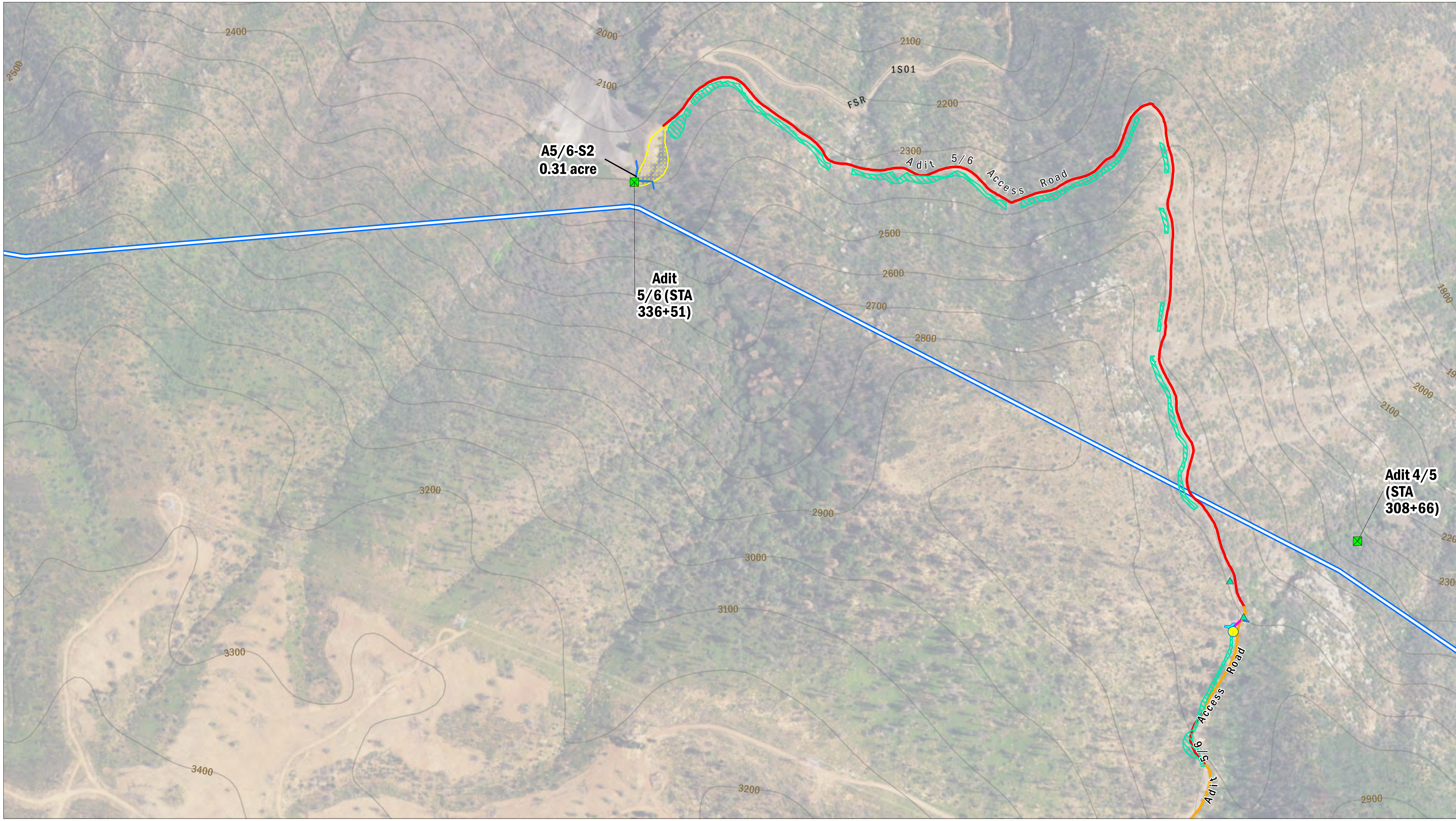
AECOM Oakland CA 3/15/2019 USER caitlin.jensen PATH L:\Projects\GIS\Projects\SFPUC_CS258\MtTunnel\02_Maps\02_Map_Production_and_Reports\Phase2\IS-MND\FigE13-1_Biological_Resource_Surveys.mxd



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Feet

1 inch = 333 feet
1:4,000

Source:
AECOM, 2019;
NAIP Imagery, 2016

AECOM
San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project

- Clarkia biloba ssp. australis
- Adit
- Proposed Culvert
- Mountain Tunnel Alignment
- Culverted Waters of the U.S. (0.06 acre)
- Contour Line
- Road - Potential Gravelling
- Road - Proposed Modifications
- Staging Area
- Other Waters (4.00 acres)
- Wetlands (0.44 acre)
- Clarkia biloba ssp. australis

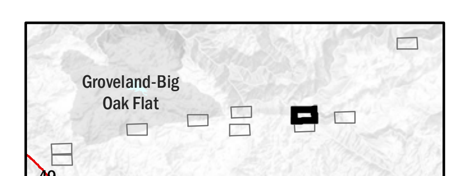

FIGURE E.13-1

Biological Resource Survey Findings

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AECOM Oakland CA 3/15/2019 USER caitlin.jensen PATH L:\Projects\GIS\Projects\SFPUC_CS258\MtTunnel\02_Maps\02_Map_Production_and_Reports\Phase2\IS-MND\FigE13-1_Biological_Resource_Surveys.mxd

1 inch = 333 feet
1:4,000

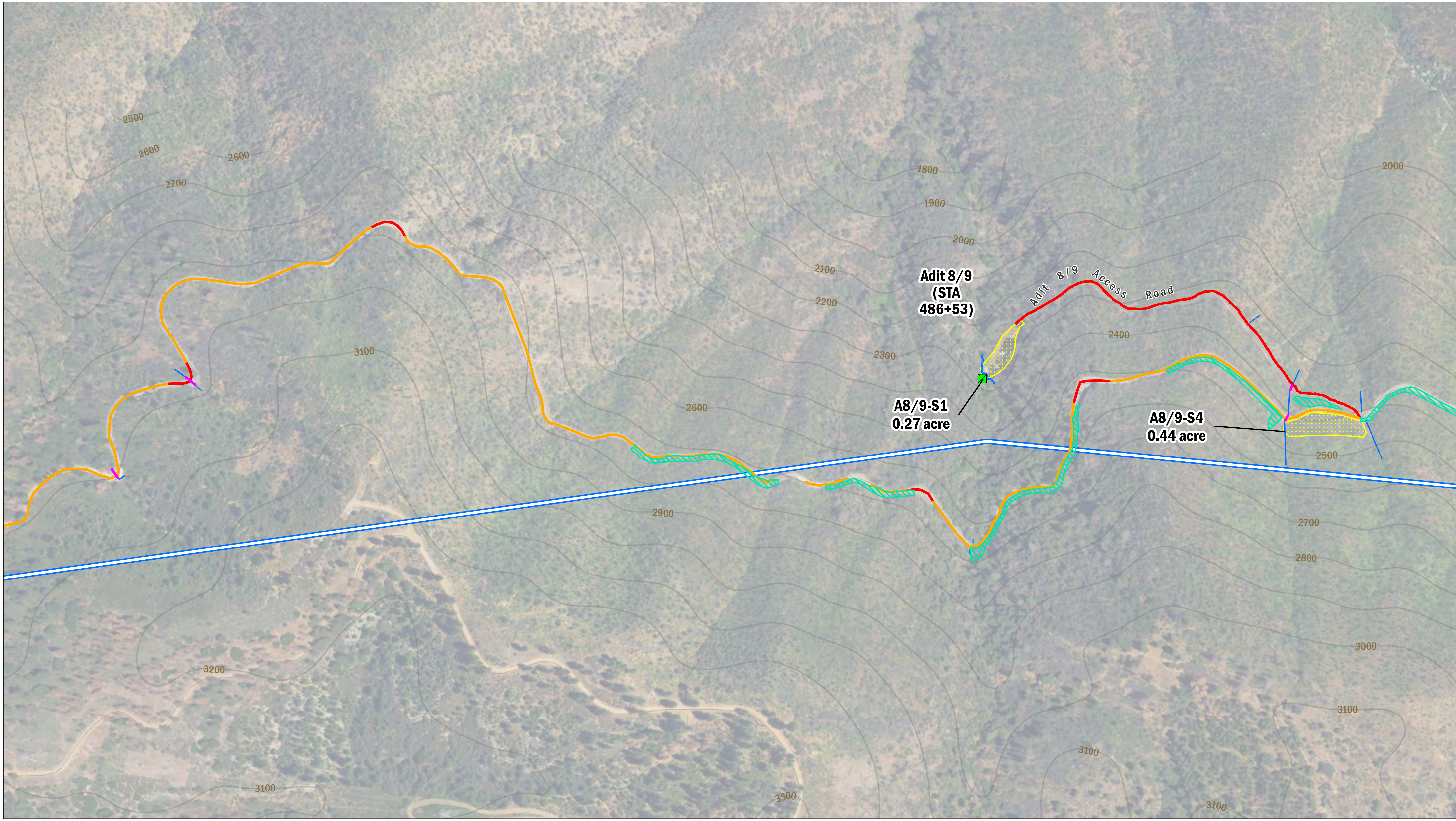
Source:
AECOM, 2019;
NAIP Imagery, 2016

AECOM
San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project

- Culverted Waters of the U.S. (0.06 acre)
- Contour Line
- Road - Potential Gravelling
- Road - Proposed Modifications
- Staging Area
- Other Waters (4.00 acres)
- Wetlands (0.44 acre)
- Clarkia australis
- Clarkia biloba ssp. australis

FIGURE E.13-1

Biological Resource Survey Findings



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Feet

1 inch = 333 feet
1:4,000

Source:
AECOM, 2019;
NAIP Imagery, 2016

AECOM
San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project

- Adit
- Mountain Tunnel Alignment
- Culverted Waters of the U.S. (0.06 acre)
- Contour Line
- Road - Potential Gravelling
- Road - Proposed Modifications
- Staging Area
- Other Waters (4.00 acres)
- Clarkia biloba ssp. australis

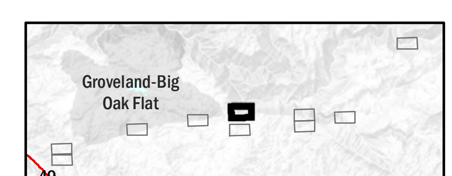

FIGURE E.13-1

Biological Resource Survey Findings

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Feet
1 inch = 333 feet
1:4,000

Source:
AECOM, 2019;
NAIP Imagery, 2016

AECOM
San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project

Contour Line
Road - Potential Gravelling
Staging Area
Other Waters (4.00 acres)
Clarkia biloba ssp. australis

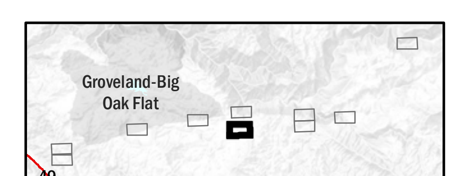
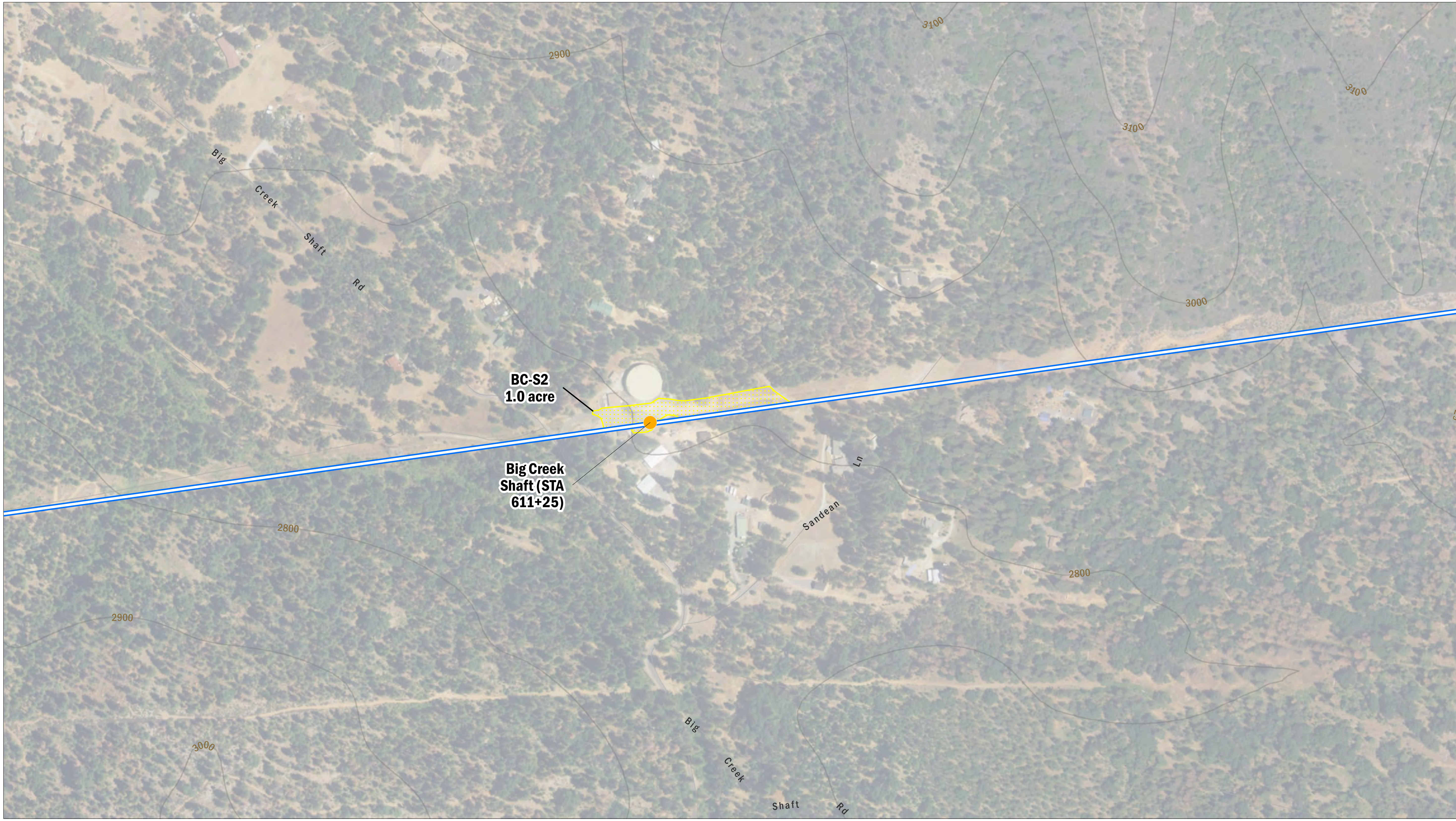


FIGURE E.13-1
Biological Resource Survey Findings
Page 6 of 10



N

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Feet

1 inch = 333 feet
1:4,000

Source:
AECOM, 2019;
NAIP Imagery, 2016

AECOM
San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project

- Project Component
- Mountain Tunnel Alignment
- Contour Line
- Staging Area

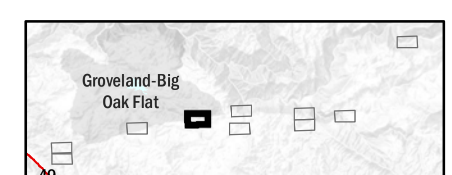

FIGURE E.13-1

Biological Resource Survey Findings

Page 7 of 10

Source:
AECOM, 2019;
NAIP Imagery, 2016

AECOM
San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project

- Project Component
- Proposed Culvert
- Mountain Tunnel Alignment
- Culverted Waters of the U.S. (0.06 acre)
- Contour Line
- Road - Potential Gravelling
- Staging Area
- Other Waters (4.00 acres)
- Wetlands (0.44 acre)

FIGURE E.13-1

Biological Resource Survey Findings

AECOM Oakland CA 6/5/2019 USER caitlin.jensen PATH L:\Projects\GIS\Projects\SFPUC_CS258\MtTunnel\02_Maps\02_Map_Production_and_Reports\Phase2\IS-MND\FigE13-1_Biological_Resource_Surveys.mxd

N
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Feet
1 inch = 333 feet
1:4,000

Source:
AECOM, 2019;
NAIP Imagery, 2016

AECOM
San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project

- Mountain Tunnel Alignment
- Culverted Waters of the U.S. (0.06 acre)
- Contour Line
- Road - Potential Gravelling
- Road - Proposed Modifications
- Staging Area
- Other Waters (4.00 acres)

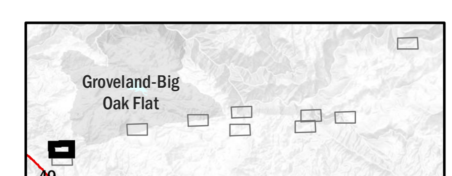

FIGURE E.13-1

Biological Resource Survey Findings

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AECOM Oakland CA 6/5/2019 USER caitlin.jensen PATH L:\Projects\GIS\Projects\SFPUC_CS258\MtTunnel\02_Maps\02_Map_Production_and_Reports\Phase2\IS-MND\FigE13-1_Biological_Resource_Surveys.mxd

N

0 500
Feet

1 inch = 333 feet
1:4,000

Source:
AECOM, 2019;
NAIP Imagery, 2016

AECOM
San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project

- Project Component
- Mountain Tunnel Alignment
- Culverted Waters of the U.S. (0.06 acre)
- Contour Line
- Road - Potential Gravelling
- Road - Proposed Modifications
- Staging Area
- Work Area
- Other Waters (4.00 acres)
- Wetlands (0.44 acre)
- Riparian Scrub and Forest
- Clarkia biloba ssp. australis

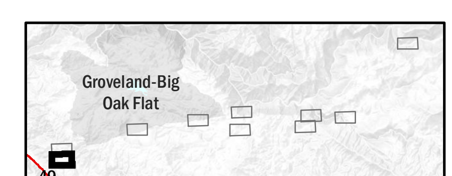

FIGURE E.13-1

Biological Resource Survey Findings

Impact BI-1. Construction of the project could have a substantial adverse effect, either directly or through habitat modifications, on 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 Wildlife or U.S. Fish and Wildlife Service. (Less than Significant with Mitigation)

Construction

Project construction could have an adverse effect on special-status species that have the potential to occur in the project site or project area, such as special-status wildlife, special-status plant species, and/or nesting birds. The effects could be direct (e.g., harassment or take of an individual) or indirect (e.g., modifying existing habitat, disrupting foraging and nesting efforts, or interfering with movement). Construction activities that could cause direct impacts on special-status wildlife and plant species include ground disturbance (e.g., grading and excavation) to accommodate the use of temporary staging areas and access roads; the permanent installation of the new flow control facility, adit, portal, and new power distribution line at Priest Reservoir; the transportation of materials and equipment along project access roads; and noise and vibration. Construction activities could cause indirect impacts on special-status plants and wildlife through the introduction of nonnative, noxious species that could modify existing plant communities/habitat or disrupt animal foraging patterns.

Impacts to special-status plants would be considered significant if they remove critical populations, reduce the reproductive capacity of the species in a geographic area, or otherwise decrease the viability of the species. Impacts to special-status wildlife would be considered significant if they caused take of a listed species, remove critical wildlife habitat elements required for reproduction and/or survival, modify occupied or suitable habitat for the species, and/or significantly reduce the viability of local populations.

Special-Status Plants

Mariposa Clarkia. In the floristic survey area, Mariposa clarkia primarily occurs on rocky outcrops and roadsides and was specifically recorded on the rocky road banks of the Adit 5/6 and Adit 8/9 access roads. It also occurs in disturbed areas such as the eroding road bank along the South Fork Access Road/ Forest Service Road 1S28B; and can grow in construction gravel, such as at the margin of the parking lot of EI-S1 and in the Early Intake Switchyard (EI-S3). It occurs on both south-facing slopes, such as along the South Fork Access Road/Forest Service Road 1S28B; and north-facing slopes, such as along the Adit 8/9 Access Road/Forest Service Road 1N10 (Lumsden Road). Figure E.13-1 shows the locations of Mariposa clarkia in the floristic survey area.[237]

Ground disturbance required to construct road and culvert/drainage improvements along the South Fork, Adit 5/6, Adit 8/9, and Priest Reservoir access roads could result in direct impacts to Mariposa clarkia, including mortality of individuals and disturbance to the seedbank; and indirect impacts resulting from the removal or degradation of habitat for this species through the introduction of invasive species. Mariposa clarkia is locally abundant in the project area and thrives in disturbed areas, as evidenced by the locations where it has been observed to date.[238] Therefore, crushing of individual Mariposa clarkia plants and disturbance to the seedbank from construction activities are anticipated to have a negligible effect on the distribution and abundance of the local metapopulation. Due to this species' affinity for disturbed areas, natural recolonization of Mariposa clarkia in areas disturbed by construction is anticipated.

Consequently, the only potential impact to the species that could result from the implementation of the project is associated with the potential for construction activities, including personnel, materials, and

[237] SFPUC, Biological Resources Assessment for the Mountain Tunnel Improvements Project, prepared by AECOM, 2019.
[238] SFPUC, Biological Resources Assessment for the Mountain Tunnel Improvements Project, prepared by AECOM, 2019.

equipment, to introduce invasive plant species. Once introduced, invasive plant species often spread readily, and can outcompete native species such as Mariposa clarkia, potentially limiting the ability of native species to recolonize previously occupied areas following construction disturbance. Although the project would disturb areas currently supporting Mariposa clarkia and expose bare ground, the project site is already regularly accessed by construction equipment, trucks, and workers; therefore, the temporary increase in construction equipment, trucks, and workers would not substantially increase the potential for the introduction of invasive plant species to areas that would not otherwise be exposed to them under existing conditions. Best management measures would be implemented as part of the project to avoid or minimize the spread of invasive nonnative plant species; these measures include use of certified weed-free imported erosion control materials and maintaining construction equipment clean and free of soil, seed, and plant material prior to use at the project site (see Section A.6.11). Furthermore, results of a noxious weed survey of the project site indicate that the site is already colonized by 19 noxious weeds, including approximately 12 acres of tocalote and 6 acres of Italian thistle at Priest Reservoir. Based on results in the noxious weed risk assessment[239] and from floristic surveys of the project site, it appears that Mariposa clarkia, which is locally abundant in the project site, is successfully coexisting with a thriving and diverse noxious weed population. Therefore, the potential introduction of weed seed through construction activities is not anticipated to put additional stress on the Mariposa clarkia populations and prevent successful recolonization of disturbed sites. The removal of some individuals from the project site would not directly cause the extirpation of the species or indirectly decrease the overall viability of the Mariposa clarkia population in the area. Therefore, the direct and indirect effects of project construction would have a *less-than-significant impact* on Mariposa clarkia.

Small's Southern Clarkia. In the floristic survey area, Small's southern clarkia occurs in one location, consisting of approximately 10 to 15 individuals (in July 2018) in the understory of ponderosa pine forest along the Adit 5/6 Access Road/Forest Service Road 1S01. Figure E.13-1 shows the locations of Small's southern clarkia in the floristic survey area. Because this species occurs outside of the project site, no direct impacts to Small's Southern clarkia are anticipated.[240] Similar to Mariposa clarkia, significant indirect effects resulting from noxious weed introduction as a result of the project are not expected, because Adit 5/6 Access Road/Forest Service Road 1S01 is already regularly accessed by construction equipment, trucks, and workers. Therefore, the project would not introduce invasive plant species to areas that would not otherwise be exposed to them under existing conditions. In addition, as noted above, best management measures would be implemented as part of the project to avoid or minimize the spread of invasive nonnative plant species (see Section A.6.11). Therefore, impacts on Small's Southern Clarkia would be *less than significant*.

Special-Status Wildlife

Foothill Yellow-Legged Frog. The project is within the geographic range of the foothill yellow-legged frog, and suitable aquatic habitat for the species is present in the Tuolumne River and its immediate tributaries. A breeding population of foothill yellow-legged frogs is known to occur in the Tuolumne River, approximately 1 mile upstream of Early Intake.[241,242] Foothill yellow-legged frogs are rarely

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239 SFPUC, Noxious Weed Risk Assessment for the Mountain Tunnel Improvement Project, prepared by AECOM, 2019.

240 SFPUC, Biological Resources Assessment for the Mountain Tunnel Improvements Project, prepared by AECOM, 2019.

241 U.S. Forest Service, Stanislaus National Forest. Rim Fire Recovery Project (43033), Biological Evaluation: Aquatics—Forest Service Sensitive Species, 151 pp., 2014.

242 SFPUC, Technical Memo: Foothill Yellow-Legged Frog Habitat on the Upper Tuolumne River, prepared by McBain Associates, February 26, 2019.

encountered more than a few yards from permanent water. This species is therefore very unlikely to be encountered in any upland portions of the project site where project construction is planned to occur.

Foothill-yellow legged frogs have a moderate potential to occur in the Tuolumne River at Early Intake and South Fork Crossing due to the presence of suitable habitat features, but they have a low potential to occur out of the water in the project site at Early Intake and South Fork Crossing. This is because, as stated above, foothill yellow-legged frogs are rarely encountered more than a few yards from permanent water. Foothill yellow-legged frogs have a low potential to occur in Lower Rattlesnake Creek (based on surveys completed by SFPUC[243,244]), and therefore have a low potential to occur in the project site at PP-S13, which is more than 25 feet from the creek. Foothill yellow-legged frogs have no potential to occur in the remainder of the project site because of the absence of suitable pool and flowing water habitat within a feasible dispersal radius (25 feet or less) of project improvement, construction, and staging areas. No in-water work is proposed at Early Intake, South Fork Crossing, or near PP-S13; staging areas at Early Intake, South Fork Crossing, and Priest Reservoir are in existing disturbed upland areas where foothill yellow-legged frogs are unlikely to take refuge, as explained above. Therefore, *no impacts* to foothill yellow-legged frogs are anticipated from project construction activities.

Golden Eagle. Nests of golden eagles are usually established on cliffs or in mature trees. Individual pairs may use both cliffs and trees if both types of nesting sites are available in their territory. Golden eagles often construct multiple nests in a single breeding territory. A search of the California Natural Diversity Database found no historic records of golden eagles or their nests within 5 miles of the project; however, a golden eagle nest in the vicinity of the project was reported by the U.S. Forest Service in March 2019. The nest is located approximately 0.5 mile from the project site. The nest was reported by U.S. Forest Service staff to be in use during the 2019 breeding season (based on the presence of eagles at the nest and the general area; however, additional surveys by SFPUC staff revealed that the eagles did not lay eggs at the nest this year),[245] and the nest was known to be active in 2018, with the eagles laying eggs and successfully rearing young. There are no known alternate nest sites in the breeding territory. According to U.S. Forest Service, this golden eagle nest is the only one that has been documented in the Stanislaus National Forest.[246]

Nesting golden eagles are sensitive to disturbance in the vicinity of their nests. Visual and noise disturbance arising from construction activity have the potential to disrupt normal nesting behavior and negatively impact reproductive success of eagles, depending on the intensity and distance of the activity from the nest. For most types of human disturbance, U.S. Fish and Wildlife Service guidance recommends a 1-mile (5,280-foot) no-disturbance buffer surrounding golden eagle nesting sites. A 2-mile (10,560-foot) buffer is recommended for detonation devices and other loud nonregular noise. Recommended buffer distances may increase or decrease depending on specific site or activity circumstances and local jurisdiction recommendations.[247] For example, buffers may be reduced in consultation with the U.S. Fish and Wildlife Service when the nest is not in use or activities are out of line-of-sight of the nest. Other factors that may be considered in determining an appropriate no-disturbance

[243] From 2012 to 2017, SFPUC biologists conducted visual encounter surveys approximately once per year from Priest Dam to where Moccasin Creek crosses Highway 49. The surveys included portions of Rattlesnake Creek, Big Jackass Creek, and Moccasin Creek. No foothill yellow-legged frogs were found in any of the surveys.

[244] SFPUC, Biological Resources Assessment for the Mountain Tunnel Improvements Project, prepared by AECOM, 2019.

[245] Espinoza, Travis, SFPUC Biologist, email communication to U.S. Forest Service and SFPUC staff, May 13, 2019.

[246] SFPUC and San Francisco Planning Department, Environmental Planning Division, Impact Assessment for Golden Eagle Nest in Vicinity of the Mountain Tunnel Improvements Project, prepared by AECOM, 2019.

[247] U.S. Fish and Wildlife Service, Recommended Buffer Zones for Ground-based Human Activities around Nesting Sites of Golden Eagles in California and Nevada, 2017.

buffer distance include whether territories are maintained year-round, the intensity and duration of activities, and historic levels of human activity in the vicinity.

Vehicular and human foot-traffic occur regularly within 1 mile of the nest. To evaluate the potential for visual and audible disturbance at the nest location, a 3-dimensional (3-D) viewshed analysis was conducted using ArcGIS software in combination with lidar data from U.S. Forest Service, and nest location information provided by the U.S. Forest Service and confirmed in the field by a SFPUC biologist.

Areas visible from the nest location were identified to better understand the existing environment and potential impacts of project-related construction activities. The analysis considered the potential disturbance associated with proposed staging areas and construction work. With one exception, the proposed activities within 1 mile of the nest are low-impact and include human foot traffic, parking and staging, or storage of equipment at least 3,682 feet (0.70 mile) from the nest. The use of larger equipment could be required at one staging area; however, the proposed activities would not present nesting eagles with a level of visual disturbance above what typically occurs at these locations.[248] Night lighting may be required at the staging areas and could be visible from the nest. However, the lighting would be directed at the ground (see Section A.6.5, Project Workforce, Work Hours, and Construction Vehicle Parking), and the potential for disturbance from spillover lighting is expected to be minimal given the distance between the locations and the nest, and the fact that there are residences and businesses in the vicinity that have lesser amounts of lighting at similar distances.

Eagles using the nest could currently be exposed to a variety of natural and anthropogenic sounds, including noise from vehicular traffic and aircraft, human voices, sounds from whitewater rushing through the canyon below, gun shots, and high winds. Noise disturbance associated with project construction could result from the use of heavy equipment for excavating, from drilling activities, and from controlled detonations associated with excavation of rock for tunnel improvements or for slope stabilization and other access road improvements. Noise from these project construction activities would be attenuated by the distance between the nest location and the construction sites, and by the SFPUC standard requirement that contractors use containment mats for controlled detonations. The mats are for safety to prevent flyrock from leaving the blast location and potentially injuring construction workers and damaging property and resources; they also help reduce noise. Moreover, nearly all of the improvement, construction, and staging areas within 2 miles of the nest would not have a direct line of sight to the nest. The intervening terrain and landforms that obstruct direct views of the nest would further reduce the potential for disturbance from construction noise (by an additional 15 A-weighted decibels [dBA][249,250]). The net effect of these factors is that the project construction activities would produce noise levels at the nest below or at ambient levels that are typical of rural communities (50 dBA during the day and 35 dBA during the night) and of the noise from vehicular traffic on Highway 120 (estimated between 43 dBA and 53 dBA at the golden eagle nest). As a result, existing ambient sounds

[248] SFPUC and San Francisco Planning Department, Environmental Planning Division, Impact Assessment for Golden Eagle Nest in Vicinity of the Mountain Tunnel Improvements Project, prepared by AECOM, 2019.

[249] dBA = A weighted decibel. Sound levels are generally measured in decibels (dB) of sound pressure level.

[250] A berm (i.e., intervening terrain/landform) can provide noise attenuation of up to 15 dBA if it is several feet higher than the "line of sight" between the noise source and the receiver. United States Department of Transportation, Noise Barrier Design Handbook, 2011, *https://www.fhwa.dot.gov/environment/noise/noise_barriers/design_construction/design/design03.cfm*, accessed May 31, 2019.

would effectively mask project-related construction, and the proposed project would not be expected to affect golden eagle breeding and nesting behavior.[251]

The few improvement, construction, and staging areas that have a direct line of sight to the nest are used for staging, minimal construction activity along the steep hillsides, or general construction with controlled detonations. All but one of these construction areas involve limited activity, no heavy equipment, and construction of short duration, or are sufficiently distant that construction noise would be barely detectable at the nest if at all. For the one construction area that is in the line of sight and would involve heavy equipment and controlled detonations, the SFPUC would schedule its surface controlled detonations that could be audible at the nest to occur outside the nesting period (see Section A.6.3, Construction Equipment and Controlled Detonation). As a result, the improvement, construction, and staging areas that would be visible from the nest would not result in construction noise that would be expected to disturb the golden eagle nest.[252]

In summary, SFPUC's proposed construction methods and timing would not result in construction noise or visible construction activity that would be expected to disturb the golden eagle nest or normal golden eagle nesting behavior. Therefore, impacts to the golden eagle would be *less than significant*.

American Peregrine Falcon. The steep and rocky slopes of the South Fork Tuolumne River Canyon, particularly in the vicinity of the Early Intake, South Fork, Adit 5/6, and Adit 8/9 project sites provide suitable nesting habitat for peregrine falcon. One occurrence of this species (Occurrence Number 50) has been recorded within 5 miles of the project area.[253] Due to the presence of suitable cliff habitat, peregrine falcons have a moderate potential to occur in the project area. Because peregrine falcons nest on cliffs, project tree removal would not result in the loss of nesting habitat for peregrine falcons. Similarly, other direct impacts to American peregrine falcons are not anticipated from construction activities; however, construction activities could impact American peregrine falcons if individuals nest near active construction. Construction would result in elevated noise levels and increased human presence. These factors could result in modification of behavior detrimental to reproductive success, or nest abandonment. As a result, this impact would be *potentially significant*.

To reduce this impact, **Mitigation Measure M-BI-1a** and **Mitigation Measure M-BI-1b would be implemented. Mitigation Measure M-BI-1a** requires that workers be provided with environmental awareness training, which will familiarize them with the requirements that would prevent worker behavior from disturbing wildlife at the site. This training would familiarize workers with sensitive species in the project site, and with the physical characteristics and types of activities that disturb nesting American peregrine falcon. **Mitigation Measure M-BI-1b** requires that preconstruction nesting bird surveys be performed during the nesting season; if nests are discovered, an appropriate avoidance buffer would be implemented so that the nesting birds, including the American peregrine falcon, would not be significantly impacted. With the implementation of these measures, potential impacts to American peregrine falcon from construction would be *less than significant with mitigation*.

251 SFPUC and San Francisco Planning Department, Environmental Planning Division, Impact Assessment for Golden Eagle Nest in Vicinity of the Mountain Tunnel Improvements Project, prepared by AECOM, 2019.

252 SFPUC and San Francisco Planning Department, Environmental Planning Division, Impact Assessment for Golden Eagle Nest in Vicinity of the Mountain Tunnel Improvements Project, prepared by AECOM, 2019.

253 California Department of Fish and Wildlife, California Natural Diversity Database, Biogeographic Data Branch, California Department of Fish and Wildlife, Commercial Version, July 5, 2018.

Mitigation Measure M-BI-1a: Worker Environmental Awareness Training for Construction

A project-specific worker environmental awareness program training shall be developed by a qualified biologist for the project, and attended by all construction personnel prior to beginning work onsite. As part of the training, brochures may be given to provide reference material to contractors. The training may be provided by the qualified biologist or by designated SFPUC staff trained by the biologist to provide this training, using the materials developed by the qualified biologist, and may be administered via a video-recorded training produced specifically for the project by a qualified biologist. The worker environmental awareness program training shall at a minimum include, but not be limited to, the following:

- Applicable state and federal laws, environmental regulations, project permit conditions, and penalties for noncompliance
- Special-status plant and wildlife species with the potential to occur at or in the vicinity of the project site, avoidance measures, and a protocol for reporting the discovery, harm, injury, or mortality of any such species, including a detailed communication chain
- Known sensitive resource areas in the project vicinity that are to be avoided and/or protected, as well as restrictions of work and staging to the approved project site
- Known noxious or invasive weeds in or near the work areas, and best management practices for minimizing their spread
- Best management practices and their location on the project site for erosion control and/or species exclusion

Mitigation Measure M-BI-1b: Raptors (including the California Spotted Owl) and Migratory Bird Nesting Survey and Protection during Construction

To protect raptors and nesting migratory birds, the SFPUC shall retain a qualified wildlife biologist to conduct pre-construction surveys for nesting raptors and migratory birds prior to the commencement of construction activities that occur between March 1 and August 31 of a given year. The surveys shall be conducted a maximum of 14 days prior to the start of construction during the nesting season. The project area, plus—as allowed, based on access by the property owner—a 300-foot survey area surrounding the project area, shall be surveyed for nesting raptors; a 50-foot survey area in addition to the project area shall be surveyed for other nesting birds, such as passerines, protected under the Migratory Bird Treaty Act. For the California spotted owl, surveys shall be undertaken in areas where the protected activity centers or home range core areas overlap with the 210-foot buffer around the project site. A nest is defined to be active for raptors if there is a pair of birds displaying reproductive behavior (i.e., courting) at the nest, and/or if the nest contains eggs or chicks. For other migratory birds and passerines, a nest is defined as active if it contains eggs or chicks. If no active nests are detected, no additional action would be required. Nesting deterrents, such as mylar foil or noise deterrents, may be implemented prior to nesting season to deter birds from nesting in the project area.

If active nests are found during the pre-construction nesting survey, the wildlife biologist shall evaluate whether the schedule of construction activities could affect the active nest, and the following measures shall be implemented based on the biologist’s determination:

- If construction is not likely to affect the active nest, it may proceed without restriction; however, a biologist shall regularly monitor the nest to confirm that there is no adverse effect on nest success and may revise the determination at any time during the nesting season.

- If construction may affect the active nest, the biologist shall establish a no-disturbance buffer, taking into account the species involved; whether the presence of any obstruction, such as a building, is in the line of sight between the nest and construction; and the level of project and ambient activity (i.e., if the nest is adjacent to a road or active trail).
- If California spotted owls are discovered nesting, appropriate measures to avoid disturbance shall be undertaken in consultation with the U.S. Forest Service (as appropriate), U.S. Fish and Wildlife Service, and/or the California Department of Fish and Wildlife.
- No-disturbance buffers for passerines may be 25 feet or greater, and 300 feet for most raptors. For bird species that are federally and/or state-listed special-status species (i.e., threatened, endangered, fully protected, or Species of Special Concern), an SFPUC representative, supported by the wildlife biologist, shall consult with the U.S. Forest Service (as appropriate), U.S. Fish and Wildlife Service, and/or California Department of Fish and Wildlife regarding appropriate nest buffers.
- Removing inactive passerine nests may occur at any time. Inactive raptor nests shall not be removed unless a qualified biologist has first consulted with the U.S. Fish and Wildlife Service and/or California Department of Fish and Wildlife.
- Any birds that begin nesting within a survey buffer during construction and following the preconstruction survey are assumed to be habituated to construction-related or similar noise and disturbance levels, and no work exclusion zones shall be required. This measure does not apply to bird species that are federally and/or state-listed special-status species (i.e., threatened, endangered, fully protected, or Species of Special Concern).

California Spotted Owl. For the past two decades, California spotted owl management has been based on recommendations provided by the California Spotted Owl Technical Report[254] and incorporated into forest plan direction at a bioregional scale. [255] This direction uses a system of protected activity centers and home range core areas that are specifically managed for owl habitat. All known nest sites are associated with a protected activity center, all protected activity centers are associated with a known nest site, and home range core areas are associated with most protected activity centers. No California spotted owl protected activity centers or home range core areas overlap with the project site, and none of these protected activity centers or home range core areas occur within 0.5 mile of the project site. The closest protected activity centers and home range core areas to the project site occur 0.55 mile southeast of South Fork Crossing and south of Second Garrote Shaft. However, this protected activity center is separated from the South Fork Crossing location in the project site by steep elevation changes associated with the Tuolumne River canyon, and no suitable nesting habitat for this species occurs at South Fork Crossing. Marginally suitable nesting habitat for this species occurs within 0.5 mile south of Second Garrote; however, Second Garrote is 1.3 miles northwest of the nearest documented protected activity center and there is no current evidence of the species nesting there. Although there are currently no protected activity centers within 0.5 mile of the project site, spotted owls are a mobile species, and new pairs

[254] Verner J., et al., Technical Coordinators, The California spotted owl: a technical assessment of its current status, Gen. Tech. Rep. PSW-GTR-133, Albany, California, 1992.

[255] U.S. Forest Service, California Spotted Owl Sierran Province Interim Guidelines Environmental Assessment, January 1993.
U.S. Forest Service, Sierra Nevada Forest Plan Amendment: Final Environmental Impact Statement and Record of Decision. Forest Service, Pacific Southwest Region, Vallejo, California, 2001.
U.S. Forest Service), Sierra Nevada Forest Plan Amendment: Final Supplemental Environmental Impact Statement and Record of Decision. Pacific Southwest Region, Forest Service, 2004.

regularly establish new nesting sites. Therefore, despite the current absence of activity centers within 0.5 mile of the project site, California spotted owls could set up new nests in suitable habitat south of Second Garrote before the start of project construction.

In 2006, the U.S. Fish and Wildlife Service issued guidance for the northern spotted owl to promote reasonable determinations of effects for activities near suitable habitat that could harass owl breeding.[256] Because the guidance focused on elevated human-generated sounds or human activities near nest trees, it is relevant for identifying potential impacts from construction activities associated with the proposed project. Based on the guidance, disturbance to the owl (i.e., interference with breeding, precluding an adult owl from feeding its young during the daily feeding cycle, or precluding feeding attempts of the young during multiple feeding cycles) could occur if project-generated sound exceeds ambient conditions by 20 to 25 decibels (dB) at the nest site, project-generated sound exceeds 90 dB, or human activities occur with a visual line-of-sight distance of approximately 130 feet. As described above in the analysis for golden eagle, ambient levels in the project area are typical of rural communities (50 dBA during the day and 35 dBA during the night). Therefore, if a California spotted owl nest were to be established where project construction noise could exceed 70 dB (i.e., 20 dB above ambient conditions[257]), interference with owl breeding and nesting behaviors could occur, resulting in a significant impact. Based on the construction equipment proposed for the Second Garrote Shaft area (see Section E.6, Noise, and Appendix B for details), the 70 dBA threshold would be exceeded if the nest were within 145 feet of construction activities and the combined predicted construction noise would be 81.2 dBA at 50 feet (below the 90 dB threshold in the guidance). For the South Fork area, based on the construction equipment for that particular area, the 70 dBA threshold would be exceeded if the nest were within 210 feet of construction activities and the combined predicted construction noise would be 85.4 dBA at 50 feet (below the 90 dB threshold in the guidance). The construction activities at South Fork would be comparable or greater than other project improvement, construction, or staging areas, so the 210-foot disturbance buffer would be appropriate or conservative (i.e., larger) for other project areas. Furthermore, because the 130-foot threshold for visual disturbance lies within the 70 dB noise threshold, the critical factor for establishing a no disturbance buffer from the project construction activities is the noise threshold.

As discussed above, there are no activity centers within 0.5 mile of project construction. However, if new activity centers are established within 210 feet of the project construction activities before the start of project construction, project activities during nesting season could have a potentially significant impact on California spotted owl by disturbing their roosting/nesting behavior and potentially causing nest abandonment. To reduce impacts to the species from project construction noise and disturbance, **Mitigation Measure M-BI-1b: Raptors (including the California Spotted Owl) and Migratory Bird Nesting Survey and Protection during Construction** requires pre-construction nesting bird surveys. For the California spotted owl, surveys would be undertaken in areas where the protected activity centers or home range core areas overlap with the 210-foot buffer around the project site. If California spotted owls are discovered nesting, appropriate measures to avoid disturbance will be undertaken in consultation with the U.S. Forest Service (as appropriate), U.S. Fish and Wildlife Service, and/or the California Department of Fish and Wildlife.

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[256] U.S. Fish and Wildlife Service, Estimating the Effects of Auditory and Visual Disturbance to Northern Spotted Owls and Marbled Murrelets in Northwestern California, July 31, 2006.

[257] According to the U.S. Fish and Wildlife Service, Estimating the Effects of Auditory and Visual Disturbance to Northern Spotted Owls and Marbled Murrelets in Northwestern California, it is not necessary to make special adjustments for nighttime ambient sound levels for the owl. Accordingly, the daytime ambient sound level is used to establish the no-disturbance zone.

This species has a moderate potential to fly through the project area. It is not anticipated that noise or increased human presence from construction would result in impacts to California spotted owls that are flying through the project area, given the availability of suitable habitat and natural areas surrounding the project area. Therefore, potential impacts to California spotted owl from construction would be *less than significant with mitigation*.

Special-Status Bat Species (Pallid Bat, Townsend's Big-Eared Bat, Spotted Bat, Western Mastiff Bat, Western Red Bat, Long-Eared Myotis, Fringed Myotis, and Yuma Myotis). The project area is within the geographic range for all eight of these species, and the project area contains suitable habitat for all eight of these species. Suitable habitat includes tunnel adits, human-made structures, rock faces and cliffs in a variety of habitat types, including riparian areas, near rivers and lakes (reservoirs), oak woodland, ponderosa pine, grasslands, and a variety of other habitats that these bat species use. All eight species have between one and seven recorded California Natural Diversity Database observations within 5 miles of the project site. Due to the wide range of these species, the wide variety of roosting and foraging habitat, and the recorded occurrences of each of these species within 5 miles of the project alignment, all of these species have a moderate or greater potential to roost or forage in the project area.

The removal of trees, rock scaling and slope stabilization improvements, and demolition of an adit entryway could potentially affect day-roosting bats or maternity roosting colonies, if roosts are present in these areas. Construction of the proposed project could result in the direct mortality of individual bats in day roosts, and in the loss of bat day roosts, night roosts, and maternity colonies. If a nonbreeding colony of bats is present in cavities in trees to be removed or steep slopes or adit entryways to be modified, these bats could be directly killed or injured. If an active bat roost occurs near enough to the project site that the colony is disturbed by elevated noise or increased human presence associated with construction activities, the bats may abandon the roost. If it is a maternity roost, this could result in the abandonment and mortality of young bats that are not yet able to fly. The mortality of an individual special-status bat would be a *significant impact*.

Mitigation Measure M-BI-1c serves to identify and locate potentially affected bat roosts, including maternity and day roosts, within 25 feet of the project site. **Mitigation Measure M-BI-1c** requires that, if active bat roosts are identified, an avoidance buffer be established. In addition, **Mitigation Measure M-BI-1c** provides methods by which eviction from day (nonmaternity) roosts can occur without resulting in a significant impact. With the implementation of **Mitigation Measure M-BI-1c**, impacts to special-status bat species would therefore be *less than significant with mitigation*.

Mitigation Measure M-BI-1c: Maternity Roosts and Special-Status Bats Day Roosts

A survey for roosting bats shall be conducted by a qualified biologist prior to the commencement of construction activities that have the potential to disturb special-status bat day roosts or maternity roosts of any bat species through elevated noise levels or removal of trees, as determined by the qualified bat biologist. Areas within 25 feet of locations proposed for tree removal, slope stabilization, and/or adit modifications shall be assessed to determine whether they provide high potential for roost sites. If a visual survey is not adequate to determine the presence or absence of bats (such as in tree cavities), acoustic equipment or other methods recommended by the qualified biologist shall be used to determine potential occupancy and species composition. If no active roosts are found, then no further action is warranted. If special-status bat day roosts or maternity roosts of any bat species are found, the following measures shall be implemented:

- **Maternity Roosts:** If a maternity roost of any size supporting any bat species (special-status and non-special-status) is detected during surveys, an avoidance buffer around the active roost, as determined by a qualified bat biologist, shall be maintained from April 1 until the young are flying, typically after August 31.

- **Special-Status Bat Day Roosts:** If a day roost of any special-status bat is found in a tree planned for removal, or near enough to planned work areas that the roost could be disturbed by project activities to the point of abandoning the roost, as determined by the qualified bat biologist, the bats shall be safely evicted under the direction of a qualified bat biologist. Day roosts/trees shall not be removed unless the daytime temperature is at least 50 degrees Fahrenheit and there is no rain present. Eviction would occur as a multi-step process to make suitable habitat less desirable for special-status bats by: 1) removing surrounding trees that are determined to not contain suitable roosts (if surrounding trees are identified for removal); 2) limbing trees determined to potentially contain roosting sites; and 3) removing potential roosting trees. In some circumstances, the qualified bat biologist may allow roosting bats to continue using a roost while construction is occurring near the roost site. For example, if it is determined that the risks to bats from eviction (e.g., increased predation or exposure, or competition for roost sites) are greater than the risk of roost abandonment (resulting from construction), then the bats shall not be evicted.

Operations and Maintenance

As described under Impact HY-1 in Section E.15, Hydrology, under certain operating conditions the proposed project would result in reduction of Tuolumne River flows of up to 8 cubic feet per second between Kirkwood Powerhouse and Don Pedro Reservoir. These flow reductions could result in increased water temperature and reduced habitat area (as indicated by suitable depth and velocity) that could impact special-status fish species. Two special-status fish species, hardhead (*Mylopharodon conocephalus*) and riffle sculpin (*Cottus gulosus*), have potential to occur in this segment of the Tuolumne River. For the reasons explained below, the analysis of potential effects focuses on the Kirkwood Reach (the 1.5-mile-long reach between Kirkwood Powerhouse tailrace and the Cherry Creek confluence). Hardhead has not been reported in the upper Tuolumne River in the Kirkwood Reach, although suitable habitat is potentially available. Riffle sculpin has been reported to occur in the Upper Tuolumne River, and is assumed to be present in the Kirkwood Reach. These species are designated as species of special concern by the California Department of Fish and Wildlife.

Flow, water temperature, and flow-dependent habitat availability (i.e., habitat area) analyses were conducted to identify potential effects of flow changes on hardhead and riffle sculpin or their habitat. As explained under Impact HY-1 in Section E.15, Hydrology, because the average monthly flow in the Tuolumne River is greater below the Cherry Creek confluence—due to the addition of releases from Cherry and Eleanor reservoirs and from Holm Powerhouse—flow reduction effects would be greatest upstream of this confluence in the Kirkwood Reach. The analyses of flow illustrate that, during most months, changes in simulated flow occur under the proposed project in relation to existing conditions, and that flow differences are very small (a maximum daily change of 8 cubic feet per second, which is generally less than a 2 percent change in monthly average flow) regardless of when they occur. These flow changes would result in slight increases and decreases in usable habitat area for hardhead and riffle sculpin, depending on the total river flow when reductions of 8 cubic feet per second occur. Estimated usable habitat area for hardhead sculpin could increase up to about 2.6 percent for juveniles and about 3.3 percent for adults, and decrease up to about 0.1 percent for juveniles and about 1.1 percent for adults.[258] Estimated usable habitat area for riffle sculpin (as indicated by area for all sculpins) could increase up to about 1.3 percent and decrease up to about 3.6 percent.[259] Water temperature analyses were conducted for hardhead sculpin spawning and residence based on life stage timing, and for riffle sculpin residence year round. Analyses show that water temperatures under existing conditions rarely exceed the upper water temperature tolerance value for hardhead spawning and do not exceed the upper water temperature tolerance value for hardhead or riffle sculpin residence. For those periods when a change in the Tuolumne River flows is expected based on the Hetch Hetchy Local Simulation Model, the proposed project is expected to typically reduce flows by less than 1 percent, which would have very minor influences on water temperatures. Water temperatures under the proposed project are estimated to increase by no more than 0.1 degrees Fahrenheit during those months with reduced flows; this increase would not result in increased exceedance of water temperature tolerance values for hardhead or riffle sculpin.[260] Overall, the small flow changes of up to 8 cubic feet per second would result in small changes to habitat area and water temperatures; as a result, impacts to hardhead and riffle sculpin would be *less than significant*. Please see the end of Section E.13 for a discussion of effects on recreationally-important fish species from reductions in Tuolumne River flows as a result of the project.

Additionally, two special-status wildlife species—the foothill yellow-legged frog and western pond turtle—are expected to inhabit portions of the Tuolumne River, including the Kirkwood Reach. Analyses were performed to evaluate the effects of the project's operational flow changes (described above) on the critical life history periods of these species under different hydrologic conditions (wet to normal, dry, and critically dry). The proposed project would result in a negligible increase (median change +0.67 percent) in usable area of foothill yellow-legged frog habitat, and a negligible decrease in habitat area for western pond turtle, due to decreased surface area, volume, and stream depth. These changes—whether positive or negative—would result in changes between 0 to 2 percent from existing conditions, which would be negligible in relation to the natural variability of flows, surface area, volume, and stream depths in the Tuolumne River.[261] Therefore, impacts on these species from reductions in Tuolumne River flows as a result of the project would be *less than significant*.

Following rehabilitation, the Mountain Tunnel would be placed back into long-term service. Operations and maintenance of the flow control facility and tunnel would occur daily to every 40 years. Daily inspections and monthly maintenance would be conducted by existing staff. Flow control facility parts that are worn and require replacement would be addressed approximately every 40 years. The tunnel would be inspected every 10 years following its rehabilitation (requiring a 10-day minimum planned shutdown), and maintenance activities (requiring a 100-day planned shutdown) would take place every 20 years. Typical tunnel maintenance during the 100-day shutdown would include regular inspections; removal of debris (rock and sand) along the entire length of the tunnel and siphon; and repair of future lining defects. These operations and maintenance activities would occur in the tunnel. Some of these activities would be supported by staging areas, similar to the improvements project, at Early Intake, South Fork Siphon, Adit 5/6, Adit 8/9, and Priest Reservoir. Maintenance along access roadways would

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[258] SFPUC and San Francisco Planning Department, Environmental Planning Division, Mountain Tunnel Improvements Project: Operational Flow Effects on the Tuolumne River Environment, prepared by AECOM, 2019.

[259] SFPUC and San Francisco Planning Department, Environmental Planning Division, Mountain Tunnel Improvements Project: Operational Flow Effects on the Tuolumne River Environment, prepared by AECOM, 2019.

[260] SFPUC and San Francisco Planning Department, Environmental Planning Division, Mountain Tunnel Improvements Project: Operational Flow Effects on the Tuolumne River Environment, prepared by AECOM, 2019.

[261] SFPUC and San Francisco Planning Department, Environmental Planning Division, Mountain Tunnel Improvements Project: Operational Flow Effects on the Tuolumne River Environment, prepared by AECOM, 2019.

be required to ensure access to each of the adits and project components, including removal of small rock debris from netting or roadways, as well as repair of roadway locations that may be damaged by fires or inclement weather.

The operations and maintenance schedule would not differ significantly from the existing operations and maintenance schedule for the Mountain Tunnel. In addition, access road improvements are currently required to maintain the tunnel. Because the project would improve the stability and life of the existing access roads, road maintenance requirements due to severe road failures are anticipated to decrease following project construction. In summary, as a result of 1) the infrequent schedule of operation and maintenance activities, 2) the short duration of operations and maintenance activities when they do occur, and 3) the underground location of the majority of these activities (in the tunnel), the impacts of ongoing operations and maintenance would be comparable to existing operations and maintenance activities for the tunnel, and potential impacts would be *less than significant*.

Impact BI-2. The project could have a substantial adverse effect on riparian habitat or other sensitive natural communities identified in local or regional plans, policies, regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service. (Less than Significant with Mitigation)

Construction

Natural communities are identified and ranked with the same system used to assign global and state rarity ranks for plant and animal species in the California Natural Diversity Database. Natural communities with ranks of S1-S3 are considered sensitive natural communities. Two sensitive natural communities —riparian scrub/forest (white alder groves) and oak woodlands[262]—were identified in the project area during surveys. Riparian scrub/forest is found along the Tuolumne River and South Fork Tuolumne River (at Early Intake and South Fork Crossing), and in Lower Rattlesnake Creek south of Priest Reservoir. Riparian scrub/forest is outside the project site, so there would be no direct impacts to this habitat. Oak woodlands are found extensively in the project site at Priest Reservoir, including along Rickson Road, and at the PP-S6, PP-S9, and PP-S15 staging areas. Direct removal of approximately 6.5 acres of oak woodland at the project site) is anticipated during construction (see Table E.18-1 in Section E.18, Agriculture and Forest Resources). Removal of protected oak woodland would occur to expand access roads, clear staging areas, and clear areas for proposed improvements. Removal of oak woodlands during project construction would be a *significant impact*.

To reduce the significance of this impact in accordance with the requirements of CEQA section 21083.4(b)(4), **Mitigation Measure M-BI-2** requires the SFPUC to compensate for the loss of oak woodlands by contributing funds to the U.S. Forest Service Rim Fire Reforestation Project,[263] and to leverage an existing collaborative agreement for watershed and restoration efforts between the U.S. Forest Service and the SFPUC, specifically to implement the deer habitat enhancement component. (Oak woodlands are an essential component of mule deer habitat, providing critical food sources and habitat.) This measure involves protecting, managing, and expanding oak woodlands, such as through thinning of other vegetation, noxious weed eradication, and prescribed burning activities; therefore, with this measure, the impact on oak woodland would be reduced to *less than significant with mitigation*.

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[262] California Department of Fish and Wildlife, California Sensitive Natural Communities List, 2018, *https://www.wildlife.ca.gov/Data/VegCAMP/Natural-Communities*, accessed July 9, 2018.

[263] Additional information on the Rim Fire Reforestation Project is available at *https://www.fs.usda.gov/project/?project=45612*.

Mitigation Measure M-BI-2: Oak Woodland Mitigation.

The SFPUC shall contribute funding to the U.S. Forest Service's Rim Fire Reforestation Project, specifically to implement the deer habitat enhancement component. Implementation of deer habitat enhancement in specified U.S. Forest Service areas will mitigate for the loss of 6.5 acres of oak woodland due to the project. Funding for the loss of oak woodland acreage shall be provided to compensate for impacts at a minimum of a 2:1 ratio; i.e., the SFPUC would fund the enhancement of at least 13 acres of oak woodlands. The acreage calculation shall not include individual hazard trees that are targeted for removal for safety reasons.

Indirect impacts to riparian scrub/forest as well as to oak woodlands could occur through introduction of nonnative invasive plant species and/or accidental spills of hazardous materials, which could result in habitat degradation. As described under Impact BI-1, the project site is already abundantly colonized by noxious weeds and is regularly accessed by construction equipment, trucks, and workers, all of which can serve as sources of noxious weed introduction; therefore, the project would not introduce invasive plant species to areas that would not otherwise be exposed to them under existing conditions, and impacts related to nonnative invasive plant species would not be significant. Furthermore, best management measures would be implemented as part of the project to avoid or minimize the spread of invasive nonnative plant species (see Section A.6.11). The SFPUC Standard Construction Measure 6 for hazardous materials (see Section A.6.11, SFPUC Standard Construction Measures and Other Avoidance/ Minimization Measures Included as Part of the Project) includes actions to prevent the release of hazardous materials used during construction. These include storing hazardous materials in accordance with manufacturer recommendations; maintaining spill kits onsite; and containing any spills that occur to the extent safe and feasible, followed by collection and disposal in accordance with applicable laws; these measures would avoid and/or minimize potential impacts to sensitive natural communities from runoff/ accidental spills.

Therefore, with implementation of **Mitigation Measure M-BI-2**, impacts to these sensitive communities from construction of the project would be *less than significant with mitigation.*

Operations and Maintenance

As described under Impact HY-1 in Section E.15, Hydrology, under certain operating conditions the proposed project would result in reduction of Tuolumne River flows of up to 8 cubic feet per second between Kirkwood Powerhouse and Don Pedro Reservoir. Riparian natural communities are present along the Tuolumne River, and for the purpose of this analysis were assumed to be present along the Kirkwood Reach. Riparian communities are expected to respond to changes in the flow of the Tuolumne River, but these communities are most likely to be affected by changes to the highest and lowest flows, when flow reductions would be negligible and nonexistent, respectively. Flooding events are important to riparian vegetation because they disturb existing riparian vegetation, deposit alluvial material that can serve as seedling nursery sites, dislodge and deposit tree branches that may serve as vegetative propagules, and produce conditions conducive to successful sapling establishment. Conversely, the lowest flow periods can affect riparian vegetation by inducing stress or mortality in riparian plants, particularly on hot summer days and in streams with relatively low flows.

Analyses were conducted to identify potential effects of flow changes on riparian communities under different hydrologic conditions at periods crucial to riparian vegetation dynamics. The analyses focused on the Kirkwood Reach (the 1.5-mile-long reach between Early Intake and the Cherry Creek confluence). As explained in Section E.15, Hydrology, because the average monthly flow in the Tuolumne River is greater below the Cherry Creek confluence—due to the addition of releases from Cherry and Eleanor reservoirs and from Holm Powerhouse— flow reduction effects would be greatest in the Kirkwood Reach. Under the proposed project, flow reductions during moderate flood (one in five-year to one in 10-year) events would be in the range of 0.04 to 0.09 percent of total flow; this negligible amount would be unlikely to change the response of riparian vegetation to flood events. Similarly, in the late summer and early fall, there would be no flow reduction in dry years, and a negligible reduction (up to 0.6 percent) in wet to normal years.[264] This negligible level of flow reduction would not substantially increase stress or mortality to riparian vegetation in the Kirkwood Reach during the lowest flow periods. Given the extremely low levels of flow reduction at periods crucial to riparian vegetation dynamics, the impacts on sensitive natural communities from proposed flow reduction of up to 8 cubic feet per second would be *less than significant*.

Other operations and maintenance activities, as summarized in the project description and the Operation and Maintenance section under Impact BI-1, are not expected to impact sensitive natural communities. The locations of these operations and maintenance activities associated with the project do not occur in the same location as mapped riparian scrub/forest, or in locations containing remaining oak woodlands and would have *no impact* to sensitive natural communities.

Impact BI-3. The project would have an 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; however, state and federal regulations require measures and actions to achieve "no net loss" of these resources. (Less than Significant)

Construction

There are no seasonal or perennial wetlands in the project site. Therefore, direct impacts to wetlands in the vicinity of the project site would be restricted to the potential for runoff from the project area to enter nearby wetlands and increase sediment inputs to these features. Accidental spills of hazardous materials in the project site could also enter these nearby wetlands. As described above under Impact BI-2, Standard Construction Measure 6 includes measures to prevent the release of hazardous materials and to contain accidental releases. Furthermore, Standard Construction Measure 3 (see Section A.6.11, SFPUC Standard Construction Measures and Other Avoidance/Minimization Measures Included as Part of the Project), related to water quality, specifies the implementation of erosion and sedimentation controls, such as fiber rolls and/or gravel bags, installation of silt fences, and other such measures sufficient to prevent discharges of sediment and other pollutants to surface waterways, wetlands, swales, and streams. The implementation of Standard Construction Measures 3 and 6, as proposed, would avoid and/or minimize potential impacts to wetlands from runoff/accidental spills.

Indirect impacts to wetlands in the vicinity of the project site could occur if construction activities were to inadvertently introduce invasive plant species to the project site. Invasive plants suited to wetland environments have the potential to spread to nearby wetlands and outcompete native plants, which could result in the degradation of habitat through a reduction of suitable habitat for native species. The indirect and/or inadvertent introduction of invasive species in wetland habitats would be a potentially significant impact. However, noxious weeds already occur abundantly at the project site, as identified in the noxious weed risk assessment, and none of those listed as having high, medium, or low threat

[264] SFPUC and San Francisco Planning Department, Environmental Planning Division, Mountain Tunnel Improvements Project: Operational Flow Effects on the Tuolumne River Environment, prepared by AECOM, 2019.

potential are currently found in wetlands or adjacent uplands delineated in the project area.[265] Furthermore, the wetlands delineated at the site are fully occupied by existing plants, exhibiting 75 percent to 100 percent absolute cover, and adjacent uplands exhibit equally high levels of vegetative cover. In addition, best management measures would be implemented as part of the project to avoid or minimize the spread of invasive nonnative plant species; these measures include use of certified weed-free imported erosion control materials and maintaining construction equipment clean and free of soil, seed, and plant material prior to use at the project site (see Section A.6.11). Therefore, the disturbance of soils at the project site would be unlikely to spread the seed of noxious weeds into densely vegetated wetlands and create new infestations that could significantly impact wetlands.

Identified jurisdictional features in the project site are ephemeral and intermittent drainages, the majority of which cross the South Fork, Adit 5/6, Adit 8/9, and Priest Reservoir (Rickson Road) access roads. The project would permanently impact approximately 200 square feet and temporarily impact approximately 50 square feet of these jurisdictional features. Permanent impacts include changes to the contours of these features or the replacement or installation of culverts in these features to support access-road improvements. Temporary impacts would involve short-term changes to the contours of these features, which would be restored to near pre-construction conditions following the completion of construction, as required by SFPUC Standard Construction Measure 8 (see Section A.6.11, SFPUC Standard Construction Measures and Other Avoidance/Minimization Measures Included as Part of the Project). Permanent and temporary impacts to ephemeral and intermittent drainage features resulting from the construction of the project would be a significant impact. However, projects involving fill of a wetland or water of the U.S. or of the state must comply with federal and state regulations to avoid, minimize, and mitigate the effects. Accordingly, SFPUC would obtain permits for impacts to hydrologic features, including a U.S. Army Corps of Engineers Clean Water Act section 404 Nationwide Permit, a Regional Water Quality Control Board Clean Water Act section 401 Water Quality Certification, and a California Department of Fish and Wildlife Lake or Streambed Alteration Agreement. SFPUC will mitigate for impacts to hydrologic features as required by these permits. Because the SFPUC must obtain these permits and comply with the permit conditions identified by the above-listed regulatory agencies to implement the proposed project, impacts to protected wetlands and other water features would be *less than significant.*

Operations and Maintenance

As discussed under Impact BI-1, the operations and maintenance schedule would not differ significantly from the existing operations and maintenance schedule for the tunnel, except that Priest Reservoir would no longer need to be drained to access the tunnel because the isolation valves available in the flow control facility would isolate the tunnel from the reservoir; and the new portal and adit would facilitate access to the western end of the tunnel. In addition, access road improvements are currently required to maintain the tunnel. Because the project would improve the stability and life of the existing access roads, road maintenance requirements due to severe road failures are anticipated to decrease following project construction. In summary, as a result of 1) the infrequent schedule of operation and maintenance activities, 2) the short duration of operations and maintenance activities when they do occur, and 3) the underground location of the majority of these activities (in the tunnel), the impacts of ongoing operations and maintenance are expected to be comparable to existing operations and maintenance activities for the tunnel. Therefore, impacts associated with operations and maintenance of the tunnel would be *less than significant*.

[265] SFPUC, Noxious Weed Risk Assessment for the Mountain Tunnel Improvement Project, prepared by AECOM, 2019.

Impact BI-4. The project would not 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. (No Impact)

Construction

Much of the project construction activities occur underground, and these tunnel rehabilitation activities would have no potential to impact the migration of fish or wildlife species. Aboveground temporary staging areas would be required to construct the project; however, these staging areas are spread out along the 19-mile-long project. Each of these staging areas would be returned to near pre-project conditions following construction, except where permanent improvements would be constructed in the Priest Reservoir area. More specifically, SFPUC Standard Construction Measure 8 (see Section A.6.11, SFPUC Standard Construction Measures and Other Avoidance/Minimization Measures Included as Part of the Project) requires that upon project completion, project sites would be returned to their general pre-project condition, including regrading of the site and revegetation or repaving of disturbed areas to the extent this is consistent with SFPUC's Integrated Vegetation Management Policy. Moreover, staging areas, staged equipment, and staged materials are unlikely to create a barrier to species movement or migration, due to their relatively small size in comparison to nearby habitat in adjacent natural lands and in the Stanislaus National Forest.

The project may temporarily introduce additional noise and nighttime lighting in the vicinity of improvement, construction, and staging areas. This additional noise and lighting could result in modifications to species behavior (migrating birds in particular) in the vicinity of the project site. However, additional noise and lighting is not anticipated to result in significant impacts to migrating birds, because the project site is limited to discrete staging areas that are relatively small when compared to the amount of suitable habitat that can be used by migrating birds in the project vicinity.

Therefore, the project would have *no impact* on the movement of wildlife species and would not impede the use of native wildlife nursery sites.

Operations and Maintenance

The project would result in a limited number of new permanent features: a flow control facility on the eastern side of Priest Reservoir, a power distribution line to serve this facility, a new Priest adit and Portal (access to the existing tunnel), the spoils disposal site at Priest Reservoir, and a new nonpermeable membrane and gravel around the Second Garrote Shaft. In addition, access road improvements for the South Fork, Adit 5/6, Adit 8/9, and Priest Reservoir areas would occur along the existing road alignment. Road improvements would not hinder or alter species movement patterns, because these roads already exist, and improvements to them (e.g., turnouts, slope stabilization, rockfall hazard mitigation, and drainage features) would not introduce new barriers to wildlife movement. The flow control facility would remain in place following construction; however, the building constructed above this facility, the largest aboveground structure proposed, would be 85 feet by 85 feet and 30 feet tall, and would not be of a size or height that could substantially impede species movement or migration in the Priest Reservoir area. Based on the limited and dispersed nature of the aboveground project components, the project would not create any barriers to the movements of terrestrial or flying animals. In addition, the project would not permanently alter existing noise or lighting conditions in the project area that could adversely affect the movement of wildlife.

Therefore, operations and maintenance activities associated with the project would have *no impact* on the movement of wildlife species and would not impede the use of native wildlife nursery sites.

Impact BI-5. The project could conflict with local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance. (Less than Significant with Mitigation)

Construction

The proposed project was reviewed against the Tuolumne County General Plan, Chapter 16: Natural Resources. The Natural Resources Element lays out policies and goals for the County. Goal 16A addresses balancing property rights with conservation of the environment, notably preservation of native oak woodlands; Goal 16B addresses how Tuolumne County will support the diversity and quality of biological resources and presents various policies that describe county processes for evaluating proposed actions for their effect on the diversity and quality of biological resources such as oak woodlands, wetlands, and sensitive species.

Policy 16.B.5[266] requires the county to evaluate and mitigate impacts to biological resources, consistent with the requirements of state and federal law, which is consistent with impact evaluation and mitigation (where warranted) discussions presented above for sensitive species (Impact BI-1), sensitive natural communities (Impact BI-2) and jurisdictional wetlands (Impact BI-3) found at the project site. Policy 16.B.j details the process for evaluating impacts to oak woodlands and mitigation proposed for losses of oak woodlands, and Policy 16.C.5 sets out methods for encouraging conservation of oak woodlands throughout Tuolumne County. Project design and best management practices as well as the development of **Mitigation Measure M-BI-2** are consistent with these policies, specifically the requirements for avoiding and minimizing effects to oak woodlands as well as mitigating unavoidable losses. Therefore, the project would not conflict with Tuolumne County's Policy 16.B.

Policy 16.A.6[267] states a county intention to "encourage the protection of clusters of native trees and vegetation and outstanding individual native and nonnative trees which help define the character of Tuolumne County" through the implementation of various programs. These programs include establishing an incentive program to retain existing vegetation, establishing a heritage tree program, and maintaining the County's "Premature Removal of Native Oak Trees Ordinance." The Tuolumne County Oak Tree Ordinance (Ordinance 2903) protects oak trees in Tuolumne County from premature removal.[268] Mariposa County does not have a similar ordinance in its county code. The Tuolumne County premature removal of oak trees ordinance (chapter 9.24) would not apply to the project, because the project is not a land development project requiring approval from the county. Furthermore, the ordinance provides exemptions for projects, such as the proposed project, that require permits from the California Department of Fish and Wildlife. Nonetheless, this analysis reviews whether project activities are consistent with the intent of local codes and ordinances related to natural resources. The project would be considered to conflict with the local policies or ordinances protecting oak trees if it were to cause the removal from the project site of: 1) more than 10 percent of the canopy cover of oak woodlands, 2) old growth oak trees, or 3) valley oak trees measuring 5 inches or greater in diameter at breast height. Based on current design, project construction would result in the removal of 31 old growth oak trees from the project site, which conflicts with the Tuolumne County Oak Tree Ordinance's prohibition against the premature removal of old growth oak trees. **Mitigation Measure M-BI-2** would require the SFPUC to contribute to the U.S. Forest Service's Rim Fire Restoration Program, Deer Enhancement Component, and

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266 Tuolumne County, Tuolumne County General Plan, 2018, *https://www.tuolumnecounty.ca.gov/DocumentCenter/View/11752/Vol-I-Goals-Policies-Policies-Final*, accessed May 7, 2019.

267 Tuolumne County, Tuolumne County General Plan, 2018, *https://www.tuolumnecounty.ca.gov/DocumentCenter/View/11752/Vol-I-Goals-Policies-Policies-Final*, accessed May 7, 2019.

268 Tuolumne County Oak Tree Ordinance 2903, *https://www.tuolumnecounty.ca.gov/190/Oak-Conservation*.

would result in the enhancement of oak woodland habitat as compensation for lost oak trees and oak woodland areas at the project site. Therefore, with the implementation of **Mitigation Measure M-BI-2**, the proposed project would not conflict with any local policies or ordinances intended to conserve oak woodlands and native oak trees, such as the Tuolumne County Oak Tree Ordinance (Ordinance 2903) and Policy 16.A.6 of the General Plan, and impacts would be *less than significant with mitigation*.

Operations and Maintenance

Operation and maintenance activities would not be considered land development projects but could potentially require hazard tree removals. Because the Tuolumne County premature removal of oak trees ordinance is generally limited to land development projects requiring local discretionary approvals, operations and maintenance activities associated with the proposed project would also not be subject to this tree-preservation ordinance. Although maintenance of the project could occasionally require the removal of a hazard tree, for example, it would not require the large-scale removal of oak trees and therefore would not conflict with the intent of the Tuolumne County tree-preservation ordinance. In addition, because operation and maintenance of the project would not be considered "land development," this aspect of the project would not conflict with the intent of General Plan Policy 16.A.6. Furthermore, hazard trees are exempt from consideration as trees at risk for premature removal under the County Oak Tree Ordinance because they pose a risk to public safety. As a result, operation and maintenance activities associated with the project that may require the removal of hazard trees would not conflict with the intent of local policies or ordinances protecting biological resources, and the impact would be *less than significant*.

Impact BI-6. The project would not conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan. (No Impact)

The project is not within any Habitat Conservation Plans, Natural Community Conservation Plans, or other approved local, regional, or state habitat conservation plans. The project would therefore not conflict the provisions of any of these plans and would have *no impact.*

Impact C-BI. The proposed project, in combination with reasonably foreseeable future projects in the vicinity of the project site, would result in a significant cumulative impact to biological resources. (Less than Significant with Mitigation)

Construction

Reasonably foreseeable future projects in the vicinity of the proposed project are detailed in Table B-1. SFPUC projects in this table take place in the same location or immediately adjacent to the proposed project, including the Early Intake Dam and Bridge Rehabilitation Project, Reliable Power Project, Intake Switchyard Slope Stabilization Project, and Transmission Line Clearance Mitigation Project. These projects may have potential construction-related impacts to special-status species, sensitive natural communities, wetlands, and trees similar to those of the proposed project. The primary cumulative effect of these SFPUC projects and the proposed project on biological resources would be alteration of natural habitats through ground-disturbing activities; disturbance to wildlife behaviors, such as nesting; or injury to special-status wildlife. This could be a potentially significant impact. However, similar to the proposed project, other SFPUC facility improvements would implement mitigation measures and SFPUC Standard Construction Measures (described above), which include provisions to protect biological resources, would comply with state and federal regulations that require preservation and management of sensitive biological resources, and, if necessary, obtain permits that will include review and approval by regulatory agencies (i.e., the U.S. Army Corps of Engineers, Regional Water Quality Control Board, and California

Department of Fish and Wildlife). Therefore, these projects, together with the proposed project would have a less-than-significant cumulative effect on biological resources.

The U.S. Forest Service Rim Fire Reforestation Project may have temporary impacts to biological resources during construction/recovery activities but would have a net beneficial effect on biological resources because it seeks to rehabilitate the affected ecosystem. During the short-term construction period, this project may, however, combine with the SFPUC projects above to result in temporary but potentially significant cumulative impacts to biological resources. In addition, several other projects in the greater area, such as the Rim Range Infrastructure Phase II Project and the Feretti Non-Motorized Trails Project, may also contribute to similar impacts on biological resources, such as potential habitat modification and disturbance to wildlife behavior during construction, resulting in a potentially significant cumulative impact.

However, because the proposed project includes SFPUC Standard Construction Measures, and because it would adhere to state and federal regulations for biological resources, obtain necessary permits, and implement **Mitigation Measures M-BI-1a through M-BI-1c, and M-BI-2,** its contribution to potentially significant cumulative effects on biological resources would be less than cumulatively considerable.

Operations and Maintenance

With the exception of the Reliable Power Project, none of the other cumulative projects involve operational impacts. The Reliable Power Project includes ongoing maintenance activities, including vegetation management and repair and replacement of culverts associated with transmission line access roads. This project could combine with the proposed project to result in temporary cumulative impacts from operations and maintenance. As described in Impacts BI-1 through BI-6, project-related impacts to biological resources from operations and maintenance would be similar to existing impacts for ongoing operations and maintenance at the tunnel. Therefore, impacts from operations and maintenance activities associated with the project would be comparable to existing operations and maintenance associated with the tunnel and would not contribute to significant cumulative impacts.

Additional Discussion Provided for Informational Purposes

Rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*) are recreationally important species that inhabit the Upper Tuolumne River. Because these species have no special-status designation, this information is provided solely for informational purposes and is not used to determine the significance of the environmental impacts of the project under CEQA.

As described under Impact HY-1 in Section E.15, Hydrology, under certain operating conditions the proposed project would result in reduction of Tuolumne River flows of up to 8 cubic feet per second between Kirkwood Powerhouse and Don Pedro Reservoir. These flow reductions could result in increased water temperature and reduced habitat area (as indicated by suitable depth and velocity).

Flow, water temperature, and flow-dependent habitat availability (i.e., habitat area) analyses were conducted to identify potential effects of flow changes on rainbow trout and brown trout or their habitat. The analyses focused on the Kirkwood Reach (the 1.5-mile-long reach between the Kirkwood Powerhouse tailrace and the Cherry Creek confluence). As explained under Impact HY-1 in Section E.15, Hydrology, because the average monthly flow in the Tuolumne River is greater below the Cherry Creek confluence—due to the addition of releases from Cherry and Eleanor reservoirs and from Holm Powerhouse—flow reduction effects would be greatest in this area. The analyses of flow illustrate that, during most months, the proposed project would result in differences in simulated flow compared to existing conditions. The analyses also demonstrate that these flow differences are very small (a maximum daily change of 8 cubic feet per second, which is generally less than a 2 percent change in monthly average flow) regardless of when they occur. These flow changes would result in slight increases and decreases in usable habitat area for rainbow trout and brown trout, depending on the total river reach flow when reductions of 8 cubic feet per second occur. Estimated usable habitat area for rainbow trout could increase up to about 4.7 percent for juveniles and about 1.2 percent for adults, and decrease up to about 0.1 percent for juveniles and about 5.7 percent for adults.[269] Estimated usable habitat area for brown trout could increase up to about 4.7 percent for juveniles and about 4.3 percent for adults, and decrease up to about 0.2 percent for juveniles and about 0.2 percent for adults.[270] Water temperature analyses also show that water temperatures under existing conditions do not exceed the upper tolerance value for rainbow trout and brown trout residency, but sometimes exceed the spawning and incubation tolerance values. For those periods when a change in the Tuolumne River flows is expected based on the Hetch Hetchy Local Simulation Model, the proposed project is expected to typically reduce flows by less than 1 percent, which would have very minor influences on water temperatures. Water temperatures under the proposed project are estimated to increase by no more than 0.1 degrees Fahrenheit during those months with reduced flows; this increase would not result in increased exceedance of water temperature tolerance values.[271] The small flow changes of up to 8 cubic feet per second under the proposed project would result in small changes to habitat area and water temperatures, which would not substantially affect rainbow trout or brown trout.

[269] SFPUC and San Francisco Planning Department, Environmental Planning Division, Mountain Tunnel Improvements Project: Operational Flow Effects on the Tuolumne River Environment, prepared by AECOM, 2019.

[270] SFPUC and San Francisco Planning Department, Environmental Planning Division, Mountain Tunnel Improvements Project: Operational Flow Effects on the Tuolumne River Environment, prepared by AECOM, 2019.

[271] SFPUC and San Francisco Planning Department, Environmental Planning Division, Mountain Tunnel Improvements Project: Operational Flow Effects on the Tuolumne River Environment, prepared by AECOM, 2019.

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E.14 Geology and Soils

Topics:	*Potentially Significant Impact*	*Less than Significant with Mitigation Incorporated*	*Less-than-Significant Impact*	*No Impact*	*Not Applicable*
14. GEOLOGY AND SOILS					
Would the project:					
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:	☐	☐	☒	☐	☐
i) 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.					
ii) Strong seismic ground shaking?					
iii) Seismic-related ground failure, including liquefaction?					
iv) Landslides?					
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☒	☐	☐
c) 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 off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☐	☒	☐	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☒	☐	☐
e) 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 waste water?	☐	☐	☐	☐	☒
f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☒	☐	☐

The project would not include the use of septic tanks or alternative onsite wastewater disposal systems; therefore, criterion 14(e) is *not applicable*, and is not discussed further in this section.

Impact GE-1. The project would not expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, involving rupture of a known earthquake fault, seismic ground shaking, or seismically induced ground failure or landslides. (Less than Significant)

Phase I and phase II geotechnical data reports were prepared[272,273] to investigate the geologic conditions in the vicinity of the Mountain Tunnel project and to guide the design, engineering, and construction of

[272] McMillen Jacobs Associates and GEI Consultants, Mountain Tunnel Improvements Project Phase I Geotechnical Data Report, Final Revision No. 1, 2017.

[273] McMillen Jacobs Associates and GEI Consultants, Mountain Tunnel Improvements Project Phase 1 and 2 Geotechnical Data Report, Draft Revision No. 0a, 2018.

the proposed improvements. The geotechnical reports included field exploration, site-specific geologic mapping, seismic research, on-site borehole testing, and laboratory testing of borehole samples. A summary of the results of the seismic data and geologic mapping, as relevant to this analysis, is presented below.

Surface Fault Rupture

As shown in the geotechnical reports prepared for the project, none of the proposed improvement, construction, or staging areas are in or adjacent to a fault designated under the Alquist-Priolo Earthquake Fault Zoning Act[274] (California Public Resources Code sections 2621–2630). Due to the age of last known activity on the faults that cross underneath the Mountain Tunnel (i.e., Kassabaum lineament, Calaveras Shoo Fly Thrust, Sonora Fault, and Melones Fault), these faults are not considered active or potentially active by the California Geological Survey, and it is unlikely that surface fault rupture would occur on these faults.

The proposed project would not be exposed to surface fault rupture from known faults in the area and is being designed to account for existing geologic conditions (based on results of the site-specific geotechnical reports) in accordance with SFPUC Standard Construction Measure 1, which requires that the engineering and design of the project account for and minimize risks from geological hazards at the project site (see Section A.6.11, SFPUC Standard Construction Measures and Other Avoidance/ Minimization Measures Included as Part of the Project); it would therefore have a *less-than-significant* impact related to exposure to, or exacerbation of, surface fault rupture.

Ground Shaking

"Active" faults are the most likely to result in surface ground rupture and strong seismic ground shaking; faults are classified as "active" if they have exhibited evidence of movement during the Holocene epoch (i.e., 11,700 years Before Present [B.P.] to Present Day). Faults are classified as "potentially active" if they have exhibited evidence of movement during the Quaternary period (i.e., 2.6 million years B.P.). The faults underlying the project site are not considered "active" or "potentially active" by the California Geological Survey; therefore, there is a lower potential for these faults to generate earthquakes. However, 10 minor earthquakes (magnitude 2.5 to 4.0) have been recorded in the project vicinity; three of these earthquakes occurred near Early Intake, and one occurred near Rainbow Pool. Because there are known faults crossing the Mountain Tunnel that are of Paleozoic to Mesozoic age (older than the Quaternary period), a small number of low-magnitude earthquakes were measured in the project area, and a potentially active fault is approximately 8 miles west of the project area in the Foothills Fault System, the project area could experience a minor earthquake (i.e., Magnitude 4.0 or less) during the life of the project facilities. The proposed aboveground building over the flow control facility at Priest Reservoir would not expose people or structures to substantial adverse effects from ground shaking, because the structure would be constructed pursuant to seismic design and engineering requirements of the California Building Standards Code, as specified in the project construction drawings. New underground facilities involving a substantial amount of construction (i.e., the South Fork Siphon extension, the new flow control facility, and new adits and shafts), would be constructed in stable bedrock, which would reduce the effects of ground shaking; because the facilities would be below ground, they would not pose a substantial risk for life or property if damaged during ground shaking. The new electrical line installed along the northern and eastern sides of Priest Reservoir to serve the flow control facility would not be

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[274] California Geological Survey, Alquist-Priolo Earthquake Fault Zone Maps, 2017, *http://maps.conservation.ca.gov/cgs/informationwarehouse/index.html?map=regulatorymaps*, accessed August 3, 2018.

adjacent to people or structures; therefore, a substantial adverse effect would not result if this line were temporarily disrupted due to ground shaking. Staging areas and the temporary facilities at these areas (e.g., the water treatment plants, grouting plants, and the rock crushing plant) would be used only during the project's construction phase, and a minor earthquake would not result in a substantial risk to life or property, given that few people would be near this equipment at any one time, and the equipment would not likely be toppled by a minor earthquake.

SFPUC completed phase I and II geotechnical reports, identifying potential risks that will be accounted for in project design and engineering as required by SFPUC Standard Construction Measure 1. In addition, project structures would be designed to satisfy the engineering requirements of the California Building Standards Code, which are specifically intended to reduce damage from seismic hazards to the maximum extent practicable. Use of the California Building Standards Code design requirements is specified on the project construction drawings. Accordingly, the proposed project would have a *less-than-significant* impact related to exposure to, or exacerbation of, seismic ground shaking.

Liquefaction, Lateral Spreading, and Earthquake-Induced Settlement

Liquefaction, lateral spreading, and settlement could represent a hazard in areas that are prone to strong seismic ground shaking and where loose, unconsolidated, water-saturated sediments (generally of recent geologic age) are present within 50 feet of the ground surface. Except for Staging Areas A8/9-3, A8/9-5, and A8/9-6, proposed improvement, construction, and staging areas are in Mesozoic- to Paleozoic-age bedrock. The results of tests from core drilling indicated that the Mountain Tunnel facilities are in hard to very hard bedrock with high compressive strengths.[275] The Mehrten Formation, where the above three staging areas would be located, consists primarily of very hard deposits of volcanic origin. Furthermore, as discussed above, there is a low likelihood that project-related facilities would be subject to strong seismic ground shaking. Therefore, project improvement, construction, and staging areas would not be subject to hazards from liquefaction, lateral spreading, or earthquake-induced settlement, and there would be *no impact.*

Seismically Induced Landslides

The project area has not yet been mapped for seismically induced landslide hazards under the Seismic Hazards Mapping Act.[276] However, based on observations by SFPUC personnel and AECOM staff (on behalf of the San Francisco Planning Department) during site visits, the steep hillsides in the vicinity of Early Intake Adit, South Fork, Adit 8/9, Adit 5/6, and Rickson Road (at Priest Reservoir) are locally unstable. Landslides, mudslides, and rockfalls have been known to occur along the access roads in these areas, particularly during the winter months following periods of heavy rainfall. Areas with little or no vegetation, or where vegetation regrowth has been slow following the Rim Fire, are particularly susceptible to landslides. A moderate to large earthquake in the project area could increase the potential for landslide hazards. The proposed project includes roadway improvements that are specifically designed to reduce localized landslide hazards in areas prone to slides and rockfalls. As described in detail in Section A, Project Description (Table A-1), landslide and rockfall protection measures would include drilled and grouted rock dowels in key blocks, draped mesh, post-mounted cable net, flexible barrier, or anchored mesh. Additional stabilization measures in some locations would include drilled and grouted lateral anchors through the rocks walls and a permanent facing, such as shotcrete or rockfall

[275] McMillen Jacobs Associates and GEI Consultants, Mountain Tunnel Improvements Project Phase I Geotechnical Data Report, Final Revision No. 1, Figures 4-27 through 4-37 and Appendix B-1, 2017.

[276] Public Resources Code sections 2690–2699.6. Enacted in 1990, the Seismic Hazards Mapping Act established a mapping program for areas that have the potential for liquefaction, landslide, strong ground shaking, or other earthquake and geologic hazards.

mesh. Furthermore, retaining walls and gabion embankments would be constructed in several locations along access roads to reduce risks from slope instability. The proposed drainage features along access roads would also help provide additional stability by reducing erosion. In addition, the SFPUC may perform remedial slope stabilization across from the Early Intake Switchyard prior to start of construction.

As described above for other types of seismic and geotechnical hazards, the proposed project improvements have been designed and engineered to account for existing geologic conditions (based on site-specific geotechnical reports), standard engineering practices, and the California Building Standards Code to reduce risks to life and property. Therefore, project implementation would have a *less-than-significant* impact related to exposure to, or exacerbation of, seismically induced landslides.

Impact GE-2. The project would not result in substantial soil erosion or the loss of topsoil. (Less than Significant)

Project-related construction activities, particularly those related to proposed access road improvements and material stockpiles, would expose soil and stockpiled materials such as sand and aggregate road base to rain events, which could mobilize loose materials and result in soil erosion. Subsequent soil and material transport during storm events could result in sedimentation downstream of the project improvement, construction, and staging areas. Furthermore, earthmoving activities during the summer months could result in wind-generated erosion. These potential effects would be lessened through the implementation of best management practices required as part of the proposed project. SFPUC Standard Construction Measure 3 (see Section A.6.11, SFPUC Standard Construction Measures and Other Avoidance/Minimization Measures Included as Part of the Project) includes both temporary and permanent erosion and sedimentation controls, as appropriate, tailored to each proposed project construction and staging area—such as fiber rolls and/or gravel bags around stockpiles and newly created steep slopes, and revegetation of exposed soil areas—which would minimize the potential for soil erosion during construction. SFPUC would also develop and implement a Stormwater Pollution Prevention Plan, in accordance with Central Valley Regional Water Quality Control Board requirements. The Stormwater Pollution Prevention Plan would include a site map and description of construction activities and would identify best management practices that would be employed to prevent soil erosion.

With the exception of two of the staging areas (i.e., PP-S6 and PP-S15, discussed below), the power line alignment in the Priest Portal area, road improvement areas, and the Second Garrote area (see Section A.6.10, Surface Restoration and Revegetation), all other improvement, construction, and staging areas would be restored to pre-project conditions and contours following construction. The proposed project also includes installation of drainage features along the improved access roads, which would convey natural runoff from surrounding hillsides. New and extended culvert outfalls would be protected by installing armored discharge pads (e.g., rock riprap). The proposed drainage improvements would reduce stormwater erosion on the roads associated with construction and would reduce erosion in the future during the operational life of the project. The proposed project also includes installation of drainage culverts to convey natural runoff from the surrounding hillside at entrances of Adits 5/6 and 8/9 (see Section A.5.8, Drainage Improvements Outside Adits 5/6 and 8/9). These culverts would prevent further erosion during the operational phase of the project and would also protect the adit entrances from being blocked by debris.

Where possible, spoils generated by project excavations would be used as fill for project improvements (see Section A.6.8, Excavation, Stockpiling and Disposal of Spoils). All other project spoils would be transported to a disposal area at PP-S6 near Priest Reservoir. The disposal site at PP-S6 is on moderately sloping topography, and therefore the proposed project includes excavation to create a stable base for spoils disposal. A rock crushing plant would be temporarily located at Priest Reservoir, and disposal materials from this facility could be transported to the disposal area via a conveyor or by trucks along Rickson Road. The material would be compacted in layers, and the side slopes of the fill embankment would be a maximum slope ratio (horizontal distance to vertical distance) of 2 to 1. The spoils disposal site at Priest Reservoir would receive approximately 126,010 cubic yards of material. Although the overall elevation of the spoils disposal site would increase, the side slopes of the fill embankment would be no more than 2 to 1, which would help to reduce the erosion potential during the project's operational phase.

As discussed in Section A.7.3, Flow Control Facility Operations and Maintenance, the flow control facility shaft and the new Priest Adit at Priest Reservoir (PP-S15 and PP-S6) are expected to collect clean groundwater inflow; this water would be pumped to the surface and discharged overland (see Section E.15, Hydrology and Water Quality, for additional detailed discussion). This water would be collected by discharging in catch basins and flow dispersion trenches at the top of the flow control facility shaft and Priest Portal Adit outlet, respectively. To avoid erosion, the water flow would be dissipated by discharging through the dispersion trenches overland onto the graded surface (overlain with crushed gravel). The area along the new power line and around each of the new support poles on the northern and eastern sides of Priest Reservoir would be cleared for maintenance access and to reduce fire risks. Clearing to the natural surface would not result in substantial soil erosion or loss of topsoil, because the area is protected by surrounding vegetation.

The installation of a nonpermeable membrane and gravel around the Second Garrote shaft would help prevent stormwater from entering the Second Garrote Shaft. This project component would not result in substantial soil erosion or loss of topsoil, because the work area surrounding Second Garrote would be covered by the nonpermeable membrane and gravel.

Therefore, the impact of construction, operation, and maintenance of the project on substantial soil erosion would be *less than significant*.

Impact GE-3. The project would not expose people or structures to potential substantial adverse effects from landslide hazards or other unstable geologic conditions. (Less than Significant)

As discussed in detail under Impact GE-1, Seismically Induced Landslides, the steep hillsides in the vicinity of Early Intake, South Fork, Adit 8/9, Adit 5/6, and Rickson Road (at Priest Reservoir) are susceptible to local landslide or rockfall hazards, based on observations by SFPUC personnel and AECOM staff (on behalf of the San Francisco Planning Department) during site visits. As discussed in detail under Impact GE-1, Seismically Induced Landslides, above, landslide and rockfall protection measures would be implemented as part of the proposed project along access roads to reduce landslide and rockfall hazards.

In addition to landslides, unstable conditions related to underground facility improvements could include excessive fractures in the bedrock, a low rock quality designation, low rock strength, and high hydraulic conductivity, as identified in the site-specific phase I and II geotechnical reports. The proposed project includes the following underground improvements to the existing tunnel: debris removal, lining repairs, invert paving, steel lining placement, and pressure grouting. The proposed project also includes major new underground facilities at the South Fork Crossing (siphon extension and shaft, as described in Section A.5.4) and at Priest Reservoir (flow control facility and new Priest portal and adit, as described in Section A.5.6 and Section A.5.7, respectively).

The phase I and II geotechnical reports included field exploration, site-specific geologic mapping, seismic research, on-site borehole testing, and laboratory testing of borehole samples obtained from nine locations in the project area. Laboratory test results indicated that in general, the rocks are not highly fractured, with the vast majority of the core samples exhibiting two or fewer fractures per foot. The majority of the rock has a rock-quality designation considered good to excellent. The average compressive strength of 67 total samples tested can be classified as strong to very strong. The laboratory test results indicate that the rocks generally exhibit low hydraulic conductivity; however, high conductivity zones do occur locally along the alignment (for example, in a fractured rock zone east of the South Fork Siphon).[277]

As described in Impact GE-1, landslide and rockfall protection measures would be implemented as part of the proposed project to reduce localized landslide and rockfall hazards; project implementation would therefore have a *less-than-significant* impact.

Impact GE-4. The project would be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code, but would not create substantial risks to life or property. (Less than Significant)

A review of U.S. Natural Resources Conservation Service[278] soil survey data indicates that portions of some of the access roads and staging areas are located in Josephine Family and Holland Family soils, which have a moderate shrink-swell potential. However, most staging areas would require minor to no excavation or grading. Most staging areas (exceptions discussed below) would be used solely for materials and equipment storage, and therefore expansive soils would not represent a hazard to life or property. The proposed widening, culvert/drainage feature installation, and graveling would not subject the existing access roads to additional hazards from expansive soil. Pursuant to SFPUC Standard Construction Measure 1, any road paving that would occur in areas of moderate shrink-swell potential would be guided by standard engineering methods.

The proposed project would include construction of various structures at Priest Reservoir, including a flow control facility, adit, and portal.

The geotechnical investigations, phases I and II, included numerous borings and samples at the location of this structure and the Priest Reservoir area. The borings and samples found a surface layer of decomposed rock of thicknesses ranging from several inches to 24 inches overlying hard rock. No expansive soils were found.

In summary, project implementation would have a *less-than-significant* impact related to expansive soils.

Impact GE-5. The project would not directly or indirectly destroy a unique paleontological resource or site or unique geologic feature (Less than Significant)

In its standard guidelines for assessment and mitigation of adverse impacts on paleontological resources, the Society of Vertebrate Paleontology[279] established three categories of sensitivity for paleontological resources: high, low, and undetermined. Areas where fossils have been previously found are considered to have a high sensitivity and a high potential to produce fossils. Areas that are not sedimentary in origin and that have not been known to produce fossils in the past typically are considered to have low sensitivity. Areas that have not had any previous paleontological resource surveys or fossil finds are

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277 McMillen Jacobs Associates and GEI Consultants, Mountain Tunnel Improvements Project Phase I Geotechnical Data Report, Final Revision No. 1, 2017.

278 United States Natural Resources Conservation Service, Soil Survey Data, Central Sierra Foothills Area and Stanislaus National Forest, Web Soil Survey, 2017, *https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm*, accessed August 7, 2018.

279 Society of Vertebrate Paleontology, Assessment and Mitigation of Adverse Impacts to Nonrenewable Paleontologic Resources—Standard Guidelines, *Society of Vertebrate Paleontology News Bulletin* 163:22–27, 1996.

considered to be of undetermined sensitivity until surveys and mapping are performed to determine their sensitivity. In keeping with the significance criteria of the Society of Vertebrate Paleontology, all vertebrate fossils are generally categorized as being of potentially significant scientific value.

The paleontological sensitivity of the project component areas is summarized in Table E.14-1. Of the proposed improvement, construction, and staging areas, three staging areas are in an area of high paleontological sensitivity.

Table E.14-1
Paleontological Sensitivity Assessment

Project Component	Formation Name and Age	Composition	Fossils	Sensitivity
Staging Areas A8/9-3, A8/9-5, and A8/9-6	Mehrten Formation, Pliocene-Miocene	Consists primarily of volcanic (andesitic) sandstone, siltstone, and lenses of conglomerate. Also includes volcanic breccia, tuff-breccia, and tuff of mudflow origin	Contains vertebrate fossils and fossils of plant assemblages	High
Early Intake, South Fork, Adit 8/9,[1] Adit 5/6, Second Garrote Shaft, Big Creek Shaft, portions of Priest Reservoir	Mafic Plutonic and Granitic rocks, Mesozoic	Gabbro, granite, and granodiorite form when magma cools and solidifies below the earth's surface	No fossils	Low
Priest Reservoir	Sullivan Creek Terrane, Jurassic	Highly metamorphosed rock formation containing primarily greenschist, with smaller amounts of argillite, mudstone, sandstone, limestone, and volcanic debris	Locally contains fossils of marine invertebrates such as clams and mollusks	Low

Note:

1 Except for Staging Areas A8/9-3, A8/9-5, and A8/9-6

Sources: University of California Museum of Paleontology, Paleontological Collections Database, 2018; Olmsted, F.H., and G.H. Davis, Geologic Features and Ground-Water Storage Capacity of the Sacramento Valley California, U.S. Geological Survey Water-Supply Paper 1497, pp. 37, 59, Washington, D.C., 1961; and Jefferson, G.T., *Technical Report No. 7: A Catalogue of Late Quaternary Vertebrates from California – Part Two: Mammals*. Natural History Museum of Los Angeles County, California, 1991.

Due to the number of vertebrate and plant fossils that have been recovered from the Mehrten Formation, it is considered paleontologically sensitive. However, no excavation is proposed at the three staging areas (A8/9-3, A8/9-5, and A8/9-6) that are in the Mehrten Formation. Furthermore, reconnaissance-level site visits at Staging Areas A8/9-3, A8/9-5, and A8/9-6 did not identify any fossil resources on the ground surface. Therefore, project implementation would have a *less-than-significant* impact on unique paleontological resources.

Impact C-GE. The project, in combination with reasonably foreseeable future projects, would not result in a significant cumulative impact related to geologic hazards or paleontological resources. (Less than Significant)

The geographic scope for potential cumulative impacts related to geology and soils is site-specific because the potential hazards related to seismicity, soil erosion, and expansive and unstable soils are based on local, site-specific geologic conditions. Geologic and soil conditions inherent at the project site would not contribute to geologic and soil conditions or related hazards at other proposed project improvement, construction, and staging areas considered in this cumulative analysis, because the engineering and design requirements that would allow any particular project to proceed are site-specific, and such requirements are based on the different soils and geologic conditions found at each different project location throughout the earth's surface. Therefore, the proposed project and the other projects considered in this cumulative analysis would not combine to create cumulative impacts, and a significant cumulative impact related to seismic, soils, and geologic hazards would not occur.

Project-related excavation activities would not take place in the paleontologically sensitive Mehrten Formation, and a site-specific survey found no fossil resources on the surface of the Mehrten Formation where project-related activities would occur. Because the proposed project would not contribute to a cumulative impact on paleontological resources, a significant cumulative impact on unique paleontological resources would not occur.

E.15 Hydrology and Water Quality

Topics:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Not Applicable
15. HYDROLOGY AND WATER QUALITY					
Would the project:					
a) Violate any water quality standards or waste discharge requirements?	☐	☐	☒	☐	☐
b) 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 pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☒	☐	☐
c) 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-site?	☐	☐	☒	☐	☐
d) 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-site?	☐	☐	☒	☐	☐
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☒	☐	☐
f) Otherwise substantially degrade water quality?	☐	☐	☐	☒	☐
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other authoritative flood hazard delineation map?	☐	☐	☐	☐	☒
h) Place within a 100-year flood hazard area structures that would impede or redirect flood flows?	☐	☐	☐	☐	☒
i) 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?	☐	☐	☒	☐	☐
j) Expose people or structures to a significant risk of loss, injury or death involving inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☒	☐

The proposed project does not involve the construction of any housing; therefore, significance criterion 15(g) is *not applicable*, and is not discussed further in this section. In addition, the proposed project does not involve the construction of structures in a 100-year floodplain that would impede or redirect flood flows. Therefore, significance criterion 15(h) is *not applicable*, and is not discussed further in this section.

Hydrologic Setting

Hydrology in the Tuolumne River Watershed

The project is in the Tuolumne River watershed, which encompasses 1,958 square miles and includes portions of Yosemite National Park, Emigrant Wilderness, and the Stanislaus National Forest. The Tuolumne River originates in Yosemite National Park and flows approximately 150 miles to its confluence with the San Joaquin River. The San Joaquin River flows north to the Sacramento-San Joaquin Delta, and then to the San Francisco Bay Estuary and the Pacific Ocean. The Tuolumne River headwaters are composed of small streams that descend the slopes of Mount Lyell and Mount Dana in Yosemite National Park; these streams join to form the river itself at Tuolumne Meadows. There are four impoundments on the Tuolumne River: O'Shaughnessy Dam (forming Hetch Hetchy Reservoir), upstream from the project area; Early Intake Diversion Dam (forming the Early Intake Reservoir), in the project area; and New Don Pedro Dam (forming Don Pedro Reservoir) and La Grange Dam (forming La Grange Reservoir), downstream from the project area. Six miles below Hetch Hetchy Reservoir, the Tuolumne River leaves Yosemite National Park and enters the Stanislaus National Forest. Except for the short reach at Early Intake Reservoir, the river flows unimpeded through a deep canyon for approximately 40 miles from Hetch Hetchy to the upstream end of Don Pedro Reservoir.

There are several tributary streams in the project region, including Cherry Creek, Jawbone Creek, the Middle and the South Fork of the Tuolumne River, the Clavey River, Indian Creek, Big Creek, the North Fork Tuolumne River, Turnback Creek, Deer Creek, and Moccasin Creek.

The hydrology of the Tuolumne River basin is dominated by snowmelt runoff, which typically occurs during the April through July time period. Throughout the wet season, rainfall events at lower elevations, primarily in the Sierra foothills and the valley floor, trigger runoff events. Median annual runoff in the Tuolumne River basin is 1.68 million acre-feet and historically has varied from 0.38 million acre-foot to 4.81 million acre-feet.

Peak flows associated with floods on the mainstem Tuolumne River and South Fork Tuolumne River occur under several conditions, the most common of which are winter and spring rainstorms. The largest flood events are the result of winter storms (i.e., during large winter rainstorms when antecedent melting snowpack conditions in the upstream reaches add to the total runoff). Seasonal peak flow events are driven by spring snowmelt events in the upper elevations.

Tuolumne River Flows below Kirkwood Powerhouse[280]

Changes to the Tuolumne River as a result of the proposed project would affect the river between the Kirkwood Powerhouse and Don Pedro Reservoir. As seen in Figure A-13 (Section A, Project Description), this area consists of the "Kirkwood Reach" between the Kirkwood Powerhouse tailrace and the confluence of the Tuolumne River and Cherry Creek; and the "Below Cherry Creek Confluence" reach between the confluence and Don Pedro Reservoir. To define existing conditions in this portion of the Tuolumne River, the SFPUC analyzed 47 years of hydrologic data using the Hetch Hetchy Local Simulation Model, a deterministic mass balance model that simulates the operation of storage and facilities in the Regional Water System.

The Hetch Hetchy Local Simulation Model simulates the operations of the Regional Water System, including reservoirs, water treatment plants, powerhouses, pipelines, and diversions from Hetch Hetchy Reservoir, including flow through the Canyon Power and Mountain Tunnels. This model uses historic

[280] Information on Tuolumne River flows are based on the SFPUC, Mountain Tunnel Improvements Project – Operational Flow Memorandum, February 21, 2019.

hydrologic conditions, system configuration, capacities, water supply demand, and operating rules to simulate Regional Water System operations given an introduced limitation or change to the Regional Water System. This modeling approach allows for comparison of a baseline condition to an alternative condition. In this case, the SFPUC used the model to evaluate the potential effect of the project on the flows in the Tuolumne River below Kirkwood Powerhouse, assuming that the baseline flow capacity of the Mountain Tunnel of 670 cubic feet per second would be increased to a capacity of 678 cubic feet per second. Although the model simulates the Regional Water System and releases of Kirkwood Powerhouse to the Tuolumne River, it does not account for the natural flow existing on the Tuolumne River. To calculate the total Tuolumne River flow below Kirkwood Powerhouse, the SFPUC calculated natural flow and added it to the model's simulated release from Kirkwood Powerhouse. The SFPUC's comparison of the total flow condition was intended to provide the context for changes in the river system. The SFPUC also calculated the total flow on the Tuolumne below the confluence of Cherry Creek (a primary tributary) to add additional context regarding the geographic extent of measurable changes in flow. This total flow condition was calculated by the SFPUC to estimate the existing conditions and to compare the estimated total flow condition that could result with the implementation of the project. The results of this analysis are summarized under Impact HY-1, below.

Water Quality

The federal Clean Water Act defines water quality standards as including both "designated uses" (i.e., beneficial uses) and "water quality criteria" (i.e., water quality objectives). The applicable standard used for the proposed project is the Central Valley Regional Water Quality Control Board's Basin Plan,[281] which lists the following beneficial uses for the Tuolumne River from the source to Don Pedro Reservoir (which includes the project area): municipal and domestic water supply, agricultural irrigation and stock watering, industrial power generation, water contact and nonwater contact recreation, warm and cold freshwater habitat, and wildlife habitat. California adopts water quality standards to protect beneficial uses of waters of the state as required by section 303(d) of the federal Clean Water Act and the state Porter-Cologne Water Quality Control Act.

The State Water Resources Control Board identifies waters failing to meet standards for specific pollutants, which are then listed in accordance with Clean Water Act section 303(d). If it is determined that waters of the state are impaired for one or more constituents and the standards cannot be met through point source or nonpoint source controls (i.e., National Pollutant Discharge Elimination System permits or Waste Discharge Requirements), the Clean Water Act requires the establishment of total maximum daily loads. To identify candidate water bodies for total maximum daily load analysis, a list of water-quality-impaired segments is generated by the State Water Resources Control Board. These stream or river segments are impaired by the presence of pollutants and are more sensitive to disturbance because of this impairment.

The Tuolumne River from Don Pedro Reservoir to Hetch Hetchy Reservoir does not have any pollutants listed on the Clean Water Act section 303(d) list of impaired waterbodies.[282] However, the Tuolumne River in the project area is a designated wild and scenic river at both the state and federal level; depending on the river segment, designations include wild, scenic, and recreation.[283] Even though the Tuolumne River in the

[281] Central Valley Regional Water Quality Control Board, Water Quality Control Plan for the Sacramento River and San Joaquin River Basins, 2018, *https://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/sacsjr_201805.pdf*, accessed July 2018.

[282] State Water Resources Control Board, Final 2014-2016 California Integrated Report (Clean Water Act section 303(d) List/ Section 305(b) List), 2018, *https://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2014_2016.shtml*, accessed July 2018.

[283] Stanislaus National Forest, Decision Memorandum, Tuolumne Wild and Scenic River Management Plan Revisions, 1988, *https://www.rivers.gov/documents/plans/tuolumne-plan.pdf*, accessed July 2018.

project area is not on the Clean Water Act section 303(d) list, activities that could affect the background turbidity are a concern, particularly where persistent visible turbidity is produced during the recreation season, and especially during the low-flow summer months when background conditions would be expected to have high water clarity. One of the purposes of the federal Wild and Scenic Rivers Act is to protect the water quality of designated rivers and/or river segments.

Impact Analysis

Impact HY-1. The project would not violate any water quality standards or waste discharge requirements or create or contribute runoff water that could exceed the capacity of existing or planned stormwater drainage systems or provide substantial addition sources of polluted runoff. (Less than Significant)

Construction and Operations Effects of Project Activities at the Improvement, Construction, and Staging Areas

Stormwater Runoff and Erosion. There are no existing municipal stormwater drainage systems on or adjacent to the proposed project improvement, construction, and staging areas; therefore, the project would not create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems.

The proposed project includes installation of new culverts and water bars in several of the existing access roads, which would convey natural runoff from surrounding hillsides (see Section A.5.9, Tunnel Access Roadway and Other Drainage Improvements). Culvert outfalls would be protected by installing armored discharge pads (e.g., rock riprap). The proposed drainage improvements would reduce stormwater erosion on the roads during the critical winter shutdown windows associated with construction, thereby minimizing water quality impacts, and would reduce roadway erosion in the future during the operational life of the project. The proposed project also includes installation of drainage culverts to convey natural runoff from the surrounding hillside at the entrances to Adits 5/6 and 8/9 (see Section A.5.8, Drainage Improvements Outside Adits 5/6 and 8/9). These culverts would prevent erosion during the operational phase of the project and would also protect the adit entrances from being blocked by debris.

Water Quality Effects during Construction. An existing retaining wall would be heightened and extended along the edge of the southern portion of the South Fork Access Road next to the South Fork of the Tuolumne River to prevent the discharge of materials into the river (see Section A.5.9, Tunnel Access Roadway and Other Drainage Improvements). Also, installation of the vents on either side of the South Fork would be done primarily from inside the tunnel, and there would be a platform to prevent any construction material from falling into the river. At Priest Reservoir, the reservoir would be drawn down during the first shutdown, using best management practices between the work areas and the water's edge to prevent any discharge of construction-related contaminants to the reservoir. Subsequent shutdowns would not require draw down of the reservoir to access the tunnel, because the new Priest adit would be used. Implementation of SFPUC's Standard Construction Measures 3, Water Quality and 6, Hazardous Materials (see Section A.6.11), would include installation of both temporary and permanent erosion and sedimentation controls, as appropriate, tailored to each proposed project construction and staging area—such as fiber rolls and/or gravel bags around stockpiles and newly created steep slopes, and revegetation of exposed soil areas—along with measures intended to prevent the release of hazardous materials used during construction (such as storing materials pursuant to manufacturer recommendation, maintaining spill kits onsite, providing secondary containment, and containing any spills that occur to the extent safe and feasible, followed by collection and disposal in accordance with applicable laws), as well as the preparation of a stormwater pollution prevention plan. These measures are designed to minimize discharges of sediment and other pollutants to surface waterways.

Portions of the Mountain Tunnel have been subject to groundwater and turbid river water infiltration during operations, and one of the purposes of the proposed project is to make improvements that would permanently reduce such infiltration and protect water quality. These improvements include repairing the existing concrete lining inside the tunnel, paving the unlined tunnel invert, conducting pressure grouting, and installing a 750-foot siphon extension underground near the South Fork of the Tuolumne River. In addition, rock, sediment, and other debris that have been deposited inside the tunnel would be collected and removed.

Groundwater infiltration along the length of the Mountain Tunnel is anticipated to increase during construction activities when the tunnel is shut down due to a change in hydrostatic pressure in the tunnel. This groundwater would need to be removed to create dry working conditions for construction activities in the tunnel. Discharge of this groundwater could affect water quality of surface drainages if the groundwater were to become polluted with sediment or construction debris. Any water that comes into contact with construction activities or is produced by construction activities (e.g., excavation) is likely to have elevated pH levels and contain dissolved and suspended solids, and also may contain hydrocarbons; water that has come in contact with potential pollutants or contaminants during construction is referred to as construction water. Construction water released in the tunnel would mix with groundwater that seeps into the tunnel from the surrounding rock mass. Natural biofilm may also be present in the tunnel water. Raw water entering the tunnel from infiltration or through upstream gates is expected to be clean (i.e., uncontaminated by construction material or activities). Several measures have been developed as part of the proposed project to protect surface water quality. First, where possible, clean groundwater would be diverted out of the tunnel upstream of active construction areas before it mixes with construction water. Depending on upstream activities, potential raw water release locations include the eastern access point at South Fork Crossing, Adit 5/6, and Adit 8/9. Adits 5/6 and 8/9 each have existing blow-off valves to allow raw water discharge. Raw water from the South Fork Siphon would be pumped out of the eastern access point at South Fork Crossing and directed into the river.

As described in Section A.6.9, Water Management, any remaining water that comes into contact with construction activities or materials would be treated in accordance with applicable Basin Plan water quality standards. Water would be pumped to and collected at small treatment facilities along the tunnel (Early Intake, South Fork, Adit 5/6, or Adit 8/9) if water volumes are minimal. Treatment facilities (e.g., baker tanks) would be located on nearby staging areas or work areas, depending on space constraints. Following treatment, water from small treatment facilities at Early Intake, South Fork, Adit 5/6, or Adit 8/9 would be discharged using existing or new dissipation facilities and erosion control measures located in the project site after being tested to ensure that the water meets discharge standards. Larger volumes of construction water would flow downstream inside the tunnel and would be collected, pumped, and treated at the main water treatment plant at either Staging Area PP-S13 or Staging Area PP-S6. Following treatment, water would be discharged to Rattlesnake Creek in accordance with Central Valley Regional Water Quality Control Board discharge requirements. Discharges would be authorized under the section 401 Water Quality Certification which the SFPUC will obtain for the project. Furthermore, SFPUC would require continuous monitoring at the Priest water treatment plant during its operation to ensure treatment corrections (e.g., adding more flocculant to accommodate increased turbidity) to adhere to water quality requirements (see Section A.6.9, Water Management). The proposed project is required by law to comply with all Central Valley Regional Water Quality Control Board waste discharge requirements. All surface water originating from within or entering the limits of Staging Area PP-S13 or Staging Area PP-S6 (depending on where the treatment plant is located) would be managed using best management practices, such as installation of fiber rolls or silt fences, pursuant to SFPUC Standard Construction Measure 3 (see Section A.6.11). At the conclusion of construction activities, the main water treatment plant at the Priest Reservoir area (PP-S13 or PP-S6) and any other smaller water treatment areas in the project footprint would be removed and the affected areas would be restored to pre-project conditions.

During the construction phase, for tunnel interior improvements, grout plants would be sited at the Big Creek Shaft Staging Area BC-S2 and Second Garrote Staging Area SG-S1 for pumping grout into the tunnel. Because grout would be self-contained within a system (grout plant) and pumped down a shaft for use in repairs, it would not be exposed to surface waters that could cause a water quality concern. Washout water would be contained and hauled to the water treatment plant at either PP-S13 or PP-S6 for treatment.

Finally, trees would be removed throughout the Priest Reservoir area to accommodate new facilities, and hazard trees would be removed along tunnel access roads (see Section A.6.2, Construction Staging). In the Priest Reservoir area, trees could be mechanically removed using heavy, ground-based equipment that would be expected to create ground disturbance (e.g., a bulldozer mounted with a tree-cutting blade). Removal of trees along steep slopes and at staging areas where excavation is not proposed would be manually removed using hand-held equipment (e.g., a gas powered chainsaw); in this case, trees would be cut to the stump to avoid ground disturbance. Tree removal would require implementation of best management practices to control sediment and erosion, along with a stormwater pollution prevention plan as required by the Central Valley Regional Water Control Board, pursuant to the SFPUC's Standard Construction Measure 3 (see Section A.6.11). Best management practices could include fiber rolls or silt fences, as appropriate, tailored to each proposed project construction and staging area to minimize discharges of sediment to surface waterways.

Because SFPUC would implement its Standard Construction Measure 3 designed to prevent water quality degradation, and because SFPUC would implement onsite water quality treatment and discharges of treated water in accordance with the Central Valley Regional Water Quality Control Board requirements designed to protect water quality, the project's impact related to violation of waste discharge requirements, alteration of drainage patterns in a manner that would produce increased runoff containing increased pollutant discharges, or creation or contribution to runoff water that could exceed the capacity of existing or planned stormwater drainage systems, would be *less than significant*. Furthermore, project-related activities would not result in degradation of water quality in the Tuolumne River, a federal- and state-designated wild and scenic river.

Water Quality Effects during Operations. The proposed project includes a new flow control facility that would be installed underground near Priest Reservoir to maintain the tunnel in full flow (pressurized) conditions during normal tunnel operations. During normal project operations, the flow control facility shaft is expected to collect a clean groundwater inflow of approximately 5 gallons per minute. When valves are shut, this inflow is expected to temporarily increase to around 40 gallons per minute. During normal operations, the clean groundwater inflows in the new Priest Adit are anticipated to be between 10 and 20 gallons per minute. This water would be collected by pumping to the surface and discharging in catch basins and flow dispersion trenches at the top of the flow control facility shaft and Priest Adit outlet, respectively. To avoid erosion, the water flow would be dissipated by discharging through the dispersion trenches overland onto the graded surface (overlain with crushed gravel).

During a maintenance outage in the project's operational phase, the new Priest Adit would be used for entrance into the Mountain Tunnel. Depending on maintenance activities, up to 1,500 gallons per minute of water would be discharged out of the new adit throughout the shutdown period. If there were no construction in the tunnel, this water would be raw groundwater and disposed of according to the State Water Resources Control Board Order WQ 2014-0194-DWQ General Order No. CAG140001 (Statewide National Pollutant Discharge Elimination System Permit for Drinking Water Systems Discharges to Waters of the United States). If construction activities were underway, this construction water would be pumped to a temporary onsite water treatment facility for treatment prior to discharge. SFPUC would comply with all Central Valley Regional Water Quality Board conditions for water treatment and disposal, as required by law.

Operations Effects of the Project on Tuolumne River Flows and Other Hydrologic Characteristics

The proposed project would restore capacity in the Mountain Tunnel that has been lost over time due to degradation of the tunnel lining and accumulated debris. The proposed project would restore capacity by approximately 8 cubic feet per second—from the existing 670 cubic feet per second to 678 cubic feet per second—thereby allowing up to 8 cubic feet per second of additional flow to be conveyed through the Mountain Tunnel when flow releases to Canyon Power Tunnel are at or above the existing (pre-project) capacity of the Mountain Tunnel. This restored flow, which would otherwise be released to the Tuolumne River at Kirkwood Powerhouse, would instead be conveyed through the Mountain Tunnel to the Moccasin Powerhouse and released to Don Pedro Reservoir via Moccasin Creek (see Figure A-13 in Section A, Project Description). As a result, implementation of the proposed project would cause a change in flows to the Tuolumne River.[284]

The results of 47 years of hydrologic data using the Hetch Hetchy Local Simulation Model are summarized within the context of water year types defined in the stipulated instream flow requirements. The distribution of the water year typing varies by month (Table E.15-1) and is heavily weighted to the "Wet to Normal" classification, which applies to 59 percent of the analysis period. Due to this distribution, most occurrences where flow is estimated by the SFPUC to be affected by the implementation of the project fall within the "Wet to Normal" classification (Table E.15-2 and Table E.15-3). Given that discharges to the Tuolumne River from Kirkwood Powerhouse only occur when flow exceeds the capacity of the Mountain Tunnel, the SFPUC estimates that project-induced flow changes would primarily occur during months when the reservoir is managed for snowmelt runoff (March through July).

However, the overall relative effect on total flow below the Kirkwood Powerhouse is estimated to be greater during the "Dry" and "Critically Dry" years (Table E.15-4). This is due to the relatively large amount of flow within the river system in the "Wet to Normal" in comparison to the "Dry" and "Critically Dry" years. As a result, a reduction in discharge produces a higher magnitude of relative change in "Dry" and "Critically Dry" years than in "Wet to Normal" years. It should be noted that even during "Dry" and "Critically Dry" years, there may be inflows to Hetch Hetchy Reservoir that exceed the volume of water required for instream flow releases and water delivery. This additional water is managed through diversions to Kirkwood Powerhouse or discharged directly from the dam, and the balance of water that is not conveyed into the Mountain Tunnel is discharged to the Tuolumne River below Kirkwood Powerhouse.

The greatest relative reduction in estimated discharge to the Tuolumne River from the Kirkwood Powerhouse would primarily be observed in early spring during the "Dry" or "Critically Dry" years (Table E.15-4, Figure E.15-1), during the snowmelt runoff period. The largest reduction occurs in March of "Critically Dry" years (Table E.15-4); however, there are only four occurrences (Table E.15-2) over the 47 years simulated. The greatest post-project changes in estimated potential flows in the Tuolumne River would be localized to the Kirkwood Reach; below the Cherry Creek confluence, flows from Cherry Creek and discharges from Holm Powerhouse would moderate the downstream effect (Figure E.15-2).

[284] SFPUC, Mountain Tunnel Improvements Project – Operational Flow Memorandum, February 21, 2019.

Table E.15-1
Water Year Type Analyzed in Historical Data Set
(in Months)

Historical Data Set Analyzed (October 1, 1970 through June 30, 2017)				
Month	**Wet to Normal**	**Dry**	**Critically Dry**	**Total**
January	29	10	8	47
February	32	7	8	47
March	29	10	8	47
April	31	7	9	47
May	28	12	7	47
June	28	12	7	47
July	27	8	11	46
August	25	10	11	46
September	25	10	11	46
October	26	10	11	47
November	26	10	11	47
December	26	10	11	47
Total	**332**	**116**	**113**	**561**
Source: SFPUC 2019				

Table E.15-2
Estimated Number of Months with Change in Flows in the Tuolumne River below Kirkwood Powerhouse by Water Year Type with Implementation of MTIP
(over 47-year modeling period)

Historical Data Set Analyzed (October 1, 1970 through June 30, 2017)				
Month	**Wet to Normal**	**Dry**	**Critically Dry**	**Total**
January	9	0	0	9
February	19	0	0	19
March	29	10	4	43
April	31	7	4	42
May	28	10	2	40
June	28	3	0	31
July	19	0	0	19
August	3	0	0	3
September	1	0	0	1
October	1	0	0	1
November	2	0	0	2
December	5	5	1	11
Total	**175**	**35**	**11**	**221**
Source: SFPUC 2019				

Table E.15-3
Estimated Percentage of Months with Change in Flows in the Tuolumne River below Kirkwood Powerhouse with Implementation of MTIP by Water Year Type
(over 47-year modeling period)

Historical Data Set Analyzed (October 1, 1970 through June 30, 2017)				
Month	**Wet to Normal**	**Dry**	**Critically Dry**	**Total**
January	31%	0%	0%	19%
February	59%	0%	0%	40%
March	100%	100%	50%	91%
April	100%	100%	44%	89%
May	100%	83%	29%	85%
June	100%	25%	0%	66%
July	70%	0%	0%	41%
August	12%	0%	0%	7%
September	4%	0%	0%	2%
October	4%	0%	0%	2%
November	8%	0%	0%	4%
December	19%	50%	9%	23%
Total	**53%**	**30%**	**10%**	**39%**
Source: SFPUC 2019				

Table E.15-4
Estimated Mean Percentage Difference in Flow in the Tuolumne River below Kirkwood Powerhouse with Implementation of MTIP
(over 47-year modeling period)

Historical Data Set Analyzed (October 1, 1970 through June 30, 2017)			
Month	**Wet to Normal**	**Dry**	**Critically Dry**
January	-0.8%	0.0%	0.0%
February	-1.0%	0.0%	0.0%
March	-0.9%	-1.2%	-3.1%
April	-0.9%	-1.1%	-1.4%
May	-0.4%	-1.3%	-1.8%
June	-0.2%	-0.9%	0.0%
July	-0.4%	0.0%	0.0%
August	-0.4%	0.0%	0.0%
September	-0.3%	0.0%	0.0%
October	-0.5%	0.0%	0.0%
November	-0.6%	0.0%	0.0%
December	-0.9%	-1.6%	-0.7%
Source: SFPUC 2019			

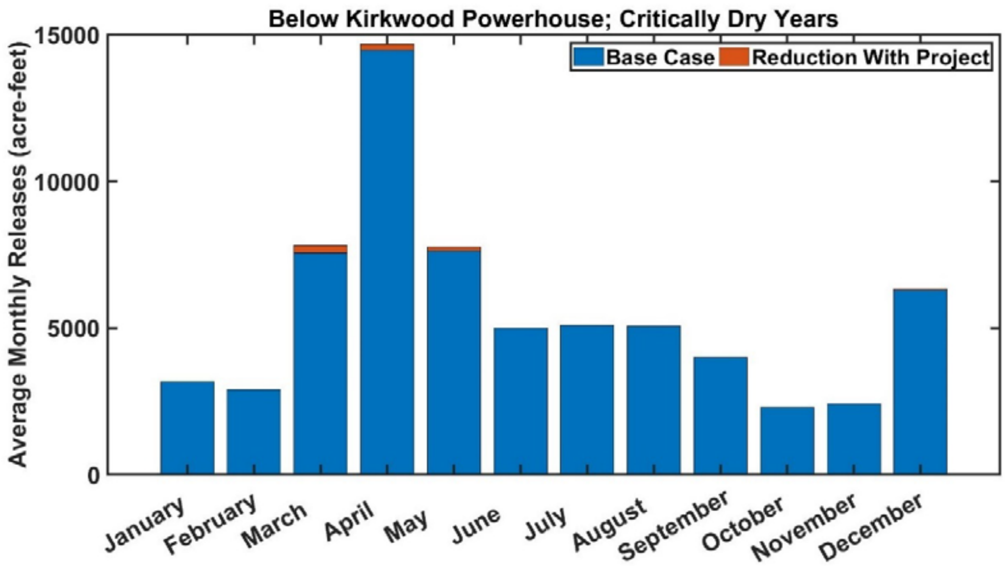

Figure E.15-1
Modeled Average Monthly Flow Volumes on the Tuolumne River below Kirkwood Powerhouse in Critically Dry Years

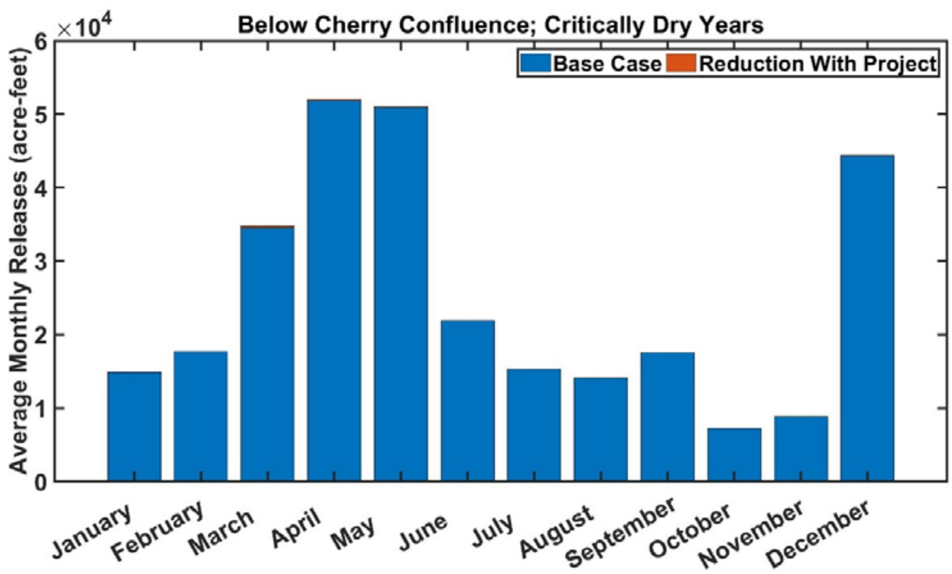

Figure E.15-2
Modeled Average Monthly Flow Volumes on the Tuolumne River below the Cherry Creek Confluence in Critically Dry Years

The potential change to releases from the Kirkwood Powerhouse and Tuolumne River flows in the Kirkwood Reach would depend on the capacity of the Mountain Tunnel and how the system is operated. With the restored capacity of 678 cubic feet per second, the expected change to flows in the Kirkwood Reach is estimated to be minor. The summary statistics in the following paragraph were derived using the modeled output from the Hetch Hetchy Local Simulation Model.[285]

Of the 561 months of data analyzed, there would be 80 individual months where the estimated reduction in discharge to the Tuolumne River would result in more than a 1 percent maximum decrease in flows in the Kirkwood Reach (1.1 to 6.7 percent). The estimated reduction in discharge would primarily be between March and May when Hetch Hetchy Reservoir is being managed for spring runoff; Wet to Normal years would be affected more often (about 59 percent of the time during "Wet to Normal" years; 27 percent during "Dry" years; and 14 percent during "Critically Dry" years). Of those 80 months with more than a 1 percent reduction in flow, four of them are estimated to have more than a 5 percent reduction in flow, with an estimated maximum monthly reduction in flow of 6.7 percent. When the flow below the confluence with Cherry Creek is added to the analysis, the estimated percentage change in Tuolumne River flow would be reduced because of the increased tributary flow below this location (which also includes discharges to Cherry Creek from Holm Powerhouse). Of the 561 months analyzed, there would be 13 individual months where the estimated reduction in discharges would result in a maximum decrease in flows below the Cherry Creek confluence of more than 1 percent (1.1 to 1.8 percent), with a maximum reduction in flow of 1.8 percent (Table E.15-5).

Table E.15-5
Estimated Mean Percentage Difference in Flows in the Tuolumne River below Cherry Creek with Implementation of MTIP
(over 47-year modeling period)

Historical Data Set Analyzed (October 1, 1970 through June 30, 2017)			
Month	**Wet to Normal**	**Dry**	**Critically Dry**
January	-0.2%	0.0%	0.0%
February	-0.4%	0.0%	0.0%
March	-0.4%	-0.5%	-0.7%
April	-0.4%	-0.5%	-0.4%
May	-0.2%	-0.4%	-0.3%
June	-0.1%	-0.3%	0.0%
July	-0.2%	0.0%	0.0%
August	-0.2%	0.0%	0.0%
September	-0.1%	0.0%	0.0%
October	-0.1%	0.0%	0.0%
November	-0.2%	0.0%	0.0%
December	-0.2%	-0.4%	-0.1%
Source: SFPUC 2019			

[285] SFPUC, Mountain Tunnel Improvements Project – Operational Flow Memorandum, Appendix B, February 21, 2019.

As described above, under certain operating conditions the proposed project would result in reduction of Tuolumne River flows of up to 8 cubic feet per second between Kirkwood Powerhouse and Don Pedro Reservoir. Because the average monthly flow in the Tuolumne River is greater below the Cherry Creek confluence—due to the addition of releases from Cherry and Eleanor reservoirs and from Holm Powerhouse—the differences between existing and project conditions below the Cherry Creek confluence would be less than those found upstream of the confluence (i.e., in the Kirkwood Reach, below the Kirkwood Powerhouse tailrace to its confluence with Cherry Creek). Approximately 40 percent of the time, the proposed project would result in a reduction in flow in the Tuolumne River. However, 60 percent of the time there would be no or negligible (less than 0.1 percent) change in Tuolumne River flows. For those periods when a change in the Tuolumne River flows are expected based on the Hetch Hetchy Local Simulation Model as described above, the reduction would typically be less than 1 percent (and no greater than 7 percent).[286] These minor changes in flow would not substantially impact other stream parameters, as described below.

At a flow of 150 cubic feet per second (a conservative flow rate, based on the results of the Hetch Hetchy Local Simulation Model), a change in flow of about 20 cubic feet per second corresponds to a 1-inch change in water surface elevation. Although the slope of the bank varies along different stretches of the river, changes in water surface elevations due to an 8-cubic-foot-per-second flow reduction in the Tuolumne River would be less than significant, because they would equate to less than approximately 0.5 inch.[287]

A substantial reduction in flow can affect water velocities, depth, and surface area, and consequently temperature. One of the most important meteorological parameters controlling stream temperature is direct solar radiation. For example, reduced flow velocities can expose the water to solar radiation (which warms water) for a longer time; reduced water depths resulting from reduced flow allow more of the flow volume to be exposed to solar radiation (the effect of solar radiation lessens with depth); and a reduced flow volume is easier to heat. Although the surface area would also be reduced with decreasing flow, the reduction in depth of the water and the duration of exposure to solar radiation are the dominant factors affecting temperature of the water. A mixing equation was used to estimate potential effects to temperature from an 8-cubic-foot-per-second reduction in flows immediately below the Kirkwood Powerhouse tailrace; temperatures were found to increase by no more than 0.1 degree Fahrenheit during months with reduced flows.[288] As a result, the proposed project effects on water temperature would be *less than significant*.

A change in flow rates could affect a water course's ability to erode fine-grained materials; however, the Upper Tuolumne River is a bedrock-dominated stream system, and the bed materials in the Kirkwood Reach and farther downstream in the reach below the Cherry Creek confluence consist of bedrock, boulders, and cobbles that would generally be unaffected by a change in flow of 8 cubic feet per second. Therefore, the effects on erosion and sediment transport, if any, from project-related reductions in Tuolumne River flows would be *less than significant*.

In summary, the proposed project operations would have a *less-than-significant* impact on Tuolumne River flows, water surface elevation, water temperature, erosion rates and patterns, and water quality, and would not result in violation of water quality standards or waste discharge requirements.

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[286] SFPUC and San Francisco Planning Department, Environmental Planning Division, Mountain Tunnel Improvements Project: Operational Flow Effects on the Tuolumne River Environment, prepared by AECOM, 2019.

[287] SFPUC and San Francisco Planning Department, Environmental Planning Division, Mountain Tunnel Improvements Project: Operational Flow Effects on the Tuolumne River Environment, prepared by AECOM, 2019.

[288] SFPUC and San Francisco Planning Department, Environmental Planning Division, Mountain Tunnel Improvements Project: Operational Flow Effects on the Tuolumne River Environment, prepared by AECOM, 2019.

Impact HY-2. The project would not substantially deplete groundwater supplies or interfere substantially with groundwater recharge to the extent that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production of pre-existing nearby wells would not drop to a level that would not support existing land uses or planned uses for which permits have been granted). (Less than Significant)

The proposed access road improvements, staging areas, and minor aboveground improvements at existing facilities would not result in a loss of groundwater recharge, because all of these facilities and work areas have been previously used for many years and already consist of compacted surfaces that inhibit recharge. The proposed new 85-foot by 85-foot building (7,200 square feet) at the new shaft of the proposed flow control facility at Priest Reservoir would result in a negligible increase in impervious surface coverage in the affected groundwater basin and would not interfere substantially with groundwater recharge. As discussed in Impact HY-1 above, one of the purposes of the proposed project is to permanently reduce the amount of existing Mountain Tunnel groundwater infiltration by repairing the existing concrete lining inside the tunnel, paving the unlined tunnel invert, conducting infiltration cutoff grouting, and installing a 750-foot siphon extension underground near the South Fork of the Tuolumne River. As a result, in the long-term the project would reduce the tunnel's existing effect on groundwater. Therefore, the proposed project would have a *less-than-significant* impact related to groundwater recharge.

Impact HY-3. The project would not 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 onsite or offsite erosion or siltation. (Less than Significant)

The proposed project includes installation of drainage features (i.e., waterbars) and extension/ replacement of culverts along the improved access roads, which would convey natural runoff from surrounding hillsides (see Section A.5.9, Tunnel Access Roadway and Other Drainage Improvements). These features would either tie in to existing drainages on either side of the road and would thus maintain existing drainage patterns, or would direct drainage where there was previously sheet flow. In both scenarios, these features would improve the conveyance of water across the roads. The culvert outfalls would be protected by installing armored discharge pads (e.g., rock riprap). As a result, the proposed improvements would reduce erosion from the roads and related offsite erosion or siltation in the future during the operational life of the project.

Most of the project-related work would be conducted underground: repairing and removing debris from the tunnel, constructing a 750-foot siphon extension underground near the South Fork of the Tuolumne River, and constructing a new vertical access shaft and new adit at Priest Reservoir. Above-ground work generally entails improvements to existing roads, implementing rock slope protection measures, constructing new doors/entrances at existing adits, installing a nonpermeable membrane around the shaft at Second Garrote, and constructing a large above-ground building and a new electrical line at Priest Reservoir. None of the work that would occur as part of the proposed project would alter the course of a streambed or river.

With the exception of the Priest Reservoir area, Second Garrote area, and other road improvement areas where permanent changes to the existing ground surface and vegetation would occur, all improvement, construction, and staging areas would be restored to pre-project conditions and contours following construction. The adit and portal area at Priest Reservoir would not be restored to pre-construction contours but would involve a vertical cut into the hillside to accommodate these facilities. The drainage system (consisting of catch basins and flow dispersion trenches) would be installed as part of these improvements to ensure that the project would not result in substantial onsite or offsite erosion or siltation. The flow control shaft facility area would also not be restored to preconstruction conditions. The site would consist of a graded, mostly flat area cut across a slope consisting of an aboveground, 30-foot-tall, concrete flow control facility building surrounded by small concrete pads for appurtenant structures, an asphalt driveway, and crushed gravel on the remaining graded surface. As discussed in Section A.7.3, Flow Control Facility Operations and Maintenance, dispersion trenches at the top of the flow control facility shaft and crushed gravel on the graded surface would dissipate water and reduce erosion.

The spoils disposal site at Priest Reservoir would receive approximately 90,000 to 97,000 cubic yards of material (after natural compaction); therefore, this area would not be restored to pre-project contours. There are no drainages in this area that would be filled or altered. Although the overall elevation of the spoils disposal site would increase, the side slopes of the fill embankment would be no more than 2:1, which would help to reduce the erosion potential during the project's operational phase and thus minimize offsite siltation. In addition, silt fences would be installed around the disposal site to prevent offsite siltation. The installation of a nonpermeable membrane and gravel around the Second Garrote shaft would help prevent stormwater from entering the Second Garrote Shaft; there are no drainages in this area that would be filled or altered. The proposed project also includes installation of drainage culverts to convey natural runoff from the surrounding hillside at Adits 5/6 and 8/9 (see Section A.5.8, Drainage Improvements Outside Adits 5/6 and 8/9). The culverts would be installed along the same alignment as the current surface flow and would therefore not alter the drainage course. These culverts would prevent further erosion from the edge of the staging area during the operational phase of the project and would also protect the adit entrances from being blocked by debris. Similarly, the water bars that are proposed as part of the improvements to Forest Service Road 1S28B/South Fork Access Road and Forest Service Road 1S01/Adit 5/6 Access Road would reduce the volume of runoff flowing down the roads and divert the flow to stable drainageways.

For the reasons stated above, the impact of construction, operation, and maintenance of the project on alteration of drainages resulting in increased erosion and siltation would be *less than significant*.

Impact HY-4. The project would temporarily 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 onsite or offsite flooding or expose people or structures to a significant risk of loss, injury, or death involving flooding including failure of a dam or levee. (Less than Significant)

Several of the project improvement, construction, and staging areas are near either the mainstem Tuolumne River or the South Fork Tuolumne River. The mainstem Tuolumne River is a 100-year flood hazard zone as classified by the Federal Emergency Management Agency (FEMA). FEMA flood hazard classifications for each project area are provided in Table E.15-6.

As reported in Table E.15-6, portions of the Early Intake area and the Priest Reservoir area are in a designated flood hazard area. Early Intake Reservoir is adjacent to the mainstem Tuolumne River. As shown in Figure E.15-3, Staging Areas EI-S2 and EI-S4, along with improvements on the Kirkwood pipeline and possible slope remediation across from the Early Intake Switchyard, are in a flood hazard zone. The proposed minor facilities improvements, such as replacing adit and tunnel access features, along with minor improvements to the pipeline and the electrical switchyard in Zone A, would have no impact on flooding, because additional structures that could impede flood flows would not be constructed.

As shown in Figure E.15-4, the Priest Portal Work Area would be in a flood hazard area. However, SFPUC would lower Priest Reservoir to facilitate work during the shutdown (winter months), and thus would control water levels so that use of the Priest Portal Work Area in Zone A would be protected. Permanent improvements, such as the new Priest portal and adit and the flow control facility, would not be in the flood hazard area and therefore would not alter the floodplain. Furthermore, no oil or lubricants would be used, and soil would not be stockpiled during the winter/spring rainy season in this drained area.

Table E.15-6
FEMA Flood Hazard Classifications and Descriptions

Project Area	Flood Hazard Classification	Description
Early Intake Area		
Staging Areas EI-S2 and EI-S4, work on the existing control panel and taps on the Kirkwood pipeline	Zone A	A 100-year flood hazard zone without an established base flood elevation
Staging Areas EI-S1, EI-S3, and EI-S7, Early Intake Adit and Switchyard work areas	Zone D	Areas with possible but undetermined flood hazards; no FEMA flood hazard analysis has been conducted
South Fork Area		
South Fork Siphon and vents work areas, staging areas, and access road	Zone D	Areas with possible but undetermined flood hazards; no FEMA flood hazard analysis has been conducted
Adit 8/9 Area		
Adit 8/9 and all associated staging areas and access roads	Zone D	Areas with possible but undetermined flood hazards; no FEMA flood hazard analysis has been conducted
Adit 5/6 Area		
Adit 5/6 and all associated staging areas and access roads	Zone D	Areas with possible but undetermined flood hazards; no FEMA flood hazard analysis has been conducted
Second Garrote Shaft Area		
Second Garrote Shaft and all associated staging areas and access roads	Zone X	An area of minimal flood hazard
Big Creek Shaft Area		
Big Creek Shaft and all associated staging areas and access roads	Zone D	Areas with possible but undetermined flood hazards; no FEMA flood hazard analysis has been conducted
Priest Reservoir Area		
Priest Reservoir, up to and including approximately 50 feet beyond the ordinary high water mark; includes Priest Portal work area	Zone A	A 100-year flood hazard zone without an established base flood elevation
All remaining Priest Reservoir staging areas, work areas, and proposed access road improvements (including the proposed water treatment plant, rock crushing plant, new flow control facility building, and the primary spoils disposal site for the project)	Zone X	An area of minimal flood hazard.

Source: FEMA 2018

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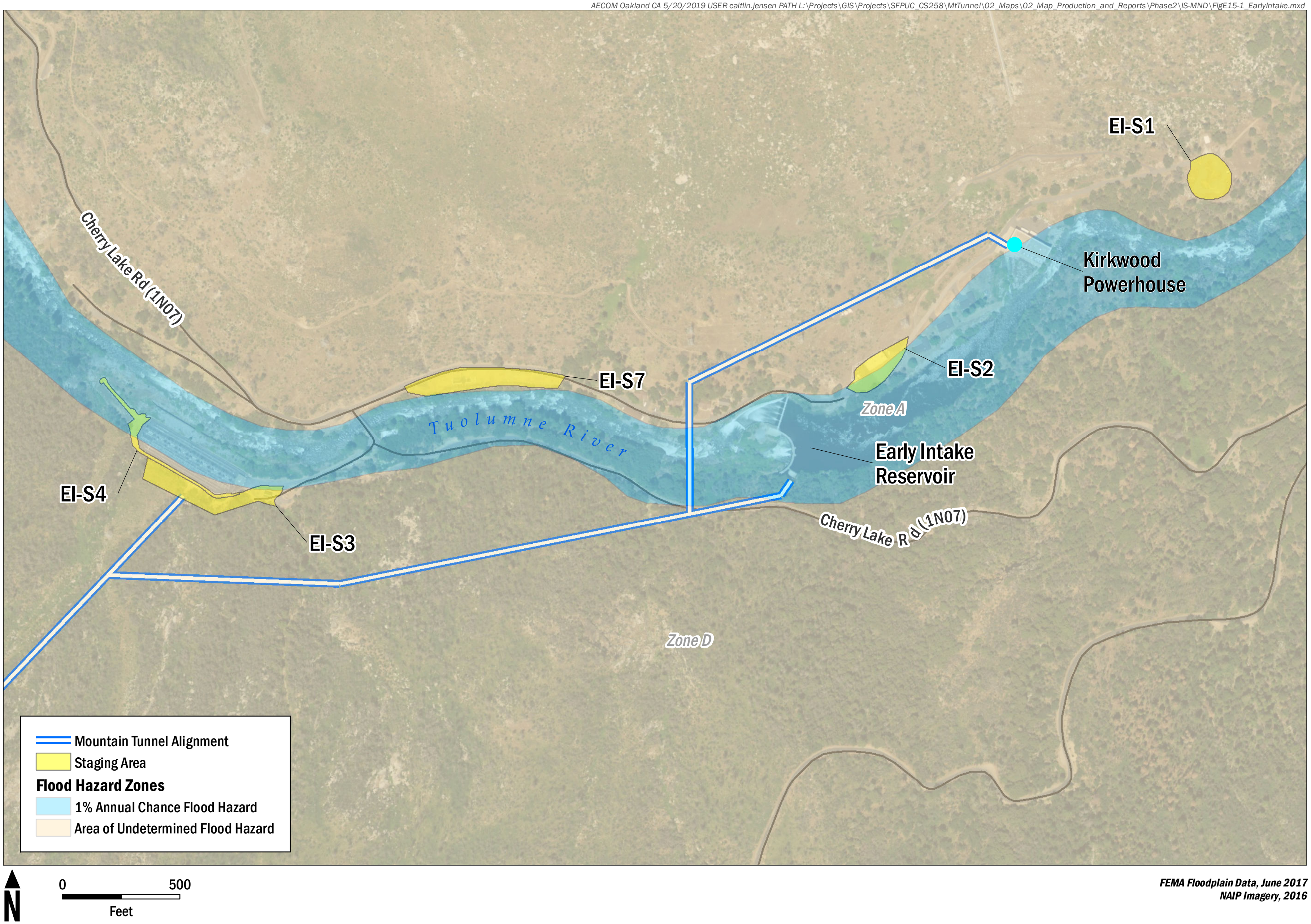


FEMA Floodplain Data, June 2017
NAIP Imagery, 2016

AECOM
San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 5/20/2019

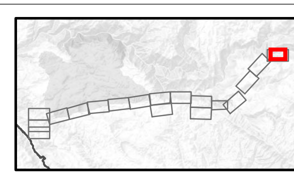
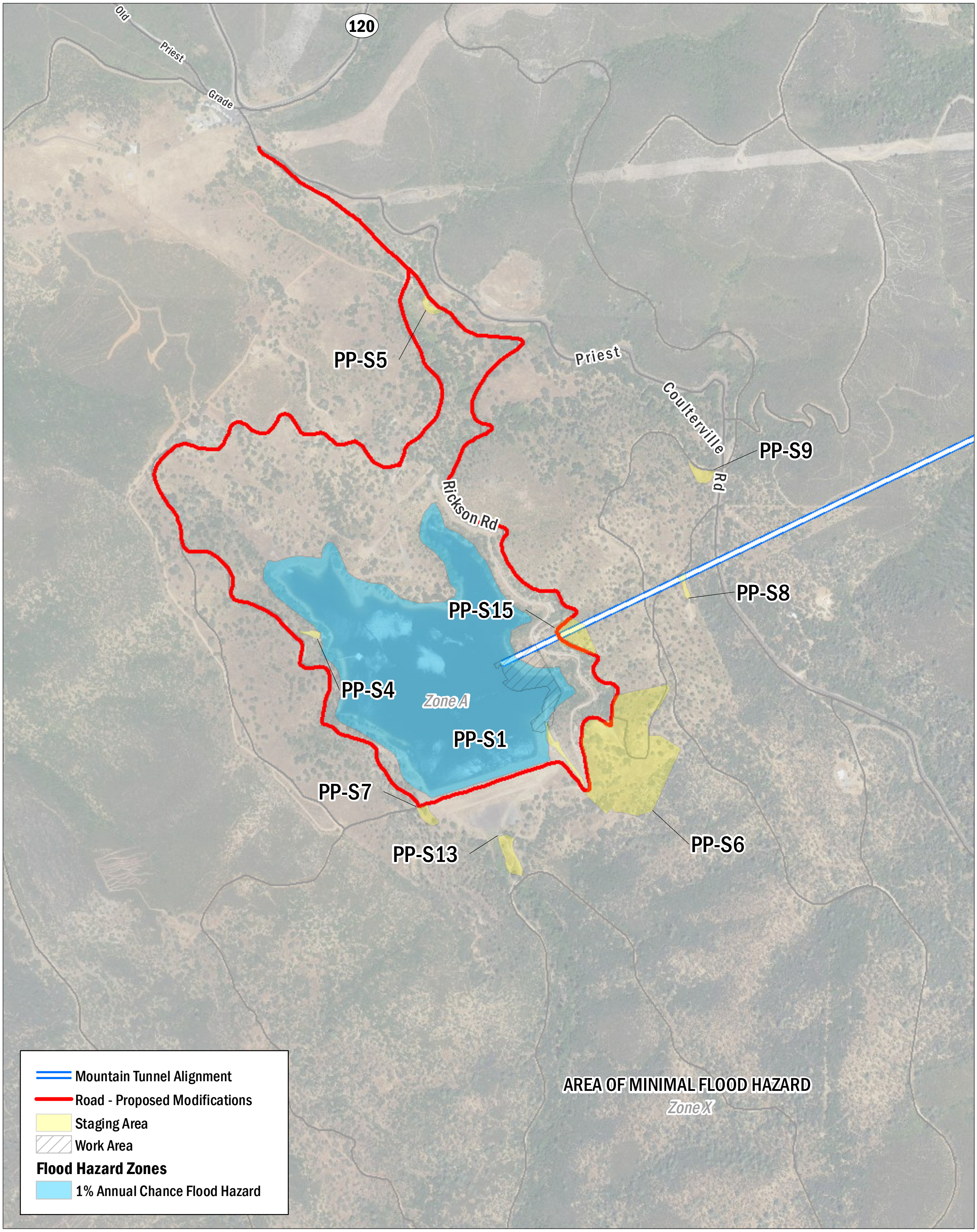


FIGURE E.15-3
Early Intake
FEMA Floodplain Designations



FEMA Floodplain Data, June 2017
NAIP Imagery, 2016

San Francisco Public Utilities Commission
Mountain Tunnel Improvements Project
DATE: 6/18/2019

FIGURE E.15-4
Priest Reservoir
FEMA Floodplain Designations

All other project areas are in Zone D or Zone X. The proposed project would improve the existing drainage in certain areas by installing features such as new or replacement culverts and water bars. In other areas within these flood hazard zones, the proposed project components are remote from surface waters and would not alter the ground surface substantially. As detailed below, project-related activities at the South Fork, Adit 5/6, Adit 8/9, Second Garrote, and Big Shaft areas would not result in increased flooding that could cause onsite or offsite flooding or expose people or structures to a significant risk of loss, injury, or death involving flooding, including failure of a dam or levee, and would not result in the potential for downstream water quality violations from flooding.

- The proposed South Fork Siphon extension and the new shafts and adit, along with other proposed improvements along the length of the existing Mountain Tunnel, such as debris removal and paving of the tunnel invert, would occur underground and therefore would have no impact on flooding. The South Fork vents work areas are on the steep slopes above the river and would involve minimal changes along the slopes (permanent vent caps and temporary small platforms around the vents to prevent debris from falling into the South Fork), and thus would have no impact on flooding.
- The South Fork staging areas and access road would not result in surface alterations that would alter the amount or rate of runoff and substantially affect occasional flooding along the South Fork of the Tuolumne River. In particular, Staging Areas SF-S7 and SF-S8 and the southern portion of the access road near the South Fork are already paved, so runoff volumes would not substantially increase flood hazards.
- Adit 5/6 and Adit 8/9 are approximately 900 to 1,000 feet above the Tuolumne River and involve surface road access and drainage improvements that would not alter the amount or rate of runoff or contribute to flood hazards.
- The proposed improvement at the Second Garrote shaft and use of Staging Area SG-S1 and the Big Creek Shaft staging area are in elevated areas, distant from the river, and would involve minimal surface alterations that would not alter the amount or rate of runoff and contribute to flood hazards.

During the project's operational phase, some of the Early Intake areas (EI-S2 and EI-S4) and /or the South Fork Siphon and vents areas may become inaccessible due to high water levels during winter storm events. However, the proposed facilities would neither be manned nor accessible to the public, and human presence at the sites would be limited to infrequent maintenance visits during times other than winter/spring storm events and the correspondingly high streamflow levels.

Early Intake, South Fork, Adit 5/6, and Adit 8/9 are downstream from Hetch Hetchy Reservoir (impounded by O'Shaughnessy Dam), Lake Eleanor (impounded by Lake Eleanor Dam), and Cherry Lake (impounded by Cherry Valley Dam). However, the proposed project would not increase the risk of dam failure because it would neither involve any work on these dams nor introduce new populations or structures into the flood zone of the Tuolumne River.

In summary, impacts related to flooding from construction and operation of the proposed project would be *less than significant*.

Impact HY-5. The project would not otherwise substantially degrade water quality. (No Impact)

All potential water quality impacts of the proposed project are characterized above under Impacts HY-1 through HY-4. There would be *no impact* related to other substantial degradation of water quality as a result of the project.

Impact HY-6: The project would not expose people or structures to a significant risk of loss, injury or death involving inundation by seiche or tsunami. (No Impact)

Because of the distance from the Pacific Ocean, the project site would not be at risk from tsunami hazards. Furthermore, the seismic hazard for the project site is considered low (see Impacts GE-1 and GE-2 in Section E.14, Geology and Soils), and due to the steep topography surrounding Priest Reservoir, there are no private residences or commercial buildings that would be affected by a seiche (if such an event were to occur). Potential hazards from mudflows are evaluated in Impact GE-3 (Section E.14, Geology and Soils). Because a seiche or tsunami would not occur in the project area, there would be *no impact*.

Impact C-HY. The project, in combination with reasonably foreseeable future projects, would result in a cumulatively considerable contribution to a significant cumulative hydrology and water quality impact. (Less than Significant)

The geographic context for the hydrology and water quality cumulative analysis consists of water bodies in the project vicinity and immediately upstream and downstream (including the Tuolumne River). All of the projects considered in this cumulative analysis would entail ground-disturbing activities in the Tuolumne River watershed. Hydrologic and water quality effects of these projects could include sedimentation or nonpoint source pollution in downstream receiving waters, or degradation of groundwater quality in the event of a contaminant release during the construction phase. The primary cumulative effect of these projects would be to alter the water quality of the Tuolumne River and its tributaries through uncontrolled erosion and subsequent downstream siltation, and to increase the potential for the release of nonpoint source pollutants (i.e., motor oil, fuels, lubricants, and trash). Therefore, the projects considered in this cumulative analysis could result in a significant cumulative impact. However, all of the projects considered in this cumulative analysis would be subject to the same federal and state regulations protecting water quality as the proposed project, including the requirement to prepare a stormwater pollution prevention plan (for projects greater than 1 acre) and implement best management practices designed to prevent erosion and protect water quality from sediment transport and the release of nonpoint source pollutants. Furthermore, both the proposed project and the U.S. Forest Service projects related to Rim Fire treatments include components that are specifically designed to prevent erosion and to improve both surface and groundwater water quality in the long term. In addition, SFPUC projects would implement best management practices to control sediment and erosion, along with a stormwater pollution prevention plan as required by the Central Valley Regional Water Control Board, pursuant to the SFPUC's Standard Construction Measure 3. Finally, the proposed project would incorporate water treatment via a temporary onsite water treatment plant at Priest Reservoir and localized baker tanks in other work areas, where necessary. Therefore, the project, in combination with the projects considered in this cumulative analysis, would not result in significant cumulative impacts related to water quality.

The Early Intake Dam Rehabilitation and Early Intake Bridge Replacement projects would entail construction in a FEMA flood hazard zone (Zone A) during the construction phase. Therefore, these two projects could result in cumulatively considerable (significant) impacts related to flooding hazards, in and of themselves, during the construction phase. However, these two projects are intended in part to improve dam safety, and to replace the existing bridge at a higher elevation to ensure that it is above high-water levels from flood flows in the Tuolumne River. Therefore, over the long-term operational phase, these two projects are not anticipated to result in significant impacts related to flooding.

Construction of the proposed project in the Priest Portal work area would occur in a FEMA flood hazard zone (Zone A). However, water in the reservoir derives from discharges from the Mountain Tunnel and surface runoff from the surrounding basin. None of the cumulative projects in Table B-1 are in the Priest Reservoir area or would be upstream; therefore, significant cumulative flood impacts would not occur.

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E.16 Hazards and Hazardous Materials

Topics:	*Potentially Significant Impact*	*Less than Significant with Mitigation Incorporated*	*Less-than-Significant Impact*	*No Impact*	*Not Applicable*
16. HAZARDS AND HAZARDOUS MATERIALS Would the project:					
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☒	☐	☐
b) 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?	☐	☐	☒	☐	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☐	☒
d) 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 it create a significant hazard to the public or the environment?	☐	☐	☐	☒	☐
e) For a project located within 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, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☐	☒
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☒	☐	☐
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☒	☐	☐

The project is not within 2 miles of a public airport or private airstrip, and the project is not within one-quarter mile of an existing or proposed school. The closest airport (Pine Mountain Lake Airport) is approximately 2.7 miles to the north of the Big Creek Shaft staging area for the proposed project. The closest schools are Tioga High School, which is approximately 3.2 miles northwest of Staging Area SG-S1; and Tenaya Elementary School, which is approximately 1.5 miles northwest of SG-S1. Therefore, significance criteria 16(c), 16(e), and 16(f) are *not applicable* to the project and are not discussed further in this section.

Impact HZ-1. The project would not create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials. (Less than Significant)

Staging areas have been identified for contractor use for active construction and materials storage. Construction equipment for project improvements includes excavators, front end loaders, dozers/graders, cranes, all-terrain tunnel utility vehicles, drilling equipment, concreting equipment, air and electric power tools, compressors, generators, water pumps, and water treatment facilities. Small amounts of hazardous materials would be used during construction, such as fuels, lubricants, and solvents for construction equipment and vehicles. Routine storage and use of hazardous materials at the project construction and staging areas could result in accidental release of small quantities of hazardous materials, which could degrade soil and/or groundwater quality at and near the project work areas and adversely affect the health and safety of construction workers. However, hazardous materials would be handled in accordance with manufacturer recommendations, applicable laws and regulations, and SFPUC's Standard Construction Measure 6 (refer to Section A.6.11), which require measures to prevent the release of hazardous materials used during construction, such as proper storage in areas away from surface waters; maintaining spill kits onsite; and containing any spills that occur, followed by collection and disposal in accordance with applicable laws.

A Hazardous Materials Assessment Report was prepared to identify the presence of hazardous materials at select project work areas.[289] Phase I and phase II soil sampling and analyses were conducted to test whether hazardous materials are present in concentrations that could affect worker and public safety during construction and to assess whether contamination, if present, would exceed California or federal hazardous waste thresholds. This report found that limited soil samples at Adit 5/6 and Adit 8/9 contained lead at concentrations that exceed California hazardous waste thresholds. The contaminated soils at these sites would be handled in accordance with applicable local, state, and federal regulations, and SFPUC's Standard Construction Measure 6 (refer to Section A.6.11). This may include measures such as the preparation and implementation of a plan for treating, containing, or removing the affected soils, as required by applicable regulations. These requirements would ensure that workers and the public would avoid adverse exposure to contaminated soils during or after construction.

Implementation of the measures described above in this section would minimize the potential for hazardous substance releases and harmful exposures. In addition, as described in Section A.5.4 (South Fork Siphon Extension and South Fork Crossing) and Section A.5.7 (New Priest Portal and Adit), the SFPUC would implement supplementary design features and best management practices in specific locations adjacent to surface waters, to prevent contaminated materials from spilling into nearby waterways during construction activities. Section E.15, Hydrology and Water Quality explains how these best management practices would reduce inadvertent spills into adjacent waterways to avoid a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials during construction. During project operation, periodic maintenance activities could also require the use of small amounts of hazardous substances; adherence to material safety data sheets for specified hazardous substances and best management practices would similarly minimize the potential for impacts. Therefore, with implementation of SFPUC's Standard Construction Measure 6, supplementary design features and best management practices in specific locations adjacent to surface waters, and conformance with applicable local, state, and federal regulations, impacts from the transport, use, or disposal of hazardous materials would be *less than significant*.

[289] Black and Veatch, Mountain Tunnel Improvements Project Hazardous Materials Assessment Report, prepared for the SFPUC, April 2019.

Impact HZ-2. The project would not 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. (Less than Significant)

Project-related construction, maintenance, and operations would not create reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment, as explained below. Hazardous materials would be used during project construction and maintenance, as described under Impact HZ-1. These materials would be managed in accordance with manufacturer recommendations, SFPUC's Standard Construction Measure 6 (see Section A.6.11), and applicable laws and regulations, including having spill containment and cleanup kits available on site to minimize impacts should a spill or release occur. SFPUC would also report spills of reportable quantities to applicable agencies such as the Governor's Office of Emergency Services. Therefore, with implementation of SFPUC's Standard Construction Measure 6 and mandatory compliance with applicable local, state, and federal regulations regarding hazardous materials handling, the potential impacts from accidental release of hazardous materials into the environment would be *less than significant*.

Impact HZ-3. The project would not 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 not create a significant hazard to the public or the environment. (No Impact)

None of the proposed project improvement, construction, or staging areas is on a list of hazardous materials sites compiled pursuant to Government Code section 65962.5,[290] the purpose of which is to identify hazardous waste facilities, hazardous waste properties, hazardous waste disposal sites on public lands, leaking underground storage tanks, and other properties that may be contaminated with hazardous materials. According to the online state-generated EnviroStor[291] and Geotracker[292] databases, the project improvement, construction, and staging areas are not in any of the listed of hazardous waste facilities or sites with known or suspected contamination. Only one active site is within 1 mile of the proposed project: an active remediation site approximately 200 feet from Staging Area A5/6-S1. The site (T0604300072) is classified as a leaking underground storage tank cleanup site and an open gasoline-release remediation site; it is undergoing semi-annual and annual groundwater monitoring. No grading, excavation, or dewatering is proposed at Staging Area A5/6-S1 that would create the potential for encountering contaminants from this cleanup site during project construction. All other sites listed in the EnviroStor and GeoTracker within 1 mile of the project have been closed by the relevant regulatory agency. Therefore, the project would have *no impact* related to potential hazards from hazardous materials sites listed pursuant to Government Code section 65962.5.

Impact HZ-4. The project would not impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan. (Less than Significant)

The proposed project could interfere with an adopted emergency response plan or emergency evacuation plan if it required the closure of roadways used for emergency services and/or evacuation routes. Tuolumne County has prepared the Tuolumne County Health Emergency Preparedness and Response Plan to guide local preparation for and response to a public health or medical event affecting the

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[290] DTSC (California Department of Toxic Substances Control), Online Envirostor Database, 2018, *https://www.envirostor.dtsc.ca.gov/public/*. accessed August 6, 2018.

[291] DTSC (California Department of Toxic Substances Control), Your EnviroStor, 2010c, *https://www.dtsc.ca.gov/Other/your-envirostor.cfm*, accessed September 30, 2018.

[292] State Water Resources Control Board, Online Geotracker Database, 2018, *https://geotracker.waterboards.ca.gov/*, accessed September 30, 2018.

county.[293] The Tuolumne County Health Emergency Preparedness and Response Plan includes information on the health officer emergency authorities, local collaboration in response to health and medical emergencies, and key routes for evacuation. State highways 49, 120, 108, and 132 and county road J59 are the major transportation routes through the county, and they could be used as possible evacuation routes.[294]

Highway 120 provides the primary access to all project improvement, construction, and staging areas and would be used as the haul route for material supplies and spoils disposal; movement of materials and supplies between staging areas; and worker travel. The project would require short-term construction traffic along Highway 120, as well as infrequent vehicle trips for operation and maintenance after construction is finished, but the volume of construction vehicles would not significantly increase congestion on the road and the project would not require road closures along this possible key route for evacuation. As described in Section E.5, Transportation and Circulation (under Impact TR-1), the number of vehicle trips for materials delivery, spoils hauling and disposal, and construction workforce commutes would be a small percentage of existing traffic volumes on Highway 120 and would not substantially impede emergency response vehicles. A segment of Highway 120 in the project area lies within Mariposa County, but impacts from construction traffic would be similar to those in Tuolumne County and would not require road closures on Highway 120. None of the tunnel access roads (e.g., the Adit 5/6 and 8/9 access roads), which would require temporary closure during construction, serves as a primary evacuation route for the public. In accordance with the SFPUC Standard Construction Measure 4 (refer to Section A.6.11), the project would implement traffic control measures, including coordination with local emergency responders, to maintain emergency access during construction. Therefore, the project would have a *less-than-significant impact* related to the implementation of an adopted emergency response plan or emergency evacuation plan for the project location.

Impact HZ-5. The project would not expose people or structures to a significant risk of loss, injury, or death involving wildland fires. (Less than Significant)

According to the Tuolumne County Emergency Services Plan, wildfires occur routinely during the dry season in Tuolumne County and can pose risks to human life, property, and wildlife. These wildfires are usually caused by vehicle and equipment use, as well as arson.[295] Tuolumne County contains rugged terrain and steep canyons and has the possibility of severe fire weather throughout the fire season.[296]

All of the proposed staging areas are located in very high fire hazard severity areas.[297,298,299,300]

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[293] Tuolumne County, Tuolumne County Public Health, Tuolumne County Health Emergency Preparedness and Response Plan, May 15, 2018., *https://www.tuolumnecounty.ca.gov/DocumentCenter/Index/197*, accessed August 2018.

[294] Tuolumne County, Tuolumne County Public Health, Tuolumne County Health Emergency Preparedness and Response Plan, May 15, 2018., *https://www.tuolumnecounty.ca.gov/DocumentCenter/Index/197*, accessed August 2018.

[295] Tuolumne County, Tuolumne County Emergency Services Plan, June 2012, *https://www.tuolumnecounty.ca.gov/DocumentCenter/View/6165/Tuolumne-County-EOP?bidId=*,.accessed August 7, 2018.

[296] Tuolumne County, Tuolumne County Emergency Services Plan, June 2012, *https://www.tuolumnecounty.ca.gov/DocumentCenter/View/6165/Tuolumne-County-EOP?bidId=*,.accessed August 7, 2018.

[297] CAL FIRE (California Department of Forestry and Fire Protection), Fire Hazard Severity Zones in SRA: Mariposa County. November 2007, *http://frap.fire.ca.gov/webdata/maps/mariposa/fhszs_map.22.pdf*, accessed August 7, 2018.

[298] CAL FIRE, Fire Hazard Severity Zones in SRA: Tuolumne County, November 2007, *http://frap.fire.ca.gov/webdata/maps/mariposa/fhszs_map.22.pdf*, accessed August 7, 2018.

[299] CAL FIRE, Fire Hazard Severity Zones in LRA: Tuolumne County, September 2008, *http://frap.fire.ca.gov/webdata/maps/tuolumne/fhszl_map.55.jpg*, accessed January 7, 2019.

[300] CAL FIRE, Fire Hazard Severity Zones in LRA: Mariposa County, September 2007, *http://frap.fire.ca.gov/webdata/maps/mariposa/fhszl06_1_map.22.jpg*, accessed January 7, 2019.

As described in Section A.5.6 (New Flow Control Facility at Priest Reservoir), a new power line with approximately 30 new power poles would be installed over a distance of 3,200 feet in the Priest Reservoir area. The construction and operation of the new power line and poles would comply with SFPUC's Integrated Vegetation Management Policy to ensure that grasses and vegetation within the SFPUC right-of-way are properly managed to abide by local fire ordinances enacted to reduce potential fire risk and protect public safety.

Additionally, during project construction and operational maintenance, a fire risk could be posed by construction vehicles and equipment, and by the temporary onsite storage and use of small quantities of diesel fuel, gasoline, and lubricants. State and county regulations (e.g., Title 14 of the California Code of Regulations for the California Department of Forestry and Fire Protection (CAL FIRE), the International Building Code, the State Strategic Fire Plan, and fire safe ordinances in the Tuolumne County Ordinance Code) governing the use of construction equipment in fire-prone areas are designed to minimize the risk of wildland fires. These regulations restrict the use of equipment that may produce a spark, flame, or fire; require the use of spark arrestors on construction equipment that has 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 for various types of work in fire-prone areas. The project would also be subject to the requirements of the California Fire Code, which requires measures such as appropriate storage of materials susceptible to ignition (such as flammable and combustible liquids, and oily rags), and maintenance of portable fire extinguishers and water for firefighting, to protect life and property from the hazards of fire and explosions in new and existing buildings as well as structures and premises, and to provide safety to emergency responders during emergency situations.[301] Adherence to these plans and regulations would reduce impacts to people or structures related to wildland fire to *less-than-significant* levels.

Impact C-HZ. The project, in combination with reasonably foreseeable future projects in the site vicinity, would not result in a significant cumulative impact related to hazards and hazardous materials. (Less than Significant)

The scope for potential cumulative impacts related to hazards and hazardous materials is the proposed project and the projects listed in Table B-1. Because the proposed project would not be located on a hazardous materials site, it would not combine with other cumulative projects listed in Table B-1 to cause cumulative impacts related to exposure to hazardous waste from a site on the Cortese List. Therefore, there would not be a significant cumulative hazard impact for exposure to the public or the environment pursuant to Government Code section 65962.5.

With respect to cumulative impacts related to routine hazardous materials transport, hauling, and disposal and accidental releases of hazardous materials, projects on the cumulative list are required to follow federal, state, and local regulations governing use of hazardous materials. The SFPUC is the sponsor for the proposed project, and for five of the cumulative projects listed in Table B-1; the SFPUC would implement its Standard Construction Measures for each of these projects, which include actions to comply with regulations governing hazardous materials and to prevent and report accidental releases. The other agencies responsible for the listed projects (i.e., U.S. Forest Service and Caltrans) each have their own internal guidelines and procedures to avoid hazardous material-related impacts to their own personnel, the public, and the environment (e.g., the U.S. Forest Service has a training guide for its

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[301] California Building Standards Commission, California Fire Code, California Code of Regulations, Title 24 Part 9, January 2016, *http://www.citymb.info/home/showdocument?id=28089*, accessed August 7, 2018.

employees; Caltrans has an internal Hazardous Waste Management program to assist with training staff, and directing assessment, investigation, or cleanup activities). Furthermore, the lead agencies sponsoring the cumulative projects coordinate their efforts through integrated emergency response plans such as the Tuolumne County Health Emergency Preparedness and Response Plans, communications procedures, and defined areas of responsibility. As a result, cumulative impacts related to use of hazardous materials would not be significant.

None of the identified cumulative projects involve construction on a major roadway that could serve as an evacuation route. As mentioned above, the agencies sponsoring the cumulative projects coordinate their emergency response activities and have established communications procedures if the need to evacuate arises. As a result, cumulative impacts that would impede implementation of response plans, such as the Emergency Operations Plan for Tuolumne County and the Tuolumne County Health Emergency Preparedness and Response Plan, would not be significant.

Because the cumulative geographic area for the proposed project includes areas that are classified primarily as very high fire hazard severity zones, there is a potential for fire hazards. Construction, operation, and maintenance activities of the proposed project in combination with reasonably foreseeable future projects could increase the potential and incidents for wildland fires. Wildfire protection for the cumulative projects would be the responsibility of CAL FIRE and the federal agencies. All projects within the CAL FIRE area of responsibility would be subject to Title 14 of the California Code of Regulations. These regulations include minimum wildfire protection standards addressing emergency access, fuel load modification, setbacks and vegetation clearance, signage, and water supply. The other cumulative projects that are within federal responsibility areas would be protected by the Stanislaus National Forest Fire and Aviation Management program, which covers fire prevention and response planning, fuels management, prescribed burns, prevention, and suppression. As a result of these plans and regulations, the identified cumulative projects in the project vicinity would not result in a significant cumulative wildland fire hazard impact.

E.17 Mineral and Energy Resources

Topics:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Not Applicable
17. MINERAL AND ENERGY RESOURCES Would the project:					
a) 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?	☐	☐	☐	☒	☐
b) 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?	☐	☐	☐	☒	☐
c) Encourage activities which result in the use of large amounts of fuel, water, or energy, or use these in a wasteful manner?	☐	☐	☐	☒	☐

Impact ME-1. The proposed project would not 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. (No Impact)

Most of the project-related operational facilities and proposed work areas are on SFPUC parcels that are either in a Raker Act right-of-way or owned in fee by the City and County of San Francisco. Mining that would entail excavation would not be permitted on these lands. Improvements to existing access roads would not preclude any future mining activities if valuable mineral resources were discovered in the future. The proposed project does not include the creation of new operational areas or the creation of new access roads that would potentially block access to any as-yet-undiscovered mineral resources. None of the proposed construction or operational areas are in mineral resource areas of designated regional or statewide value (i.e., areas that have been classified by the California Geological Survey as MRZ-2).[302] Therefore, there would be *no impact.*

Impact ME-2. The proposed project would not 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. (No Impact)

The Tuolumne County General Plan[303] specifies numerous locally important mineral resource recovery sites, all of which correspond to the areas classified by the California Geological Survey as MRZ-2. As discussed above, none of the construction or operational areas associated with the proposed project are in areas that have been classified as MRZ-2.

The Mariposa County General Plan[304] states that there are several small localized gold mining operations, one slate quarry, and several aggregate quarries in the county. However, the general plan does not designate any locally important mineral resource recovery sites. As discussed above, none of the known

[302] Higgins, C., Mineral Land Classification of a Portion of Tuolumne County, California, for Precious Metals, Carbonate Rock, and Concrete-Grade Aggregate, 1997, *ftp://ftp.consrv.ca.gov/pub/dmg/pubs/ofr/OFR_97-09/*, accessed July 2018.

[303] Tuolumne County, Tuolumne County General Plan Volume II: Technical Background Report, 2018, *https://www.tuolumnecounty.ca.gov/DocumentCenter/View/11958/TBR-Public-Review-Final*, accessed May 2019.

[304] Mariposa County, County of Mariposa General Plan, Volume I, Countywide General Plan, December 18, 2006, *https://www.mariposacounty.org/DocumentCenter/Home/View/6354*, accessed July 2018.

active mines in Mariposa County are in the vicinity of Staging Area A5/6-S1 (which is the only project-related facility and construction work area in Mariposa County).

Therefore, the project would not result in the loss of availability of a locally important mineral resource recovery site, and there would be *no impact.*

Impact ME-3. The project would not encourage activities that result in the use of large amounts of fuel, water, or energy, or that use these in a wasteful manner. (No Impact)

The proposed project is intended to improve the condition of the existing Mountain Tunnel and existing access points and access roadways, to ensure the tunnel's continued ability to provide reliable, high-quality drinking water to SFPUC's customers. Minor quantities of fuel, water, and energy would be required to power and properly maintain existing and small new facilities.

In addition, fuel and energy would be used by vehicles transporting construction workers, and by equipment and vehicles during project construction. Temporary power during construction would be supplied by portable diesel generators placed at the staging areas. Based on the relatively small scale of construction activities, quantities used would not be substantial.

Over the long term, the flow control facility at Priest Reservoir would require a permanent power source, which would be available from existing SFPUC distribution lines north of the reservoir. SFPUC typically provides hydroelectricity from Moccasin Powerhouse to the Priest area. The SFPUC has developed and implements its own Strategic Sustainability Plan and Program,[305] which is used to help plan, manage, and evaluate SFPUC actions and projects. Compliance with the program's energy-conserving and energy efficiency objectives as proposed would further ensure that fuel, water, and energy resources would be used conservatively and not wastefully. The proposed project would be exempt from Title 24 California Buildings Standards Code requirements because it qualifies for a process facility exemption.[306] Although it is not mandatory, the SFPUC would elect to install energy efficient elements, such as energy-efficient lighting in the flow control facility and skylights, to supplement artificial lighting to minimize unnecessary energy usage (refer to Section A.1, Introduction and Background and Section A.5.6, New Flow Control Facility at Priest Reservoir). Therefore, the project's use of these resources would be minimal, and would not be wasteful; and the project would have *no impact* relative to this criterion.

Impact C-ME. The proposed project, in combination with other reasonably foreseeable projects, would not result in a significant cumulative impact to mineral and energy resources. (No Impact)

The proposed project is not in an area classified by the California Geological Survey as containing mineral deposits of regional or statewide importance, nor is it in an area containing locally important mineral resources under the Tuolumne County or Mariposa County General Plans. Furthermore, the project would not require large amounts of or result in the wasteful use of fuel, water, or energy. Therefore, the project would not contribute to significant cumulative impacts on these resources, should they occur as the result of other cumulative projects.

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[305] SFPUC, Strategic Sustainability Plan, March 2011, *https://sfwater.org/modules/showdocument.aspx?documentid=987*, accessed February 2019.

[306] Martin, Rachel, personal communication from Rachel Martin, McMillen Jacobs Associates, with Sue Chau, SFPUC, regarding Title 24 Requirements, January 28, 2019.

E.18 Agriculture and Forest Resources

Topics:	*Potentially Significant Impact*	*Less than Significant with Mitigation Incorporated*	*Less-than-Significant Impact*	*No Impact*	*Not Applicable*
18. AGRICULTURAL AND FOREST RESOURCES					
In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. Would the project:					
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance, as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒	☐
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒	☐
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?	☐	☐	☒	☐	☐
d) Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☒	☐	☐	☐
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to non-agricultural use or forest land to non-forest use?	☐	☐	☐	☒	☐

Impact AG-1. The project would not convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance, as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to nonagricultural use. (No Impact)

The California Department of Conservation Farmland Mapping and Monitoring Program has not prepared maps of important farmlands for either Tuolumne County or Mariposa County.[307] However, the U.S. Department of Agriculture Natural Resources Conservation Service has collected data and mapped the farmland classifications for Tuolumne and Mariposa counties in the Web Soil Survey online database. According to this database, there is no prime farmland, unique farmland, or farmland of statewide

[307] California Department of Conservation, DLRP Important Farmland Index, 2016, *https://maps.conservation.ca.gov/dlrp/ciff/*, accessed August 1, 2018.

importance in the project area.[308] Therefore, the project would have *no impact* related to the conversion of these important farmlands to nonagricultural use.

Impact AG-2. The project would not conflict with existing zoning for agricultural use, or a Williamson Act contract. (No Impact)

All but two of the proposed staging areas are zoned P (public); portions of Staging Area PP-S6 (Priest Reservoir) and Staging Area SG-S1 (Second Garrote) are zoned AE-37 (exclusive agricultural).[309] For Staging Area PP-S6, approximately 0.44 acre of the 9.94-acre staging area is zoned AE-37; for Staging Area SG-S1, approximately 0.80 acre of the 0.99-acre staging area is zoned AE-37. Neither of these staging areas is currently used for agricultural purposes.

The purpose of the AE-37 zoning district is to provide agricultural and resource production where commercial agricultural uses can exist without encroachment of incompatible uses.[310] Although the main objective of this district is to provide land for agricultural purposes, permitted and conditional uses also include public utility uses, once a use permit is secured.[311] Staging Areas PP-S6 and SG-S1 are on city-owned land dedicated for water-related infrastructure and use by the SFPUC.

California Government Code section 53090 et seq. mutually exempts cities and counties from complying with each other's building code and zoning ordinances. The SFPUC is therefore exempt from complying with the building and zoning ordinances of other cities and counties. Although SFPUC would not be required to obtain a permit, public utility use is an allowed use in the AE-37 district, and therefore the project would not conflict with the intent of this zoning designation. Furthermore, the use of Staging Area SG-S1 would be temporary during construction of the project. Following construction, this staging area would be restored to existing conditions and would not preclude future agricultural use. Staging Area PP-S6, by contrast, would be used as the primary spoil disposal site. Future agriculture use would be highly unlikely, given that the site is not used for agricultural purposes, it is surrounded by SFPUC-related water delivery infrastructure, and its future landform and topography would not be conducive to exclusive agricultural production.

No portion of the project's improvement, construction, and staging areas is under a Williamson Act contract.[312,313]

Therefore, the project would not conflict with an existing agricultural use zoning designation or a Williamson Act contract, and there would be *no impact*.

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308 U.S. Department of Agriculture Natural Resources Conservation Service, Web Soil Survey, 2019, *https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx*, accessed February 6, 2019.

309 Tuolumne County, Tuolumne County General Plan, Zoning Map Viewer, 2019, *http://gis.co.tuolumne.ca.us:8093/flexviewers/General%20Plan%20And%20Zoning/*, accessed May 7, 2019.

310 Tuolumne County, Tuolumne County Zoning Ordinance Code, Title 17, 1996, *https://www.tuolumnecounty.ca.gov/DocumentCenter/View/421/Chapter-1708---Exclusive-Agricultural-District-or-AE-37-District?bidId=*, accessed August 1, 2018.

311 Tuolumne County, Tuolumne County Zoning Ordinance Code, Title 17, 1996, *https://www.tuolumnecounty.ca.gov/DocumentCenter/View/421/Chapter-1708---Exclusive-Agricultural-District-or-AE-37-District?bidId=*, accessed October 1, 2018.

312 California Department of Conservation, Williamson Act/Land Conservation Act, Data and Maps, 2018, *ftp://ftp.consrv.ca.gov/pub/dlrp/wa/Mariposa_13_14_WA.pdf*, accessed August 2, 2018.

313 California Department of Conservation, Williamson Act/Land Conservation Act, Data and Maps, 2018, *ftp://ftp.consrv.ca.gov/pub/dlrp/wa/Tuolumne_13_14_WA.pdf*, accessed August 2, 2018.

Impact AG-3. The project would not conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g)). (Less than Significant)

A small portion of the project site is zoned for agricultural uses, but none of the project site is identified for forest land or timber land. Approximately 29 acres of project lands which are zoned P (public) are managed by the U.S. Forest Service as part of the Stanislaus National Forest. Only 14 of those 29 acres contain forest vegetation and fall in areas where vegetation removal is proposed to accommodate project activities. Removal of forest vegetation from the Stanislaus National Forest would require special use authorizations from the U.S. Forest Service, but would not conflict with the Stanislaus Forest Plan. Therefore, the project would not conflict with existing zoning for, or cause rezoning of, forest land, timber land, or timber land zoned for Timber Land Production, and impacts would be considered *less than significant.*

Impact AG-4. The project would result in the loss of forest land or conversion of forest land to non-forest use. (Less than Significant with Mitigation)

Undisturbed portions of the project site contain various vegetation communities, including forests. The three primary forest types in the project site are mixed-oak woodlands, montane hardwood forest, and montane hardwood-conifer forest.[314] None of these forest types are currently managed or planned to be managed as productive forest lands. Regardless, the vegetation communities are considered forest lands due to their vegetation composition, and the loss of any portion of these areas could result in a potentially significant impact to forest resources if converted to a non-forest use, such as industrial, commercial, or residential development.

Vegetation removal and clearance, including tree removal, would take place for construction of the flow control facility (PP-S15), the new Priest adit, and Priest Portal (PP-S6); for widening of Rickson Road; for clearing of smaller staging areas (EI-S3 and PP-S9); and for improvements of other access roads to other project components, such as the road and staging areas associated with South Fork Crossing, Adit 5/6, and Adit 8/9. Coarse vegetation mapping indicates that approximately 33 acres identified for vegetation removal/clearance at the project site may be considered forest land, approximately 14 acres of which is on the Stanislaus National Forest, managed by the U.S. Forest Service Groveland Ranger District.[315,316] Most of the areas in the project site mapped as forest contain only scattered living trees due to past land uses and the effects of recent forest fires. More than 75 percent of the forest land in the project site was burned by the Rim Fire in 2013 and 2014; it is currently sparsely vegetated with young shrubs and low-lying plants as a result. The mixed oak woodland found predominantly at Priest Reservoir, by contrast, appears relatively undisturbed and has moderately dense cover of oak trees.[317]

A tree inventory of the project area was performed to identify trees required for removal during project construction and to refine estimates of potential forest loss associated with project construction activities. Approximately 592 trees, including approximately 377 oak trees and 215 conifers more than 5 inches in

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[314] SFPUC and San Francisco Planning Department, Environmental Planning Division, Biological Resources Assessment for the Mountain Tunnel Improvements Project, prepared by AECOM, 2019.

[315] California Protected Areas Database, 2017, *www.calands.org*, accessed August 1, 2018.

[316] SFPUC and San Francisco Planning Department, Environmental Planning Division, Biological Resources Assessment for the Mountain Tunnel Improvements Project, prepared by AECOM, 2019.

[317] SFPUC and San Francisco Planning Department, Environmental Planning Division, Biological Resources Assessment for the Mountain Tunnel Improvements Project, prepared by AECOM, 2019.

diameter at breast height were identified in the vegetation removal/clearance areas. The oak trees were concentrated at Priest Reservoir in staging areas and along Rickson Road; the conifers were found primarily in the Stanislaus National Forest, along the South Fork Access Road (Forest Service Road 1S28B), Adit 5/6 Access Road/Forest Service Road 1S01, and Adit 8/9 Access Road/Forest Service Road 1N10 (Lumsden Road).

Table E.18-1 summarizes the proposed tree removal by work area and indicates the approximate acreage of forest vegetation (including oak woodland and conifer-dominant forest) to be removed.

Table E.18-1
Estimated Tree Removal for the Proposed Project by Improvement, Construction, and Staging Area

Work Area	Oak Woodland Acreage	Conifer-Dominant Forest Acreage	Total Acreage	Number of Oaks	Number of Conifers[1]	Total Number of Trees
Early Intake Area[2]						
EI-S3	0.0	0.0	0.0	5	0	5
South Fork Area[2]						
Access Road	0.0	4.86	4.86	12	45	57
Adit 5/6 Area[2]						
A5/6-S2	0.0	0.02	0.02	0	1	1
Access Road	0.0	1.27	1.27	13	107	120
Adit 8/9 Area[2]						
A8/9-S1	0.0	0.05	0.05	2	1	3
A8/9-S4	0.0	0.02	0.02	0	4	4
Access Road	0.0	0.59	0.59	6	12	18
Priest Reservoir Area						
PP-S6	4.62	8.31	12.93	263	3	266
PP-S9	0.01	0.0	<0.01	1	0	1
PP-S15	0.50	0.90	1.40	23	11	34
Rickson Road	1.40	9.95	11.35	52	31	83
Totals	**6.5**[3]	**26.0**[3]	**32.5**[3]	**377**	**215**	**592**

Source: Compiled by AECOM and MJA, 2019.

1 The inventories of non-oak trees were not species-specific, but the trees are predominantly conifers; all non-oak trees have been counted as conifers.

2 Habitat at the Early Intake, South Fork, Adit 5/6, and Adit 8/9 Areas is generally characterized as conifer-dominant forest interspersed with oaks. Accordingly, acreages in these areas are presented as conifer-dominant forest even though some oaks are present. Although only oaks are present in the footprint requiring tree removal at Early Intake, this area does not qualify as oak woodland based on the surrounding habitat features, and the density and number of trees.

3 The area of each feature presented above, and the sum of the acres is calculated from the totals of square feet. The total acres may differ from the sum of the individual acre values due to rounding.

As shown in Table E.18-1, most of the permanent tree removal would occur at the Priest Reservoir area. Approximately 6.5 acres of oak-dominated forest, containing approximately 339 trees more than 5 inches in diameter at breast height, would be removed for proposed project improvement, construction, and staging areas; this represents approximately 20 percent of the total affected forest area but 57 percent of the total number of trees (forest vegetation) removed for the proposed project. The removal of 339 oak trees at the Priest Reservoir area for roads, structures, and disposal sites in previously forested areas, and seven oak trees at staging areas outside of the Priest Reservoir area, would constitute a loss of oak woodland. This loss of oak woodland would be a significant impact on forest land. Implementation of **Mitigation**

Measure M-BI-2, **Oak Woodland Mitigation** (refer to Section E.13, Biological Resources) would reduce impacts to oak-dominated forest land to a less-than-significant level by enhancing oak woodland areas in the Stanislaus National Forest and increasing the health of oak trees in other areas (yet to be determined), thus increasing the coverage of oak woodland forest in the region. Therefore, impacts on oak woodland forest would be *less than significant with mitigation*.

Permanent removal of conifer-dominated forest land would occur in narrow bands, primarily along the access roads to South Fork Crossing, Adit 5/6, and Adit 8/9. Improvements and construction along these roads account for 76 percent of the total number of conifers anticipated to be removed by the proposed project. The conifer-dominated forest at the project site is primarily within the Stanislaus National Forest and includes the removal of approximately 253 conifer and oak trees scattered along approximately 2,200 feet of roadway. Despite the number of trees being removed to expand the access roads, the loss of these trees to expand roads does not constitute a conversion of forest land to another land-use type. Access roads are a feature of National Forest lands and are consistent with forest land use. Table E.18-1 overstates forest land loss because the acreages of conifer-dominated forest land it reports include areas where forest land was already degraded by the extensive tree mortality caused by the Rim Fire. It is unknown whether those burned areas will regenerate naturally into healthy forest or persist as a shrub-dominated landscape into the future, given the severity of the fire. In contrast to the degraded conifer-dominated forest land in the project site, there is expansive, relatively undisturbed conifer-dominated forest adjacent to all project activities in the 989,000-acre Stanislaus National Forest. Therefore, the removal of approximately 215 conifers, primarily from within narrow bands of land beside access roads, across the entire project alignment, would not constitute a significant loss of conifer forest vegetation or conversion of conifer dominated forestland to another use, and impacts would therefore be *less than significant*.

Impact AG-5. The proposed project would not involve other changes in the existing environment that—due to their location or nature—could result in conversion of farmland to nonagricultural use or forest land to non-forest land. (No Impact)

During operations, the project site would have limited visitation for maintenance, and there would not be a significant increase in traffic or visitation to the site, both of which could increase the incidence of pests or hazards and result in conversion of forest land to non-forest land. Therefore, beyond project activities discussed under Impact AG-4 that would directly convert forestland to non-forest land through expansion of facilities and improvement of roadways during project construction, there would be no other changes to the existing environment that would result in conversion of forest to non-forest use. As a result, the project would not result in long-term changes to the current environment that would cause the conversion of farmland to nonagricultural use or forest land to non-forest land (*no impact*).

Impact C-AG. The proposed project, in combination with reasonably foreseeable future projects in the vicinity, would not result in a significant cumulative impact related to agriculture and forest lands. (Less than Significant)

Because the proposed project would have no agricultural impacts, it would not combine with other cumulative projects listed in Table B-1 to cause cumulative impacts. Therefore, the project would not result in cumulative impacts related to agricultural lands.

Projects identified in the region affecting forest resources include tree replanting efforts to reforest land devastated by wildfires, including the Rim Fire. Native forest replanting would improve the quality and quantity of forest resources in the vicinity of the project and not result in a significant cumulative impact. These planting efforts, when combined with the limited loss of forest vegetation from the proposed project, would result in an increase in forest resources in the region, both in extent and in health, when compared to current conditions. Moreover, none of these cumulative projects would result in the conversion of forest lands to non-forest land uses. Therefore, the cumulative impacts to forest lands from the project, in combination with reasonably foreseeable future projects, would not be significant.

E.19 Mandatory Findings of Significance

Topics:	*Potentially Significant Impact*	*Less than Significant with Mitigation Incorporated*	*Less-than-Significant Impact*	*No Impact*	*Not Applicable*
19. MANDATORY FINDINGS OF SIGNIFICANCE					
Would the project:					
a) Does the project 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, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory?	☐	☒	☐	☐	☐
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	☐	☒	☐	☐	☐
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☒	☐	☐	☐

The discussion in Section E, Evaluation of Environmental Effects, identifies potentially significant impacts on the environment related to cultural resources, noise, air quality, biological resources, and forest resources. However, mitigation measures have been provided to address these potentially significant project-level impacts. Implementation of the mitigation measures would reduce the impacts to a less-than-significant level.

a) As discussed in Section E.13, Biological Resources, project construction, operations, and maintenance could have an adverse effect on one or more special-status species that have the potential to occur in the project site or project area, such as special-status wildlife (including American peregrine falcon, California spotted owl, multiple special-status bat species), and/or nesting birds. These impacts would be reduced to a less-than-significant level with the implementation of the following mitigation measures: **Mitigation Measure M-BI-1a, Worker Environmental Awareness Program Training for Construction; Mitigation Measure M-BI-1b, Raptors (including the California Spotted Owl) and Migratory Bird Nesting Survey and Protection during Construction; Mitigation Measure M-BI-1c, Maternity Roosts and Special-Status Bats Day Roosts; and Mitigation Measure M-BI-2, Oak Woodland Mitigation.** As discussed in Section E.13, impacts on special-status species and sensitive natural communities from reductions in Tuolumne River flows as a result of the project would be less than significant.

   As discussed in Impact CR-1 in Section E.4, Cultural Resources, project impacts on historic architectural resources would be less than significant. As discussed in Impacts CR-2, CR-3, and CR-4, construction activities associated with the proposed project could result in potential impacts on unknown archeological resources and human remains and associated or unassociated funerary objects. These impacts would be less than significant with implementation of **Mitigation Measure M-CR-2a, Accidental Discovery**, and potentially **Mitigation Measures M-CR-2b, Archeological Monitoring,** and **M-CR-4, Tribal Cultural Resources**, as necessary (e.g., if Native American resources were discovered). Therefore, impacts related to elimination of important examples of California history or prehistory would be less than significant with mitigation.

b) The project would have no impact on wind and shadow, recreation, or mineral and energy resources. Therefore, the proposed project would not contribute to cumulative impacts related to these topics.

The assessment of potential cumulative impacts for the remaining environmental issue areas is provided in the relevant subsections of Section E, Evaluation of Environmental Effects. However, for the reasons described in Sections E.1 through E.18, the proposed project's contribution to all cumulative impacts on the environment would either be less than significant or would not be cumulatively considerable with implementation of mitigation measures to address potentially significant project-level impacts.

c) The discussion in Section E, Evaluation of Environmental Effects, identifies significant impacts related to noise and air quality that could adversely affect human beings. Mitigation measures have been provided in this initial study to reduce these significant project-level impacts to a less-than-significant level. No project-level potentially significant impacts were identified for the following environmental issue areas that could affect human beings: land use and planning, aesthetics, population and housing, transportation and circulation, greenhouse gas emissions, wind and shadow, recreation, utilities and service systems, public services, geology and soils, hydrology and water quality, and hazards and hazardous materials. Therefore, with implementation of the mitigation measures specified in Section E.6, Noise (**Mitigation Measure M-NO-4: Implement Noise Control Measures for Construction Activities at the Big Creek Shaft and Second Garrote Areas**), and Section E.7, Air Quality (**Mitigation Measure M-AQ-2: Minimize Off-Road Construction Equipment Emissions at the Big Creek Shaft Area**), the proposed project would not result in substantial adverse effects, direct or indirect, on human beings.

F. Mitigation Measures

The following mitigation measures are proposed to be adopted by the SFPUC and are necessary to avoid potential significant impacts of the proposed project.

F.1 Cultural Resources

Mitigation Measure M-CR-2a: Accidental Discovery (Environmental Planning Archeological Mitigation Measure I)

The following mitigation measure is required 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) and (c), on tribal cultural resources as defined in *CEQA Statute* section 21074, and on human remains and associated or unassociated funerary objects.

ALERT sheet: The SFPUC shall distribute the Planning Department archeological 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 soils-disturbing activities within the project site. Prior to any soils-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.

Training: A preconstruction training shall be provided to all construction personnel performing or managing soils-disturbing activities by a qualified archeologist prior to the start of soils-disturbing activities on the project. The training may be provided in person or using a video and include a handout prepared by the qualified archeologist. The video and materials will be reviewed and approved by the Environmental Review Officer. The purpose of the training is to enable personnel to identify archeological resources that may be encountered and to instruct them on what to do if a potential discovery occurs. Images of expected archeological resource types and archeological testing and data recovery methods should be included in the training.

Affidavit: The SFPUC shall provide the Environmental Review Officer with a signed affidavit from the responsible parties (prime contractor, subcontractor(s), and utilities firm) to the Environmental Review Officer confirming that all field personnel have received copies of the Alert Sheet and have taken the preconstruction training.

Stop work provision: Should any indication of an archeological resource be encountered during any soils-disturbing activity of the project, the project Head Foreman and/or the SFPUC shall immediately notify the Environmental Review Officer and shall immediately suspend any soils-disturbing activities in the vicinity of the discovery until the Environmental Review Officer has determined what additional measures should be undertaken.

Discoveries on nonfederal lands: On fee-owned land or easements on private property, if the Environmental Review Officer determines that an archeological resource may be present within the project site, the SFPUC shall retain the services of an archeological consultant from the pool of qualified archeological consultants maintained by the Planning Department archeologist. The archeological consultant shall advise the Environmental Review Officer as to whether the discovery is an archeological resource, 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 Environmental Review Officer may require, if warranted, specific additional measures to be implemented by SFPUC. The Environmental Review Officer may also determine that the archeological resource is a tribal cultural resource and will consult with affiliated Native Americans tribal representatives, if warranted.

Measures might include preservation in situ of the archeological resource; an archeological monitoring program; an archeological testing program; and an interpretative program. If an archeological monitoring program, archeological testing program, or interpretative program is required, it shall be consistent with the Environmental Planning division guidelines for such programs and reviewed and approved by the Environmental Review Officer. The Environmental Review Officer may also require that the SFPUC immediately implement a site security program if the archeological resource may be at risk from vandalism, looting, or other damaging actions.

The archeological consultant shall submit a Draft Final Archeological Resources Report to the Environmental Review Officer that evaluates the historical significance of any discovered archeological resource and describes the archeological and historical research methods employed in the archeological testing/monitoring/data recovery program(s) undertaken. The Draft Final Archeological Resources Report shall include a curation and deaccession plan for all recovered cultural materials. The Draft Final Archeological Resources Report shall also include an Interpretation Plan for public interpretation of all significant archeological features.

Copies of the Draft Final Archeological Resources Report shall be sent to the Environmental Review Officer for review and approval. Once approved by the Environmental Review Officer, the consultant shall also prepare a public distribution version of the Final Archeological Resources Report. Copies of the Final Archeological Resources Report shall be distributed as follows: California Archaeological Site Survey Central California Information Center shall receive one copy and the Environmental Review Officer shall receive a copy of the transmittal of the Final Archeological Resources Report to the Central California Information Center. The Environmental Planning division of the Planning Department shall receive one bound and one unlocked, searchable PDF copy on compact disc of the Final Archeological Resources 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. In instances of public interest in or the high interpretive value of the resource, the Environmental Review Officer may require a different or additional final report content, format, and distribution than that presented above.

Discoveries on federal lands: In the event that either cultural resources are discovered, or historic properties are inadvertently affected on a Raker Act right-of-way or on National Forest System lands, the SFPUC shall notify both the Environmental Review Officer and the federal land manager. Treatment of the discovery and any tribal consultation shall be conducted under the guidance of the Forest Heritage Resources Program Manager and in accordance with the Archaeological Resource Protection Act of 1979, as amended (93 Stat. 721, et seq.; 16 United States Code [U.S.C.] 470 et. seq.), section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470), and its implementing regulations, entitled Protection of Historic Properties (36 CFR part 800).

The Forest Heritage Resources Program Manager shall submit written notification describing the circumstances of the discovery to the Regional Heritage Program Leader and the California State Historic Preservation Officer (e.g., letter or email notification). The Forest Heritage Resources Program Manager will provide written reports describing the status or resolution of the discovery/inadvertent effect every six months until it is resolved.

Discoveries of human remains and associated or unassociated funerary objects on nonfederal lands: If human remains and associated or unassociated funerary objects are discovered during any soils-disturbing activity on lands owned in fee by the City of San Francisco, or easements on private property, all applicable state and federal laws shall be followed. This shall include immediate notification of the Tuolumne County Sheriff's Office and Coroner's Office and/or the Mariposa County Sheriff's Office and Coroner's Office, depending on the county in which the discovery is made; 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 who shall appoint a Most Likely Descendant (Public Resources Code section 5097.98). The Environmental Review Officer shall also be immediately notified upon discovery of human remains. The archeological consultant, SFPUC, Environmental Review Officer, and Most Likely Descendant shall have up to but not beyond six days after the discovery to make all reasonable efforts to develop an agreement for the treatment of human remains and associated or unassociated funerary objects with appropriate dignity (CEQA Guidelines. section 15064.5[d]). The agreement should take into consideration the appropriate excavation, removal, recordation, analysis, curation, possession, and final disposition of the human remains and associated or unassociated funerary objects. Nothing in existing state regulations or in this mitigation measure compels the SFPUC and the Environmental Review Officer to accept recommendations of a Most Likely Descendant. The archeological consultant shall retain possession of any Native American human remains and associated or unassociated burial objects until completion of any scientific analyses of the human remains or objects as specified in the treatment agreement if such as agreement has been made or, otherwise, as determined by the archeological consultant and the Environmental Review Officer. If no agreement is reached state regulations shall be followed including the reinterment of the human remains and associated burial objects with appropriate dignity on the property in a location not subject to further subsurface disturbance (Public Resources Code section 5097.98).

Discoveries of human remains and associated or unassociated funerary objects on federal lands: If human remains and associated or unassociated funerary objects are discovered during any soils-disturbing activity on a Raker Act right of way or on National Forest System lands, all applicable federal laws shall be followed, and SFPUC shall notify the Forest Heritage Resources Program Manager and Environmental Review Officer immediately. The SFPUC shall ensure that all work within 300 feet of the discovery will cease, the area will be secured, and the Heritage Resources Program Manager shall notify, depending on the location of the discovery, either the Tuolumne County Sheriff's Office and Coroner's Office and/or the Mariposa County Sheriff's Office and Coroner's Office of the discovery.

Native American human remains, funerary objects, sacred objects, or items of cultural patrimony found on federal land will be handled according to section 3 of the Native American Graves Protection and Repatriation Act and its implementing regulations (43 CFR Part 10); the Archaeological Resource Protection Act of 1979, as amended (93 Stat. 721, et seq.; 16 U.S.C. 470 et. seq.), and the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470f; 479h-2) and its implementing regulations, entitled Protection of Historic Properties (36 CFR part 800). Any human remains, funerary objects, sacred objects, or items of cultural patrimony encountered during project operations shall be treated with dignity and respect. All treatment, care, and handling shall be carried out in consultation with the Tuolumne Me-Wuk Tribe of Indians.

Mitigation Measure M-CR-2b, Archeological Monitoring, below, also would be implemented for ground-disturbing work within the boundaries of identified archeological sites that have the potential for surviving buried deposits or features, as assessed above. This measure would apply to project implementation at SF-S7 and SF-S8.

Mitigation Measure M-CR-2b: Archeological Monitoring (Environmental Planning Archeological Mitigation Measure II)

Based on the reasonable potential that archeological resources may be present within the project site, the following measures shall be undertaken to avoid any potentially significant adverse effect from the proposed project on buried historical resources and on human remains and associated or unassociated funerary objects. The SFPUC shall, in consultation with the Environmental Review Officer, retain the services of a qualified archaeological consultant. The archeological consultant shall undertake an archeological monitoring program. All plans and reports prepared by the consultant as specified herein shall be submitted first and directly to the Environmental Review Officer for review and comment, and shall be considered draft reports subject to revision until final approval by the Environmental Review Officer. Archeological monitoring and/or data recovery programs required by this measure could suspend construction of the project for up to a maximum of four weeks. At the direction of the Environmental Review Officer, the suspension of *construction* can be extended beyond four weeks only if such a suspension is the only feasible means to reduce to a less-than-significant level potential effects on a significant archeological resource as defined in CEQA Guidelines Sect. 15064.5 (a) and (c).

Consultation with descendant communities on nonfederal lands: On lands owned in fee by the City and County of San Francisco or easements on private property, upon discovery during monitoring of an archeological site[318] associated with descendant Native Americans, or in the event that potential effects to such a site are identified during monitoring, the SFPUC shall contact an official representative of the Tuolumne Me-Wuk Tribe of Indians and the Environmental Review Officer. The representative of the descendant group shall be given the opportunity to monitor archeological field investigations of the site and to offer recommendations to the Environmental Review Officer regarding appropriate archeological treatment of the site, of recovered data from the site, and, if applicable, any interpretative treatment of the associated archeological site. A copy of the Final Archeological Resources Report shall be provided to the representative of the descendant group.

Consultation with descendant communities on federal lands: If the discovery is on a Raker Act right of way or on National Forest System lands, SFPUC shall immediately contact the Forest Heritage Program Manager and the Environmental Review Officer. Treatment of the discovery and any tribal consultation shall be conducted under the guidance of the Forest Heritage Resources Program Manager and in accordance with the Archaeological Resource Protection Act of 1979, as amended (93 Stat. 721, et seq.; 16 U.S.C. 470 et. seq.), section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470), and its implementing regulations, entitled Protection of Historic Properties (36 CFR part 800).

Archeological monitoring program for nonfederal lands (including fee-owned land and easements on private property). The archeological monitoring program shall minimally include the following provisions:

[318] The term "archeological site" is intended here to minimally include any archeological deposit, feature, burial, or evidence of burial.

- The archeological consultant, SFPUC, and Environmental Review Officer shall meet and consult on the scope of the archeological monitoring program reasonably prior to any project-related soils-disturbing activities commencing. The Environmental Review Officer in consultation with the project archeologist shall determine what project activities shall be archeologically monitored. In most cases, any soils-disturbing activities, such as demolition, foundation removal, excavation, grading, utilities installation, foundation work, driving of piles (foundation, shoring, etc.), site remediation, etc., shall require archeological monitoring because of the potential risk these activities pose to archaeological resources and to their depositional context;
- The archeological consultant shall undertake a worker training program for soil-disturbing workers that will include an overview of expected resource(s), how to identify the evidence of the expected resource(s), and the appropriate protocol in the event of apparent discovery of an archeological resource;
- The archeological monitor(s) shall be present on the project site according to a schedule agreed upon by the archeological consultant and the Environmental Review Officer until the Environmental Review Officer has, in consultation with the archeological consultant, determined that project construction activities could have no effects on significant archeological deposits;
- The archeological monitor shall record and be authorized to collect soil samples and artifactual/ecofactual material as warranted for analysis;
- If an intact archeological deposit is encountered, all soils-disturbing activities in the vicinity of the deposit shall cease. The archeological monitor shall be empowered to temporarily redirect demolition/excavation/pile driving/construction crews and heavy equipment until the deposit is evaluated. The archeological consultant shall immediately notify the Environmental Review Officer of the encountered archeological deposit. The archeological consultant shall, after making a reasonable effort to assess the identity, integrity, and significance of the encountered archeological deposit, present the findings of this assessment to the Environmental Review Officer.

If the Environmental Review Officer in consultation with the archeological consultant determines that a significant archeological resource is present and that the resource could be adversely affected by the proposed project, at the discretion of the SFPUC either:

A. The proposed project shall be redesigned so as to avoid any adverse effect on the significant archeological resource; or

B. An archeological data recovery program shall be implemented, unless the Environmental Review Officer determines that the archeological resource is of greater interpretive than research significance and that interpretive use of the resource is feasible.

If an archeological data recovery program is required by the Environmental Review Officer, the archeological data recovery program shall be conducted in accord with an archeological data recovery plan. The project archeological consultant, SFPUC, and Environmental Review Officer shall meet and consult on the scope of the archeological data recovery plan. The archeological consultant shall prepare a draft archeological data recovery plan that shall be submitted to the Environmental Review Officer for review and approval. The archeological data recovery plan shall identify how the proposed data recovery program will preserve the significant information the archeological resource is expected to contain. That is, the archeological data recovery plan will identify what scientific/historical research questions are applicable to the expected resource, what data classes the resource is expected to possess, and how the expected data classes would address the applicable research questions. Data recovery, in general, should be limited to the portions of the historical property that could be adversely affected by the proposed project. Destructive data recovery methods shall not be applied to portions of the archeological resources if nondestructive methods are practical.

The scope of the Archeological Data Recovery Plan shall include the following elements:

- *Field Methods and Procedures*. Descriptions of proposed field strategies, procedures, and operations.
- *Cataloguing and Laboratory Analysis*. Description of selected cataloguing system and artifact analysis procedures.
- *Discard and Deaccession Policy*. Description of and rationale for field and post-field discard and deaccession policies.
- *Interpretive Program*. Consideration of an on-site/off-site public interpretive program during the course of the archeological data recovery program.
- *Security Measures*. Recommended security measures to protect the archeological resource from vandalism, looting, and nonintentionally damaging activities.
- *Final Report*. Description of proposed report format and distribution of results.
- *Curation*. Description of the procedures and recommendations for the curation of any recovered data having potential research value, identification of appropriate curation facilities, and a summary of the accession policies of the curation facilities.

Final Archeological Resources Report. The archeological consultant shall submit a Draft Final Archeological Resources Report to the Environmental Review Officer that evaluates the historical significance of any discovered archeological resource and describes the archeological and historical research methods employed in the archeological testing/monitoring/data recovery program(s) undertaken. The Draft Final Archeological Resources Report shall include a curation and deaccession plan for all recovered cultural materials. The Draft Final Archeological Resources Report shall also include an Interpretation Plan for public interpretation of all significant archeological features.

Copies of the Draft Final Archeological Resources Report shall be sent to the Environmental Review Officer for review and approval. Once the draft final report is approved by the Environmental Review Officer, the consultant shall also prepare a public distribution version of the Final Archeological Resources Report. Copies of the Final Archeological Resources Report shall be distributed as follows: California Archaeological Site Survey Central California Information Center shall receive one copy and the Environmental Review Officer shall receive a copy of the transmittal of the Final Archeological Resources Report to the Central California Information Center. The Environmental Planning division of the Planning Department shall receive one bound and one unlocked, searchable PDF copy of the Final Archeological Resources Report on compact disc, 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. In instances of public interest in or the high interpretive value of the resource, the Environmental

Review Officer may require a different or additional final report content, format, and distribution than that presented above.

Archeological monitoring program on federal lands: On a Raker Act right of way or National Forest System lands, an archeological monitoring program shall be conducted by a qualified archeologist under the direction of the Stanislaus National Forest Heritage Program Manager. The scope, schedule, and reporting format for monitoring on federal land shall be performed according to the specifications provided by the Heritage Program Manager with the same objectives as stated above for archaeological monitoring on nonfederal land.

Human remains, associated or unassociated funerary objects on nonfederal lands. If human remains and associated or unassociated funerary objects are discovered during any soils-disturbing activity, all applicable state and federal laws shall be followed, including immediate notification of the either the Tuolumne County Sheriff's Office and Coroner's Office and/or the Mariposa County Sheriff's Office and Coroner's Office, depending on where the discovery occurred; 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, who shall appoint a Most Likely Descendant (Pub. Res. Code Sec. 5097.98). The Environmental Review Officer shall also be immediately notified upon discovery of human remains. The archeological consultant, SFPUC, Environmental Review Officer, and Most Likely Descendant shall make all reasonable efforts to develop an agreement for the treatment of human remains and associated or unassociated funerary objects with appropriate dignity (CEQA Guidelines. Sec. 15064.5(d)) within six days of the discovery of the human remains. This proposed timing shall not preclude the PRC 5097.98 requirement that descendants make recommendations or preferences for treatment within 48 hours of being granted access to the site. The agreement should take into consideration the appropriate excavation, removal, recordation, analysis, curation, possession, and final disposition of the human remains and associated or unassociated funerary objects. Nothing in existing state regulations or in this mitigation measure compels the SFPUC and the Environmental Review Officer to accept recommendations of a Most Likely Descendant. The archeological consultant shall retain possession of any Native American human remains and associated or unassociated burial objects until completion of any scientific analyses of the human remains or objects as specified in the treatment agreement if such as agreement has been made or, otherwise, as determined by the archeological consultant and the Environmental Review Officer. If no agreement is reached, state regulations shall be followed, including the reinterment of the human remains and associated burial objects with appropriate dignity on the property in a location not subject to further subsurface disturbance (Pub. Res. Code Sec. 5097.98).

Human remains, associated or unassociated funerary objects on federal lands: If human remains and associated or unassociated funerary objects are discovered during any soils-disturbing activity on a Raker Act right of way or on National Forest System lands, all applicable federal laws shall be followed, and the SFPUC shall notify the Heritage Resources Program Manager and Environmental Review Officer immediately. The SFPUC shall ensure that all work within 300 feet of the discovery will cease, the area will be secured, and the Heritage Resources Program Manager shall notify the Tuolumne County Sheriff's Office and Coroner's Office and/or the Mariposa County Sheriff's Office and Coroner's Office (depending on where the discovery occurred) of the discovery.

Native American human remains, funerary objects, sacred objects, or items of cultural patrimony found on federal land will be handled according to Section 3 of the Native American Graves Protection and Repatriation Act and its implementing regulations (43 CFR Part 10); the

Archaeological Resource Protection Act of 1979, as amended (93 Stat. 721, et seq.; 16 U.S.C. 470 et. seq.), and the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470f; 479h-2) and its implementing regulations, entitled Protection of Historic Properties (36 CFR part 800). Any human remains, funerary objects, sacred objects, or items of cultural patrimony encountered during project operations shall be treated with dignity and respect. All treatment, care, and handling shall be carried out in consultation with the Tuolumne Me-Wuk Tribe of Indians.

Mitigation Measure M-CR-4. Tribal Cultural Resources, Tribal Consultation and Implementation of Tribal Cultural Resources Treatment Plan

In the event of an accidental discovery of cultural resources of Native American origin on fee-owned land or easements across private land, the Environmental Review Officer will consult with the tribal representative(s) of the Tuolumne Me-Wuk Tribe of Indians to determine whether the resource represents a Tribal Cultural Resource. If the tribe indicates that the resource is a Tribal Cultural Resource, the Environmental Review Officer shall consult with the SFPUC and the tribe to determine whether effective long-term protection and the avoidance of impacts are feasible, and to identify how this will be accomplished. Potential means may include, but would not be limited to, measures such as flagging of boundaries on the ground prior to work and avoiding the resource; allowing brush to grow to obscure the resource; and blocking vehicle access routes to or across the resource. The identified measures will be memorialized in a memorandum attached to the archaeological site record.

If the Environmental Review Officer, in consultation with the Tuolumne Me-Wuk Tribe of Indians and the SFPUC, determines that there are no feasible and effective means of preserving the tribal cultural resource in place, the Environmental Review Officer and SFPUC shall consult with tribal representatives and a qualified archeologist to implement additional applicable measures, such as archeological testing or monitoring, as appropriate to preserve the archeological values of the resource. The SFPUC shall supply the tribe with copies of the reports of archeological work. The SFPUC's archeological consultant shall prepare and distribute to the Tuolumne Me-Wuk Tribe of Indians a synopsis of archeological results for the use of the tribe in a format of the tribe's choice.

In addition, in cases where project work will substantially damage a significant Tribal Cultural Resource, and if requested by the tribe, the Environmental Review Officer and SFPUC shall consult with the tribe to develop a Tribal Cultural Resources Treatment Plan. This plan shall identify additional interpretive, educational or cultural measures to preserve the tribal cultural values represented by the resource, and shall be implemented by SFPUC. The plan shall identify, as applicable, materials, content and formats, venues for installation, and producers or artists for the displays, as applicable; a long-term maintenance program; and a schedule for implementation. The plan will be subject to approval by SFPUC and the Environmental Review Officer. The plan may include, but would not be limited to, measures such as the following:

- Development and installation or distribution of interpretive products such as artifact displays, interpretive signage, and artist installations by Native American artists
- Preparation, distribution, and/or archival preservation of oral histories
- Educational materials or classroom teaching kits related to the affected resource

- One or more archaeological training presentations for the tribe and identification of opportunities for the tribe to participate in future archaeological projects or resource monitoring
- Measures to ensure access to traditional resources, such as basketry or stone tool materials associated with the tribal cultural resource site, or to provide access to alternative sources of such material at other protected locations

In the event of an accidental discovery of cultural resources of Native American origin that are on federal land, the SFPUC will notify the Forest Heritage Resources Program Manager and the Environmental Review Officer. Treatment of the discovery and tribal consultation shall be conducted under the guidance of the Heritage Resources Program Manager and in accordance with the Archaeological Resource Protection Act of 1979, as amended (93 Stat. 721, et seq.; 16 U.S.C. 470 et. seq.), Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470), and its implementing regulations, entitled Protection of Historic Properties (36 CFR part 800).

F.2 Noise

Mitigation Measure M-NO-4: Implement Noise Control Measures for Construction Activities at the Big Creek Shaft and Second Garrote Areas

The SFPUC shall include in its construction contract specifications a requirement that at least 28 days before the start of nighttime construction at Big Creek and Second Garrote, the contractor submit to the SFPUC for review and approval a noise control plan prepared by a qualified noise consultant. SFPUC shall require the qualified noise consultant to be a board-certified Institute of Noise Control Engineering member or other qualified consultant or engineer approved by the SFPUC Project Construction Manager. The SFPUC will verify that the noise control plan contains at least the following elements:

- Written notification of construction activities shall be provided to all noise-sensitive receptors within 1,500 feet of construction activities at the Big Creek Shaft and Second Garrote areas. Notification shall include the dates and hours during which construction activities are anticipated to occur and contact information, including a telephone number, for the project representative to be contacted in the event that noise levels are deemed excessive. Recommendations for assisting noise-sensitive land uses in reducing interior noise levels (e.g., closing windows and doors) shall also be included in the notification.
- A detailed list of noise control methods to achieve the Tuolumne County General Plan Noise Element interior standards of 40 dBA L_{max} in sleeping areas and 45 dBA L_{max} in other rooms at noise-sensitive receptors within 1,500 feet of nighttime construction. A number of feasible methods exist and could include a combination of the following or others as identified by the qualified noise consultant:
  - Enclose stationary noise sources, such as pumps, compressors, and generators in shipping containers or other types of enclosures that are solid and block the line of sight between the construction equipment and sensitive receptors.
  - Locate noise-attenuating buffers such as structures, truck trailers, or spoil piles between noise sources and sensitive receptors to block the line of sight between the construction equipment and sensitive receptors.

- Properly maintain all construction equipment and equip it with noise-reduction intake and exhaust mufflers and engine shrouds, in accordance with manufacturers' recommendations. Equipment engine shrouds shall be closed during equipment operation.
- Shut down all motorized construction equipment when not in use, to prevent idling.
- Use the best available noise control techniques on equipment and trucks.

- The noise control measures that are anticipated to be performed shall be listed.
- The proposed staging and scheduling of noise control measures shall be included.
- The schedule and plan to document baseline noise levels at residential property lines within 1,500 feet of work areas shall be included. The baseline 1-hour L_{eq} during nighttime hours (10:00 p.m. to 7:00 a.m.) at the exterior areas of nearby noise-sensitive receptors will be documented for at least a 1-week period before construction begins.
- The number and location of monitoring locations in relation to work areas at Big Creek and Second Garotte shall be noted.
- The schedule for tests to confirm the construction noise levels and effectiveness of noise control measures prior to continuous construction activity at Big Creek and Second Garrote shall be included.
- The schedule for ongoing monitoring and reporting of construction noise levels to meet the Tuolumne County General Plan Noise Element standards shall be included. Monitoring will occur at least weekly, or more often if needed in response to complaints.
- In the event that thresholds are exceeded, the contractor will provide information to the SFPUC within 48 hours of the exceedance, identifying the source of the exceedance and corrective actions to reduce the noise.

If noise complaints are received due to tunnel repair construction noise, the SFPUC and the contractor will meet to discuss other options that can further reduce noise levels at the sensitive receptor. One option may be acoustic barriers (e.g., lead curtains or sound barriers) that could be installed on the receptor's property. When installed properly, acoustic barriers can reduce construction noise levels by approximately 5 dBA.[319]

F.3 Air Quality

Mitigation Measure M-AQ-2: Minimize Off-Road Construction Equipment Emissions at the Big Creek Shaft Area

For construction activities at Big Creek, the SFPUC shall require in its contract specifications that the compressor trailer have an engine that meets either U.S. EPA or California Air Resources Board Tier 4 Final off-road emission standards.

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[319] Caltrans, *Transportation and Construction Vibration Guidance Manual*, September 2013.

F.4 Biological Resources

Mitigation Measure M-BI-1a: Worker Environmental Awareness Training for Construction

A project-specific worker environmental awareness program training shall be developed by a qualified biologist for the project, and attended by all construction personnel prior to beginning work onsite. As part of the training, brochures may be given to provide reference material to contractors. The training may be provided by the qualified biologist or by designated SFPUC staff trained by the biologist to provide this training, using the materials developed by the qualified biologist, and may be administered via a video-recorded training produced specifically for the project by a qualified biologist. The worker environmental awareness program training shall at a minimum include, but not be limited to, the following:

- Applicable state and federal laws, environmental regulations, project permit conditions, and penalties for noncompliance
- Special-status plant and wildlife species with the potential to occur at or in the vicinity of the project site, avoidance measures, and a protocol for reporting the discovery, harm, injury, or mortality of any such species, including a detailed communication chain
- Known sensitive resource areas in the project vicinity that are to be avoided and/or protected, as well as restrictions of work and staging to the approved project site
- Known noxious or invasive weeds in or near the work areas, and best management practices for minimizing their spread
- Best management practices and their location on the project site for erosion control and/or species exclusion

Mitigation Measure M-BI-1b: Raptors (including the California Spotted Owl) and Migratory Bird Nesting Survey and Protection during Construction

To protect raptors and nesting migratory birds, the SFPUC shall retain a qualified wildlife biologist to conduct pre-construction surveys for nesting raptors and migratory birds prior to the commencement of construction activities that occur between March 1 and August 31 of a given year. The surveys shall be conducted a maximum of 14 days prior to the start of construction during the nesting season. The project area, plus—as allowed, based on access by the property owner—a 300-foot survey area surrounding the project area, shall be surveyed for nesting raptors; a 50-foot survey area in addition to the project area shall be surveyed for other nesting birds, such as passerines, protected under the Migratory Bird Treaty Act. For the California spotted owl, surveys shall be undertaken in areas where the protected activity centers or home range core areas overlap with the 210-foot buffer around the project site. A nest is defined to be active for raptors if there is a pair of birds displaying reproductive behavior (i.e., courting) at the nest, and/or if the nest contains eggs or chicks. For other migratory birds and passerines, a nest is defined as active if it contains eggs or chicks. If no active nests are detected, no additional action would be required. Nesting deterrents, such as mylar foil or noise deterrents, may be implemented prior to nesting season to deter birds from nesting in the project area.

If active nests are found during the pre-construction nesting survey, the wildlife biologist shall evaluate whether the schedule of construction activities could affect the active nest, and the following measures shall be implemented based on the biologist’s determination:

- If construction is not likely to affect the active nest, it may proceed without restriction; however, a biologist shall regularly monitor the nest to confirm that there is no adverse effect on nest success and may revise the determination at any time during the nesting season.
- If construction may affect the active nest, the biologist shall establish a no-disturbance buffer, taking into account the species involved; whether the presence of any obstruction, such as a building, is in the line of sight between the nest and construction; and the level of project and ambient activity (i.e., if the nest is adjacent to a road or active trail).
- If California spotted owls are discovered nesting, appropriate measures to avoid disturbance shall be undertaken in consultation with the U.S. Forest Service (as appropriate), U.S. Fish and Wildlife Service, and/or the California Department of Fish and Wildlife.
- No-disturbance buffers for passerines may be 25 feet or greater, and 300 feet for most raptors. For bird species that are federally and/or state-listed special-status species (i.e., threatened, endangered, fully protected, or Species of Special Concern), an SFPUC representative, supported by the wildlife biologist, shall consult with the U.S. Forest Service (as appropriate), U.S. Fish and Wildlife Service, and/or California Department of Fish and Wildlife regarding appropriate nest buffers.
- Removing inactive passerine nests may occur at any time. Inactive raptor nests shall not be removed unless a qualified biologist has first consulted with the U.S. Fish and Wildlife Service and/or California Department of Fish and Wildlife.
- Any birds that begin nesting within a survey buffer during construction and following the preconstruction survey are assumed to be habituated to construction-related or similar noise and disturbance levels, and no work exclusion zones shall be required. This measure does not apply to bird species that are federally and/or state-listed special-status species (i.e., threatened, endangered, fully protected, or Species of Special Concern).

Mitigation Measure M-BI-1c: Maternity Roosts and Special-Status Bats Day Roosts

A survey for roosting bats shall be conducted by a qualified biologist prior to the commencement of construction activities that have the potential to disturb special-status bat day roosts or maternity roosts of any bat species through elevated noise levels or removal of trees, as determined by the qualified bat biologist. Areas within 25 feet of locations proposed for tree removal, slope stabilization, and/or adit modifications shall be assessed to determine whether they provide high potential for roost sites. If a visual survey is not adequate to determine the presence or absence of bats (such as in tree cavities), acoustic equipment or other methods recommended by the qualified biologist shall be used to determine potential occupancy and species composition. If no active roosts are found, then no further action is warranted. If special-status bat day roosts or maternity roosts of any bat species are found, the following measures shall be implemented:

- **Maternity Roosts:** If a maternity roost of any size supporting any bat species (special-status and non-special-status) is detected during surveys, an avoidance buffer around the active roost, as determined by a qualified bat biologist, shall be maintained from April 1 until the young are flying, typically after August 31.
- **Special-Status Bat Day Roosts:** If a day roost of any special-status bat is found in a tree planned for removal, or near enough to planned work areas that the roost could be disturbed by project activities to the point of abandoning the roost, as determined by the qualified bat biologist, the

bats shall be safely evicted under the direction of a qualified bat biologist. Day roosts/trees shall not be removed unless the daytime temperature is at least 50 degrees Fahrenheit and there is no rain present. Eviction would occur as a multi-step process to make suitable habitat less desirable for special-status bats by: 1) removing surrounding trees that are determined to not contain suitable roosts (if surrounding trees are identified for removal); 2) limbing trees determined to potentially contain roosting sites; and 3) removing potential roosting trees. In some circumstances, the qualified bat biologist may allow roosting bats to continue using a roost while construction is occurring near the roost site. For example, if it is determined that the risks to bats from eviction (e.g., increased predation or exposure, or competition for roost sites) are greater than the risk of roost abandonment (resulting from construction), then the bats shall not be evicted.

Mitigation Measure M-BI-2: Oak Woodland Mitigation

The SFPUC shall contribute funding to the U.S. Forest Service's Rim Fire Reforestation Project, specifically to implement the deer habitat enhancement component. Implementation of deer habitat enhancement in specified U.S. Forest Service areas will mitigate for the loss of 6.5 acres of oak woodland due to the project. Funding for the loss oak woodland acreage shall be provided to compensate for impacts at a minimum of a 2:1 ratio; i.e., the SFPUC would fund the enhancement of at least 13 acres of oak woodlands. The acreage calculation shall not include individual hazard trees that are targeted for removal for safety reasons.

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G. Public Notice and Comment

G.1 Notification of Project Receiving Environmental Review

A "Notification of Project Receiving Environmental Review" was mailed on July 27, 2018 to property owners and residents of property within 300 feet of the project sites, responsible and trustee agencies, and interested parties. The comments that were received in response to the notification are summarized below.

To the extent that these comments related to physical impacts on the environment, they are addressed under the sections in the parentheses.

- **Caltrans.** Requested to review all project-related documentation. Also requested notification in the event of any change in use or scope of work concerning the Caltrans-owned Staging Area A8/9-S6, which would be shared by the SFPUC and Caltrans during construction. (Section A, Project Description)
- **Central Valley Regional Water Quality Control Board.** Commented that the Central Valley Regional Water Quality Control Board is responsible for protecting the quality of surface and groundwaters of the state. Also provided information on various regulatory and permitting requirements for the SFPUC to consider. (Section C, Compatibility with Existing Zoning and Plans; and Section E. 15, Hydrology and Water Quality)
- **Camp Tawonga.** Commented that the organization is concerned that the project may disrupt the use of roads and recreational areas in the vicinity of the camp. (Section E.5, Transportation and Circulation; and Section E.10, Recreation)
- **Central Sierra Environmental Resource Center.** Requested to be added to the notification list for future project documents. Recommended that the environmental review document include information about the effects of construction and operation of this project on the following subjects: water waste quantities, efficiency of water transport, watershed levels, sediment loading, and sensitive plants and wildlife within the project boundary. (Section E.13, Biological Resources; and Section E.15, Hydrology and Water Quality)

G.2 Tribal Notification

On July 27, 2018, the Planning Department mailed a "Tribal Notification Regarding Tribal Cultural Resources and CEQA" for this project to Native American tribal representatives in the project vicinity, as identified by the Native American Heritage Commission. During the 30-day comment period, no Native American tribal representatives contacted the Planning Department to request consultation.

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H. Determination

On the basis of this Initial Study:

☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☒ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, no further environmental documentation is required.

for

Lisa Gibson
Environmental Review Officer
for
John Rahaim
Director of Planning

DATE 7/10/19

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I. Initial Study Authors and Project Sponsor Team

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APPENDIX A
NOISE PREDICTION MODEL DATA

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Project-Generated Construction Source Noise Prediction Model

Mtn Tunnel IS/MND

Shaft, Adit Portal Excavation

Location	Distance to Nearest Receiver in feet	Combined Predicted Noise Level (L_{eq} dBA)
Threshold*	1,150	51
EI-S3	1450	49
PP-S6	1250	50

Assumptions:	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Drill Rig Truck	84	0.2
Crane	85	0.16
Front End Loader	80	0.4
Generator	82	0.5
Blasting	94	0.05

Ground Type	Soft
Ground Factor	0.50

Predicted Noise Level [2]	L_{eq} dBA at 50 feet[2]
Drill Rig Truck	77.0
Crane	77.0
Front End Loader	76.0
Generator	79.0
Blasting	81.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
85.4

Sources:

[1] Obtained from the FHWA Roadway Construction Noise Model, January 2006.

[2] Based on the following from the Federal Transit Noise and Vibration Impact Assessment, 2006.

L_{eq}(equip) = E.L.+10*log (U.F.) - 20*log (D/50) - 10*G*log (D/50)

Where: E.L. = Emission Level;

U.F.= Usage Factor;

G = Constant that accounts for topography and ground effects; and

D = Distance from source to receiver.

*Project specific threshold

Project-Generated Construction Source Noise Prediction Model

Mtn Tunnel IS/MND

Road Modifications

Location	Distance to Nearest Receiver in feet	Combined Predicted Noise Level (L_{eq} dBA)
Threshold*	536	60
Big Creek	450	62
Second Garrote	550	60

Assumptions:	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Excavator	85	0.4
Dozer	85	0.4
Front End Loader	80	0.4
Compactor (ground)	80	0.2
Rivit Buster/chipping gun	85	0.2

Ground Type	Soft
Ground Factor	0.50

Predicted Noise Level[2]	L_{eq} dBA at 50 feet[2]
Excavator	81.0
Dozer	81.0
Front End Loader	76.0
Compactor (ground)	73.0
Rivit Buster/chipping gun	78.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
85.8

Sources:

[1] Obtained from the FHWA Roadway Construction Noise Model, J

[2] Based on the following from the Federal Transit Noise and Vibrat

L_{eq}(equip) = E.L.+10*log (U.F.) - 20*log (D/50) - 10*G*log (D/50)

Where: E.L. = Emission Level;

U.F.= Usage Factor;

G = Constant that accounts for topography and ground effects; and

D = Distance from source to receiver.

*Project specific threshold

Project-Generated Construction Source Noise Prediction Model

Mtn Tunnel IS/MND

Daytime and Nighttime Grouting

Location	Distance to Nearest Receiver in feet	Combined Predicted Noise Level (L_{eq} dBA)
Threshold*	1,150	45
BC-S2	225	65
BC-S2	250	63
SG-S1	750	51

With Enclosures for Stationary Equipment

Location	Combined Predicted Noise Level (L_{eq} dBA)
BC-S2	59
BC-S2	58
SG-S1	46

Assumptions:	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Generator	82	0.5
Compressor (air)	80	0.4
Mobile Grout Unit	64	0.8

Ground Type	Soft
Ground Factor	0.50

Predicted Noise Level [2]	L_{eq} dBA at 50 feet[2]
Generator	79.0
Compressor (air)	76.0
Mobile Grout Unit	63.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
80.8

Sources:

[1] Obtained from the FHWA Roadway Construction Noise Model, January 2006.

[2] Based on the following from the Federal Transit Noise and Vibration Impact Assessment, 2006.

L_{eq}(equip) = E.L.+10*log (U.F.) - 20*log (D/50) - 10*G*log (D/50)

Where: E.L. = Emission Level;

U.F.= Usage Factor;

G = Constant that accounts for topography and ground effects; and

D = Distance from source to receiver.

*Project specific threshold

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APPENDIX B
AIR QUALITY EMISSIONS CALCULATIONS

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Mountain Tunnel Improvements Project

Tuolumne County Air Pollution Control District

	Notes	Data Inputs
Construction Duration:	Construction Start: 2020	Project Description
	Construction End: 2026	Project Description
	Construction Durations of each construction element is based upon client-provided construction equipment list.	Client-provided construction equipment list, as detailed within each tab in this worksheet.
Construction Phasing:	See Construction Schedule Tab - this shows overlap of activities. However, conservative estimates were used in emissions estimates and not necessarily broken down in the level of detail shown in this schedule. Therefore, maximum daily emissions may be less than estimated, as construction activities for a given phase may actually be spread out over various phases but estimated for emissions as potentially occurring simultaneously.	
	Maximum daily emissions scenarios are based upon anticipated construction schedule. Potential overlap periods are as follows: 1. Adit 5/6, Adit 8/9, and Priest Portal. 2. Early Intake and South Fork. 3. South Fork and Second Garrote. 4. Rickson Road Improvements	Client-provided construction equipment list, as detailed within each tab in this worksheet. Tree removal based on survey data.
	Although the overlapping work distinguishes between shutdown and non-shutdown periods, to show a conservative emissions estimates, all overlaps assumed overlap of the maximum daily emissions of the respective phases.	
	Tree removal is assumed to take place prior to construction activities beginning at a given site.	
	All sub-activities within a given construction activity are estimated as a single max daily emissions estimate, but total construction days, workers, material movement, mobile trips, etc., are estimated for the additive impacts of all sub-elements.	
Construction equipment:	Construction equipment, including type, hours per day and total days of use, is based on client-provided construction list; on-road trucks listed in the construction equipment table are assumed to be included with the already identified worker, vendor, and haul trucks from the project description.	Client-provided construction equipment list, as detailed within each tab in this workbook.
Mobile trips:	Max daily worker trips: Based upon Table 2 of Project Description Total worker trips: Based upon calculation of max daily for each sub-activity of a construction element and total work days and shifts associated with that activity (workdays/week and shifts/day vary between tunnel outage and non-outage periods) Max daily and total haul trips: Based upon Table 6 of Project Description Max daily and total vendor (material delivery) trips: Based upon Table 7 of Project Description	
	Because the details of tree removal are undecided, emissions estimates considered the maximum emissions from both removal and hauling as large logs and removal, chipping, and hauling away chipped materials.	
Cut/Fill:	Excavation / Fill Materials per construction element: Based upon Tables 4 and 5 of Project Description	
Fugitive Dust:	For the purposes of this analysis, watering is assumed to not be used as a control measure for fugitive dust. Intent is to show most conservative estimate of potential fugitive dust without on-site watering; however, watering exposed areas for dust control as needed to help minimize fugitive dust emissions, reducing maximum daily and total annual generation of fugitive dust from on-site earth moving activities and mobile vehicles driving on unpaved access roads.	Detailed fugitive dust estimates and source data provided in "Fugitive Dust" tab of this workbook.
Blasting:	Blasting estimates based on amount of material blasted, amount of explosives, and maximum number of daily blasts/rounds provided by project engineers. Maximum daily emissions are based on the maximum possible number of blasts/rounds that could be accomplished in a single day at each site; the potential overlap with blasting activities and other construction activities at a given site; and the potential overlap with construction activities taking place at other sites.	Inputs as detailed in the project description. Emission factor sources as detailed in the "Blasting" tab of this workbook.
Mitigation:	Mitigation has been applied at Big Creek and Second Garrote to minimize potential health risks to nearby sensitive receptors. Mitigation includes the use of Tier 4 final equipment.	

MTIP Construction Emissions Summary
Maximum daily emissions scenarios are based upon anticipated construction schedule. Potential overlap periods are as follows:
1. Adit 5/6, Adit 8/9, and Priest Portal.
2. Early Intake and South Fork.
3. South Fork and Second Garrote.
4. Rickson Road Improvements (West).

Although the overlapping work distinguishes between shutdown and non-shutdown periods, to show a conservative emissions esimates, all overlaps assumed overlap of the maximum daily emissions of the respective phases.

Unmitigated Emissions Estimates
Max Daily Construction Emissions (lbs/day)

		Emissions (Pounds/day)				
Construction Element	Construction Activity	ROG	NOx	CO	PM10	PM2.5
Tree Removal						
	On-Road Construction	2.28	48.26	15.80	1.52	0.91
	Fugitive Dust	-	-	-	294.79	24.71
	Construction Equipment	2.9608	22.3171	24.2390	1.1077	1.0191
	Subtotal	5.24	70.57	40.04	297.41	26.65
Early Intake						
	On-Road Construction	0.16	3.34	3.49	0.16	0.08
	Fugitive Dust	-	-	-	0.58	0.14
	Construction Equipment	10.8706	106.2040	67.0638	4.9638	4.5667
	Blasting	-	4.6344	18.2649	0.0252	0.0252
	Subtotal	11.03	114.18	88.82	5.73	4.82
South Fork						
	On-Road Construction	0.37	8.48	5.27	0.31	0.18
	Fugitive Dust	-	-	-	12.76	6.81
	Construction Equipment	17.11	173.64	103.57	7.59	6.98
	Blasting	-	12.74	50.20	0.20	0.20
	Subtotal	17.47	194.86	159.04	20.86	14.17
Big Creek						
	On-Road Construction	0.19	5.55	2.29	0.17	0.10
	Fugitive Dust	-	-	-	0.33	0.12
	Construction Equipment (No Tier 4 Equip)	12.93	124.84	76.16	5.88	5.41
	Blasting	-	-	-	-	-
	Subtotal (No Tier 4 Equip)	13.12	130.39	78.45	6.37	5.63
Adit 5/6						
	On-Road Construction	0.52	16.07	3.53	0.41	0.26
	Fugitive Dust	-	-	-	288.45	29.72
	Construction Equipment	20.36	207.82	124.44	9.13	8.40
	Blasting	-	2.06	8.13	0.07	0.07
	Subtotal	20.88	225.95	136.11	298.05	38.45
Adit 8/9						
	On-Road Construction	0.45	14.13	3.18	0.36	0.23
	Fugitive Dust	-	-	-	266.08	27.85
	Construction Equipment	17.28	174.43	113.97	7.38	6.79
	Blasting	-	2.36	9.30	0.07	0.07
	Subtotal	17.73	190.92	126.45	273.89	34.94
Second Garrote						
	On-Road Construction	0.32	10.27	2.71	0.27	0.17
	Fugitive Dust	-	-	-	36.09	10.15
	Construction Equipment (No Tier 4 Equip)	21.42	207.65	120.50	9.31	8.56
	Blasting	-	-	-	-	-
	Subtotal (No Tier 4 Equip)	21.74	217.92	123.20	45.67	18.88
Priest Portal Area						
	On-Road Construction	1.73	54.84	15.64	1.46	0.92
	Fugitive Dust	-	-	-	14.15	7.14
	Construction Equipment + Blasting	23.89	338.67	556.06	11.38	10.48
	Subtotal	25.62	393.52	571.70	26.98	18.55
Rickson Road Final Paving (West)						
	On-Road Construction	0.07	1.68	1.15	0.06	0.04
	Fugitive Dust	-	-	-	0.18	0.04
	Construction Equipment	4.15	36.11	22.23	1.43	1.32
	Subtotal	4.22	37.79	23.37	1.67	1.40
Maximum Daily Emission (Scenario 1)		64.23	810.39	834.25	869.35	100.03
Maximum Daily Emission (Scenario 2)		28.51	309.04	247.85	26.59	18.99
Maximum Daily Emission (Scenario 3)		39.21	412.78	282.24	66.53	33.06
Maximum Daily Emission (Scenario 4)		4.22	37.79	23.37	1.67	1.40
Maximum Daily Emissions		64.23	810.39	834.25	869.35	100.03

Unmitigated Emissions Estimates
Annual Construction Emissions (tons/year)

			Emissions (Tons per Phase)				
Construction Element	Year of Activity	Construction Activity	ROG	NOx	CO	PM10	PM2.5
Tree Removal	**Years 1 & 2**						
		On-Road Construction	0.01	0.24	0.08	0.01	0.00
		Fugitive Dust	-	-	-	1.46	0.12
		Construction Equipment	0.0444	0.3348	0.3636	0.0166	0.0153
		Subtotal	0.06	0.57	0.44	1.48	0.14
Early Intake	**Year 3**						
		On-Road Construction	0.01	0.20	0.33	0.01	0.01
		Fugitive Dust	-	-	-	0.02	0.00
		Construction Equipment	0.4326	4.2764	2.7749	0.2026	0.1864
		Blasting	-	0.0023	0.0091	0.0000	0.0000
		Subtotal	0.44	4.47	3.10	0.23	0.20
South Fork	Years 3, 4 & 5						
		On-Road Construction	0.03	0.64	0.67	0.03	0.02
		Fugitive Dust	-	-	-	1.88	1.02
		Construction Equipment	1.31	14.26	8.54	0.59	0.55
		Blasting	-	0.20	0.78	0.00	0.00
		Subtotal	1.35	14.90	9.21	2.51	1.59
Big Creek	Years 3, 4, 5, & 6						
		On-Road Construction	0.01	0.13	0.09	0.01	0.00
		Fugitive Dust	-	-	-	0.01	0.00
		Construction Equipment	0.65	6.24	3.81	0.29	0.27
		Blasting	-	-	-	-	-
		Subtotal (No Tier 4 Equip)	0.65	6.37	3.90	0.31	0.28
Adit 5/6	**Years 1 & 2**						
		On-Road Construction	0.06	1.82	0.41	0.05	0.03
		Fugitive Dust	-	-	-	19.97	2.48
		Construction Equipment	0.14	1.36	0.75	0.06	0.06
		Blasting	-	0.0083	0.03	0.00	0.00
		Subtotal	0.20	3.18	1.19	20.08	2.56
Adit 8/9	**Years 1 & 2**						
		On-Road Construction	0.05	1.68	0.37	0.04	0.03
		Fugitive Dust	-	-	-	16.72	2.15
		Construction Equipment	0.83	8.85	5.32	0.37	0.34
		Blasting	-	0.0059	0.02	0.00	0.00
		Subtotal	0.88	10.54	5.69	17.14	2.52
Second Garrote	Years 3, 4, 5 & 6						
		On-Road Construction	0.00	0.12	0.04	0.00	0.00
		Fugitive Dust	-	-	-	0.53	0.15
		Construction Equipment (No Tier 4 Equip)	0.96	9.29	5.61	0.44	0.40
		Blasting	-	-	-	-	-
		Subtotal (No Tier 4 Equip)	0.96	9.42	5.65	0.98	0.56
Priest Portal Area	Years 1 & 2						
		On-Road Construction	0.17	3.41	3.97	0.17	0.09
		Fugitive Dust	-	-	-	4.37	2.32
		Construction Equipment + Blasting	0.12	1.07	0.69	0.05	0.05
		Subtotal	0.29	4.47	4.66	4.59	2.46
Rickson Road Final Paving (West)	**Year 7**						
		On-Road Construction	0.00	0.02	0.01	0.00	0.00
		Fugitive Dust	-	-	-	0.00	0.00
		Construction Equipment	0.05	0.40	0.24	0.02	0.01
		Subtotal	0.05	0.42	0.26	0.02	0.02
Max Annual Emissions	Years 1 & 2		1.42	18.76	11.98	43.29	7.68
Max Annual Emissions	Year 3		3.41	35.16	21.87	4.02	2.62
Max Annual Emissions	Years 4 & 5		2.96	30.69	18.77	3.79	2.42
Max Annual Emissions	Year 6		1.62	15.79	9.55	1.29	0.84
Max Annual Emissions	Year 7		0.05	0.42	0.26	0.02	0.02
Maximum Annual Emissions			3.41	35.16	21.87	43.29	7.68

Total GHG Emissions (MT CO2e for construction period)

Construction Element	Construction Activity	MT CO2e
Tree Removal		
	On-Road Construction	48.47
	Construction Equipment	48.80
	Subtotal	97.28
Early Intake		
	On-Road Construction	90.18
	Construction Equipment	598.99
	Blasting	0.05
	Subtotal	689.22
South Fork		
	On-Road Construction	258.99
	Construction Equipment	2,558.64
	Blasting	3.91
	Subtotal	2,821.54
Big Creek		
	On-Road Construction	37.24
	Construction Equipment	902.57
	Blasting	-
	Subtotal	939.80
Adit 5/6		
	On-Road Construction	380.29
	Construction Equipment	202.59
	Blasting	0.16
	Subtotal	583.04
Adit 8/9		
	On-Road Construction	322.62
	Construction Equipment	1,268.93
	Blasting	0.12
	Subtotal	1,591.66
Second Garrote		
	On-Road Construction	25.85
	Construction Equipment	1,348.00
	Blasting	-
	Subtotal	1,373.85
Priest Portal Area		
	On-Road Construction	2,088.46
	Construction Equipment + Blasting	248.14
	Blasting	
	Subtotal	2,336.59
Rickson Road Final Paving (West)	On-Road Construction	5.13
	Construction Equipment	57.15
	Subtotal	62.29
TOTAL Construction GHG Emissions		10,495.28
Amortized MT CO2e/year (Assumes 100 year project life)		104.95

HRA - Big Creek

Unmitigated

Construction Activity	Equipment	PM2.5 (lb/day)	PM2.5 (lb/yr)	PM2.5 (g/s)
Contact Grouting	Genset, skid 545kW	1.10	2.20E+02	5.78E-03
Contact Grouting	Light Plant/Genset, 6kW, 4/1250W	0.07	1.47E+01	7.71E-05
Contact Grouting	Wheel Loader Cat 950/3.5cy	0.12	1.68E+02	9.56E-05
Contact Grouting	Hydraulic Crane 30ton/94'	0.10		
Contact Grouting	Compressor, trailer 450cfm	0.62		

Grouting Days 200

Traffic Allocation

Road	SourceID	Length (m)		
Big Creek Shaft Rd	BCSR	955.8	1.19	Miles

**Doubled to account for round trip

CalEEMod Trip Length (Workers)	28	Miles
CalEEMod Trip Length (Haul)	40	Miles
CalEEMod Trip Length (Material Deliveries)	46	Miles
Trip Miles within Modeling Domain		
Worker	4.2%	
Haul	3.0%	
Material Deliveries	2.6%	

Mitigated - Tier 4 Compressor Only

Construction Activity	Equipment	PM2.5 (lb/day)	PM2.5 (lb/yr)	PM2.5 (g/s)
Contact Grouting	Genset, skid 545kW	1.10	2.20E+02	5.78E-03
Contact Grouting	Light Plant/Genset, 6kW, 4/1250W	0.07	1.47E+01	7.71E-05
Contact Grouting	Wheel Loader Cat 950/3.5cy	0.12	5.44E+01	3.11E-05
Contact Grouting	Hydraulic Crane 30ton/94'	0.10		
Contact Grouting	Compressor, trailer 450cfm	0.05		

PM2.5 Exhaust within Modeling Domain		
Worker	4.95E-06	tons
Haul	5.29E-06	tons
Material Deliveries	3.10E-05	tons
PM2.5 Exhaust within Modeling Domain (All Mobile Sources)	1.65E-01	lb/yr
	1.98E-07	g/s

PM2.5 Total (Exhaust + Tire/Brake) within Modeling Domain		
Worker	4.34E-05	tons
Haul	6.88E-06	tons
Material Deliveries	4.04E-05	tons
PM2.5 Total within Modeling Domain (All Mobile Sources)	3.63E-01	lb/yr
	4.35E-07	g/s

Earthwork Activities	Hours of Activity	24	
Area		4120	m2
Unmitigated		0.12	lb/day
		1.50E-07	g/s/m2

** 24 hours of activity per day

HRA - Second Garrote

Unmitigated

Construction Activity	Equipment	lb/day PM2.5	lb/yr PM2.5	g/s PM2.5
Contact Grouting	Genset, skid 545kW	1.10	2.20E+02	5.78E-03
Contact Grouting	Light Plant/Genset, 6kW, 4/1250W	0.15	3.07E+01	2.02E-04
Contact Grouting	Wheel Loader Cat 950/3.5cy	0.31	9.99E+01	5.04E-05
Contact Grouting	Hydraulic Crane 30ton/94'	0.06		
Contact Grouting	Compressor, trailer 450cfm	0.13		
Pre-construction Gravel	301 Mini-Exc 3.8k/.04cy	0.55	1.65E+01	1.76E-05

Grouting Days	200
Pre-Construction Days	30

Traffic Allocation

Road	SourceID	Length (m)		
Old State Route 120	OHWY	1097.8	0.68	Miles
Second Garrote Access Rd	2GSR	819.7	0.51	Miles
	Sum	3835	2.38	Miles

**Doubled to account for round trip

CalEEMod Trip Length (Workers)	28	Miles
CalEEMod Trip Length (Haul)	40	Miles
CalEEMod Trip Length (Material Deliveries)	46	Miles

Trip Miles within Modeling Domain

Worker	8.5%
Haul	6.0%
Material Deliveries	5.2%

PM2.5 Exhaust within Modeling Domain

Worker	9.94E-06	tons
Haul	1.06E-05	tons
Material Deliveries	6.22E-05	tons
PM2.5 Exhaust within Modeling Domain (All Mobile Sources)	0.1656	lb/yr
	2.09E-07	g/s

PM2.5 Total (Exhaust + Tire/Brake) within Modeling Domain

Worker	2.93E-05	tons
Haul	1.26E-05	tons
Material Deliveries	8.11E-05	tons
PM2.5 Total within Modeling Domain (All Mobile Sources)	4.92E-01	lb/yr
	6.20E-07	g/s

Earthwork Activities	Hours of Activity	24	
Area		4375.8	m2
Unmitigated		10.15	lb/day
		1.22E-05	g/s/m2

** 24 hours of activity per day

Priest Portal Area (Includes Flow Control Facility)

Effective Duration (non-shutdown, months)	46	Sum of durations of all sub-activities
Phase (shutdown, months)	4	Sum of durations of all sub-activities
Actual Total Duration (Months)	20	Per Construction Schedule Tab
Total Years to Distribute Emissions Over	1.666666667	
Work Days per Month		
Non-Shutdown Period:	22	
Shutdown Period	30.5	
Trip Distances (mi)*		* See email communication from David Tsztoo at SF Water to Rodney Jeung (AECOM) on 6 Aug 2018.
Short Worker Trips	10	"Local Workers"
% of Trips	80%	
Long Worker Trips	30	Assumes to edge of air district.
% of Trips	20%	
(Vendor) Material Deliveries Distance	23	
Short Haul Trips Distance	3	Groveland Transfer Facility
Long Haul Trips Distance	20	Cal Sierra Earth Resource Facility (ERF)
Trip Numbers		
Workers (non-shutdown)	52	Table A-2
workers (shutdown)	54	Table A-2 *Includes 22 workers for Internal Tunnel Repairs for Localized Steel Lining
Short Haul (Daily)	0	Table A-7
Short Haul (Total)	0	Table A-7
Long Haul (Daily)	56	Table A-7
Long Haul (Total)	16563	Table A-7
(Vendor) Daily Small Deliveries	0	Table A-8
(Vendor) Total Large Deliveries	4829	Table A-8
Unpaved Road Distances (mi)		
Workers		
Haul Trucks		
Vendors		
Excavated Material (cy)	126400	Tables A-5 and A-6

Priest Portal Area Construction Emissions Summary

	months (max)	work days
Non-Shutdown Period	50	1134

Construction Activity	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	MT CO_{2e}	Emissions Summary (maximum annual emissions - tons/year) ROG	NO_x	CO	PM10	PM2.5	MT CO_{2e}
On-Road Construction	1.73	54.84	15.64	1.46	0.92	0.29	5.68	6.61	0.29	0.15	2,088.46	0.17	3.41	3.97	0.17	0.09	1,253.07
Worker Trips	0.27	1.11	10.86	0.31	0.13	0.15	0.63	6.16	0.18	0.08	1,244.26	0.09	0.38	3.70	0.11	0.05	746.56
Haul Trips	1.39	51.11	4.55	1.09	0.75	0.10	3.78	0.34	0.08	0.06	632.22	0.06	2.27	0.20	0.05	0.03	379.33
Vendor Trips	0.07	2.62	0.23	0.06	0.04	0.03	1.27	0.11	0.03	0.02	211.97	0.02	0.76	0.07	0.02	0.01	127.18
Fugitive Dust	-	-	-	14.15	7.14	-	-	-	7.28	3.87	-	-	-	-	4.37	2.32	-
Paved Road Dust	-	-	-	1.96	0.48	-	-	-	0.44	0.11	-	-	-	-	0.26	0.07	-
On-Site Construction Vehicles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Truck Loading	-	-	-	0.15	0.02	-	-	-	0.01	0.00	-	-	-	-	0.01	0.00	-
Earthwork	-	-	-	12.04	6.64	-	-	-	6.83	3.76	-	-	-	-	4.10	2.26	-
Construction Equipment + Blasting	23.89	338.67	556.06	11.38	10.48	0.19	1.78	1.15	0.08	0.08	248.14	0.1155	1.0671	0.6916	0.0490	0.0451	148.8821
TOTAL	25.62	393.52	571.70	26.98	18.55	0.48	7.45	7.76	7.65	4.10	2,336.59	0.29	4.47	4.66	4.59	2.46	1,401.96

Priest Portal Area On-Road Construction Emissions

Worker Trips

	months (max)	work days
	50	1134

	Max Daily Trips (one-way)	Distance (one-way)	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2
Worker Trips	108	14	3,024	1,134	921,200	0.27	1.11	10.86	0.31	0.13	2,194.47	0.15	0.63	6.16	0.18	0.08	1,244.26
Total						**0.27**	**1.11**	**10.86**	**0.31**	**0.13**	**2,194.47**	**0.15**	**0.63**	**6.16**	**0.18**	**0.08**	**1,244.26**

Notes: One-way trip distance per email communication with SF Water - assumes 80% are local workers (10 miles) and 20% (30 miles) are long worker trips

Haul Trips

	months (max)	work days
	50	1134

	Max Daily Trips (one-way)	Distance (one-way)	Average Daily Mileage	Total Trips per Phase	Total Mileage per Phase	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2
Spoils Disposal Truck Trips (3cy truck, short-haul)	0	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spoils Disposal Truck Trips (large-haul)	56	20	2,240	16,563	331,260	1.39	51.11	4.55	1.09	0.75	8,550.20	0.10	3.78	0.34	0.08	0.06	632.22
Total	**56**		**2,240**	**16563**	**331,260**	**1.39**	**51.11**	**4.55**	**1.09**	**0.75**	**8,550.20**	**0.10**	**3.78**	**0.34**	**0.08**	**0.06**	**632.22**

Notes: Short disposal truck trip distance based on distance to Groveland Transfer Facility and long haul truck trips based on distance to Cal Sierra Earth Resource Facility

Vendor Trips

	months (max)	work days
	50	1134

	Max Daily Trips (one-way)	Distance (one-way)	Average Daily Mileage	Total Trips per Phase	Total Mileage per Phase	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2
Material Delivery Truck Trips	5	23	115	4,829	111,067	0.07	2.62	0.23	0.06	0.04	438.96	0.03	1.27	0.11	0.03	0.02	211.97
Total						**0.07**	**2.62**	**0.23**	**0.06**	**0.04**	**438.96**	**0.03**	**1.27**	**0.11**	**0.03**	**0.02**	**211.97**

On-Road Construction Emissions Summary

Construction Activity	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2
Worker Trips	0.27	1.11	10.86	0.31	0.13	2,194.47	0.15	0.63	6.16	0.18	0.08	1,244.26
Haul Trips	1.39	51.11	4.55	1.09	0.75	8,550.20	0.10	3.78	0.34	0.08	0.06	632.22
Vendor Trips	0.07	2.62	0.23	0.06	0.04	438.96	0.03	1.27	0.11	0.03	0.02	211.97
Total	**1.73**	**54.84**	**15.64**	**1.46**	**0.92**	**11,183.63**	**0.29**	**5.68**	**6.61**	**0.29**	**0.15**	**2,088.46**

Priest Portal Area Fugitive Dust Emissions

Paved Road Dust — % Paved Roads: 100%

			Emissions Summary (lbs/day)		Emissions Summary (tons/phase)	Emissions Summary (tons/phase)
Vehicle Type	Miles per Day	Miles Per Phase	PM10	PM2.5	PM10	PM2.5
Worker	3,024	921,200	1.96	0.4806	0.30	0.07
Haul Trucks	2,240	331,260	1.45	0.3560	0.11	0.03
Vendor Trucks	115	111,067	0.07	0.0183	0.04	0.01
Total			3.48	0.8549	0.44	0.11

Daily On-Site Construction Motor Vehicle Fugitive Particulate Matter Emissions

Vehicle Type	Miles per Trip	Max Trips per Day (one way)	Max Trips per Phase (one-way)	Surface Type	Vehicle Weight	Uncontrolled Emission Factors (lb/mi)		Uncontrolled Emissions (lb/day)[a]		Uncontrolled Emissions (tons per phase)	Uncontrolled Emissions (tons per phase)
					(tons)	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5
Worker	-	108	122472	Unpaved	3	0.75	0.06	0.0	0.0	-	-
Haul Truck - small load, short-haul	-	0	-	Unpaved	7	1.15	0.10	0.0	0.0	-	-
Haul Truck - large-haul	-	56	16,563	Unpaved	13	1.56	0.13	0.0	0.0	-	-
Vendor Truck	-	5	4,829	Unpaved	13	1.56	0.13	0.0	0.0	-	-
Total						**5.02**	**0.42**	**0.0**	**0.0**	**0.0**	-

* Standard Construction Practices - watering unpaved roads -
% reduction in emissions assumed: 0%

[a] Uncontrolled emissions [lb/day] = Emission factor [lb/mi] x Number x Daily miles traveled [mi/vehicle-day]

[b] Per standard construction operations, reduced PM emissions from watering unpaved road twice a day (55%) and limiting maximum speed to 15 mph (57%), from Table XI-A, Mitigation Measure Examples, Fugitive Dust from Construction & Demolition, http://www.aqmd.gov/ceqa/handbook/mitigation/fugitive/MM_fugitive.html
Emissions reductions from watering based upon = Uncontrolled emissions [lb/day] x (1 - emissions reduction factor [%])

* Access Via Rickson Road (WILL BE PAVED - no unpaved road dust)

Truck Loading Emissions — months (max): 50; work days: 122

Total Materials Moved (cy)	Total Materials Moved (tons)	Daily Materials Moved (tons/day)	Unmitigated Daily PM_{10} (lbs/day)	Unmitigated Daily $PM_{2.5}$ (lbs/day)	Unmitigated PM_{10} (tons / phase)	Unmitigated $PM_{2.5}$ (tons/phase)
126,400	159,791	1,309.76	0.1516	0.0230	0.0092	0.0014

* Standard Construction Practices - watering - % reduction in emissions assumed: -

Earthwork Emissions — months (max): 50; work days: 1134

Number of Earth working Equipment	Daily Activity Level	Total Activity Level	PM10 Emission Factor (lb/activity)	PM2.5 Emission Factor (lb/activity)	Unmitigated Daily PM_{10} (lbs/day)	Unmitigated Daily $PM_{2.5}$ (lbs/day)	Unmitigated PM_{10} (tons)	Unmitigated $PM_{2.5}$ (tons)
2	8	16.00	0.75	0.41	12.04	6.64	6.83	3.76

* Standard Construction Practices - watering disturbed areas -
% reduction in emissions assumed: 0%

[b] Per standard construction operations, reduced PM emissions from watering disturbed areas (61%), from Table XI-A, Mitigation Measure Examples, Fugitive Dust from Construction & Demolition, http://www.aqmd.gov/ceqa/handbook/mitigation/fugitive/MM_fugitive.html
Emissions reductions from watering based upon = Uncontrolled emissions [lb/day] x (1 - emissions reduction factor [%])

Fugitive Dust Emissions Summary

	Emissions Summary - Unmitigated (lbs/day)		Emissions Summary - Unmitigated (tons per phase)	
Construction Activity	**PM10**	**PM2.5**	**PM10**	**PM2.5**
Paved Road Dust	1.96	0.48	0.44	0.11
On-Site Construction Vehicles	-	-	-	-
Truck Loading	0.1516	0.0230	0.0092	0.0014
Earthwork	12.04	6.64	6.83	3.76
Total	**14.15**	**7.14**	**7.28**	**3.87**

Priest Portal Area Construction Equipment Exhaust Emissions + Blasting

Concurrent Activities and Emissions:		Maximum Daily Emissions (lb/day)				
		ROG	NOX	CO	PM10	PM2.5
Group A Activities	Priest Adit prior to tie-in	3.63	39.54	22.85	1.76	1.62
	FCF Pad & Shaft Excavation	4.43	49.70	27.19	1.92	1.76
	Rickson Roadway	3.70	39.60	27.45	1.73	1.59
	Rock Crushing Plant	0.43	4.69	3.24	0.22	0.20
	Total	12.20	133.53	80.73	5.63	5.18
Group B Activities	Priest Adit tie-in	12.82	139.76	80.87	6.19	5.69
	FCF Tie-In Outage	7.23	78.85	42.99	3.37	3.10
	Priest Portal Support	3.85	35.57	23.05	1.63	1.50
	Total	23.89	254.19	146.92	11.19	10.29
Group C Activities	Priest Portal	3.09	35.68	20.28	1.31	1.21
	FCF Pad and Shaft Excavation	4.43	49.70	27.19	1.92	1.76
	Rickson Roadway	3.70	39.60	27.45	1.73	1.59
	Rock Crushing Plant	0.43	4.69	3.24	0.22	0.20
	Total	11.66	129.66	78.17	5.18	4.77
Group D Activities	Priest Adit	0.98	10.12	6.52	0.54	0.50
	FCF Tunnels Pre-Outage	0.68	7.94	3.13	0.26	0.24
	Rickson Roadway	0.68	7.94	3.13	0.26	0.24
	Total	2.35	26.01	12.79	1.07	0.99
Group E Activities	Priest Adit prior to tie-in	3.63	39.54	22.85	1.76	1.62
	Concrete Lining and Valve Install of FCF Shaft	2.99	32.75	21.80	1.45	1.33
	Rickson Roadway	3.70	39.60	27.45	1.73	1.59
	Total	10.33	111.88	72.10	4.94	4.55

Construction Activity:	Total Emissions at Priest Portal (Tons)					
	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Priest Portal	0.14	1.57	0.89	0.06	0.05	290.85
Pries Adit prior to tie-in	0.32	3.48	2.01	0.15	0.14	537.43
Priest Adit tie-in	0.38	4.19	2.43	0.19	0.17	640.96
FCF Pad & Shaft Excavation	0.25	2.74	1.46	0.11	0.10	479.73
FCF Tunnels Pre-Outage	0.02	0.24	0.09	0.01	0.01	35.39
Concrete Lining and Valve Insta	0.25	1.91	1.21	0.08	0.07	296.16
Rickson Roadway	0.19	2.17	1.37	0.09	0.08	369.77
Rock Crushing Plant	0.09	0.93	0.64	0.04	0.04	134.63
FCF Tie-In Outage	0.20	2.23	1.20	0.09	0.09	383.65
Priest Portal Support	0.19	1.78	1.15	0.08	0.08	248.14
Total	2.04	21.24	12.46	0.90	0.82	3,416.71

Concurrent Construction & Blasting Activities and Emissions		Maximum Daily Emissions (lb/day)				
		ROG	NOX	CO	PM10	PM2.5
Group A Activities	Construction	12.20	133.53	80.73	5.63	5.18
	Blasting	-	83.61	329.52	0.20	0.20
	Total	12.20	217.14	410.25	5.82	5.37
Group B Activities	Construction	23.89	254.19	146.92	11.19	10.29
	Blasting	-	84.49	332.98	0.19	0.19
	Total	23.89	338.67	479.90	11.38	10.48
Group C Activities	Construction	11.66	129.66	78.17	5.18	4.77
	Blasting	-	121.26	477.89	0.14	0.14
	Total	11.66	250.92	556.06	5.32	4.91
Group D Activities	Construction	2.35	26.01	12.79	1.07	0.99
	Blasting	-	86.68	341.61	0.26	0.26
	Total	2.35	112.69	354.40	1.33	1.24
Group E Activities	Construction	10.33	111.88	72.10	4.94	4.55
	Blasting	-	27.65	108.97	0.07	0.07
	Total	10.33	139.53	181.07	5.01	4.62

Priest Portal	Duration: 4 months		Single shift, M-F			Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Compressor, trailer 1600cfm	3	500	0.75	8	88	0.0988	1.1946	0.6928	0.0422	0.0388	241.2555	0.0122	0.0056	1.96	23.70	13.75	0.84	0.77	0.0863	1.0430	0.6049	0.0368	0.0339	191.0904
SK330LC Exc 77.8/2.1cy	2	238	0.65	8	88	0.0755	0.8627	0.4778	0.0263	0.0242	222.3667	0.0113	0.0051	0.41	4.71	2.61	0.14	0.13	0.0181	0.2071	0.1147	0.0063	0.0058	48.4394
Wheel Loader Cat 950/3.5cy	1	180	0.65	8	88	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.23	2.65	1.04	0.09	0.08	0.0100	0.1165	0.0460	0.0039	0.0036	17.3014
Dozer Cat D5/2.9cy	1	90	0.7	8	88	0.1286	1.3070	1.4492	0.0818	0.0752	214.9372	0.0109	0.0050	0.14	1.45	1.61	0.09	0.08	0.0063	0.0639	0.0709	0.0040	0.0037	9.5337
Generator, skid 210kW	1	314	0.65	8	88	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039	0.35	3.16	1.27	0.15	0.14	0.0153	0.1392	0.0561	0.0067	0.0062	24.4863
Total	**8**													3.09	35.68	20.28	1.31	1.21	0.1360	1.5697	0.8925	0.0578	0.0532	290.8512

Priest Adit (day shift, not tie-in)	Duration: 8 months for day shift work and 60 days for tie-in at 24/7. Tie in is only concurrent with FCF tie-in.					Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Load-Haul-Dump 4ton/2.5cy	1	82	0.7	8	176	0.1985	1.6871	1.6761	0.1362	0.1253	221.9848	0.0112	0.0051	0.20	1.71	1.70	0.14	0.13	0.0177	0.1503	0.1493	0.0121	0.0112	17.9421
HP Conc. pump, traylor 40cy/hr	1	127	0.7	8	176	0.0533	0.9024	1.0779	0.0599	0.0551	170.4003	0.0086	0.0039	0.08	1.41	1.69	0.09	0.09	0.0074	0.1245	0.1487	0.0083	0.0076	21.3310
Genset, skid 545kW	1	817	0.65	8	176	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039	0.90	8.23	3.32	0.40	0.37	0.0796	0.7244	0.2918	0.0351	0.0323	127.4222
Compressor, stationary 1200cfm	2	360	0.75	8	176	0.0988	1.1946	0.6928	0.0422	0.0388	241.2555	0.0122	0.0056	0.94	11.38	6.60	0.40	0.37	0.0828	1.0012	0.5807	0.0354	0.0325	183.4468
Wheel Loader Cat 950/3.5cy	1	180	0.65	8	176	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.23	2.65	1.04	0.09	0.08	0.0200	0.2330	0.0920	0.0077	0.0071	34.6027
Crawler Crane 100ton/200'	1	265	0.4	8	176	0.1968	2.4424	1.0345	0.0980	0.0902	249.3743	0.0126	0.0058	0.37	4.57	1.93	0.18	0.17	0.0324	0.4018	0.1702	0.0161	0.0148	37.2217
Hydraulic Crane 30ton/94'	1	130	0.65	8	176	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039	0.25	2.61	1.68	0.14	0.13	0.0223	0.2299	0.1480	0.0124	0.0114	19.9705
SK330LC Exc 77.8/2.1cy	1	238	0.65	8	176	0.0755	0.8627	0.4778	0.0263	0.0242	222.3667	0.0113	0.0051	0.21	2.35	1.30	0.07	0.07	0.0181	0.2071	0.1147	0.0063	0.0058	48.4394
Compressor, trailer 450cfm	1	170	0.75	8	176	0.1784	1.8890	1.4836	0.0998	0.0918	240.8317	0.0122	0.0056	0.40	4.25	3.34	0.22	0.21	0.0353	0.3738	0.2936	0.0198	0.0182	43.2377
Generator, trailer 5.0kW	1	9	0.65	8	176	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110	0.05	0.38	0.25	0.02	0.02	0.0042	0.0334	0.0218	0.0015	0.0014	3.8175
Total	**7**													3.63	39.54	22.85	1.76	1.62	0.32	3.48	2.01	0.15	0.14	537.43

Priest Adit (tie-in, 24/7 Shift)	Duration: 8 months for day shift work and 60 days for tie-in at 24/7. Tie in is only concurrent with FCF tie-in.					Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Load-Haul-Dump 4ton/2.5cy	1	82	0.7	24	60	0.1985	1.6871	1.6761	0.1362	0.1253	221.9848	0.0112	0.0051	0.60	5.12	5.09	0.41	0.38	0.0181	0.1537	0.1527	0.0124	0.0114	18.3499
HP Conc. pump, traylor 40cy/hr	1	127	0.7	25	60	0.0533	0.9024	1.0779	0.0599	0.0551	170.4003	0.0086	0.0039	0.26	4.42	5.28	0.29	0.27	0.0078	0.1326	0.1584	0.0088	0.0081	22.7248
Genset, skid 545kW	1	817	0.65	26	60	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039	2.94	26.75	10.78	1.30	1.19	0.0882	0.8026	0.3233	0.0389	0.0358	141.1780
Compressor, stationary 1200cfm	2	360	0.75	27	60	0.0988	1.1946	0.6928	0.0422	0.0388	241.2555	0.0122	0.0056	3.18	38.40	22.27	1.36	1.25	0.0953	1.1520	0.6681	0.0407	0.0374	211.0681
Wheel Loader Cat 950/3.5cy	1	180	0.65	28	60	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.80	9.27	3.66	0.31	0.28	0.0239	0.2781	0.1097	0.0092	0.0085	41.2874
Crawler Crane 100ton/200'	1	265	0.4	30	60	0.1968	2.4424	1.0345	0.0980	0.0902	249.3743	0.0126	0.0058	1.38	17.12	7.25	0.69	0.63	0.0414	0.5137	0.2176	0.0206	0.0190	47.5846
Hydraulic Crane 30ton/94'	1	130	0.65	31	60	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039	0.98	10.12	6.52	0.54	0.50	0.0294	0.3037	0.1955	0.0163	0.0150	26.3815
SK330LC Exc 77.8/2.1cy	1	238	0.65	32	60	0.0755	0.8627	0.4778	0.0263	0.0242	222.3667	0.0113	0.0051	0.82	9.42	5.21	0.29	0.26	0.0247	0.2825	0.1564	0.0086	0.0079	66.0538
Compressor, trailer 450cfm	1	170	0.75	33	60	0.1784	1.8890	1.4836	0.0998	0.0918	240.8317	0.0122	0.0056	1.65	17.52	13.76	0.93	0.85	0.0496	0.5257	0.4128	0.0278	0.0256	60.8031
Generator, trailer 5.0kW	1	9	0.65	34	60	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110	0.20	1.61	1.05	0.07	0.07	0.0061	0.0484	0.0315	0.0022	0.0020	5.5310
Total	**7**													12.82	139.76	80.87	6.19	5.69	0.38	4.19	2.43	0.19	0.17	640.96

FCF Pad and Shaft Excavation	Duration: 7 months	Single shift, M-F	Concurrent with Portal and then Adit as well as roadway			Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Compressor, trailer 1600cfm	2	500	0.75	8	60	0.0988	1.1946	0.6928	0.0422	0.0388	241.2555	0.0122	0.0056	1.31	15.80	9.16	0.56	0.51	0.0392	0.4741	0.2749	0.0167	0.0154	86.8593
SK330LC Exc 77.8/2.1cy	2	238	0.68	8	154	0.0755	0.8627	0.4778	0.0263	0.0242	222.3667	0.0113	0.0051	0.43	4.92	2.73	0.15	0.14	0.0332	0.3792	0.2100	0.0116	0.0106	88.6815
Wheel Loader Cat 950/3.5cy	1	180	0.65	8	154	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.23	2.65	1.04	0.09	0.08	0.0175	0.2039	0.0805	0.0068	0.0062	30.2774
Dozer Cat D5/2.9cy	1	90	0.7	8	154	0.1286	1.3070	1.4492	0.0818	0.0752	214.9372	0.0109	0.0050	0.14	1.45	1.61	0.09	0.08	0.0110	0.1118	0.1240	0.0070	0.0064	16.6840
Wheel Loader Cat 950/3.5cy	1	180	0.65	8	154	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.23	2.65	1.04	0.09	0.08	0.0175	0.2039	0.0805	0.0068	0.0062	30.2774
Hydraulic Crane 30ton/94'	1	130	0.65	8	154	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039	0.25	2.61	1.68	0.14	0.13	0.0195	0.2012	0.1295	0.0108	0.0099	17.4742
Compressor, stationary 1200cfm	2	360	0.75	8	94	0.0988	1.1946	0.6928	0.0422	0.0388	241.2555	0.0122	0.0056	0.94	11.38	6.60	0.40	0.37	0.0442	0.5348	0.3101	0.0189	0.0174	97.9773
Genset, skid 545kW	1	817	0.65	8	154	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039	0.90	8.23	3.32	0.40	0.37	0.0696	0.6338	0.2554	0.0307	0.0283	111.4944
Total	**6**													4.43	49.70	27.19	1.92	1.76	0.25	2.74	1.46	0.11	0.10	479.73

FCF Tunnels Pre-Outage	Duration: 2 months	Single shift, M-F	Concurrent with Adit			Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Wheel Loader Cat 950/3.5cy	1	180	0.65	8	44	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.23	2.65	1.04	0.09	0.08	0.0050	0.0583	0.0230	0.0019	0.0018	8.6507
Hydraulic Crane 30ton/94'	1	130	0.65	8	44	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039	0.25	2.61	1.68	0.14	0.13	0.0056	0.0575	0.0370	0.0031	0.0028	4.9926
Compressor, stationary 1200cfm	2	360	0.75	8	44	0.0988	1.1946	0.6928	0.0422	0.0388	241.2555	0.0122	0.0056	0.94	11.38	6.60	0.40	0.37	0.0207	0.2503	0.1452	0.0088	0.0081	45.8617
Genset, skid 545kW	1	817	0.65	8	44	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039	0.90	8.23	3.32	0.40	0.37	0.0199	0.1811	0.0730	0.0088	0.0081	31.8555
Load-Haul-Dump 4ton/2.5cy	1	82	0.7	24	44	0.1985	1.6871	1.6761	0.1362	0.1253	221.9848	0.0112	0.0051	0.60	5.12	5.09	0.41	0.38	0.0133	0.1127	0.1120	0.0091	0.0084	13.4566
Crawler Crane 100ton/200'	1	265	0.4	8	44	0.1968	2.4424	1.0345	0.0980	0.0902	249.3743	0.0126	0.0058	0.37	4.57	1.93	0.18	0.17	0.0081	0.1005	0.0426	0.0040	0.0037	9.3054
Total	**7**													3.30	34.56	19.67	1.63	1.50	0.07	0.64	0.37	0.03	0.03	100.48

Concrete Lining and Valve Install of FCF Shaft	Duration: 9 months	Single shift, M-F	Concurrent with Adit			Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Wheel Loader Cat 950/3.5cy	1	180	0.65	8	198	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.23	2.65	1.04	0.09	0.08	0.0225	0.2622	0.1034	0.0087	0.0080	38.9281
Generator, skid 210kW	1	314	0.65	8	198	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039	0.35	3.16	1.27	0.15	0.14	0.0344	0.3132	0.1262	0.0152	0.0140	55.0941
Hydraulic Crane 30ton/94'	1	130	0.65	8	198	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039	0.25	2.61	1.68	0.14	0.13	0.0250	0.2586	0.1665	0.0139	0.0128	22.4668
Compressor, stationary 1200cfm	2	360	0.75	8	198	0.0988	1.1946	0.6928	0.0422	0.0388	241.2555	0.0122	0.0056	0.94	11.38	6.60	0.40	0.37	0.0932	1.1264	0.6533	0.0398	0.0366	206.3777
Crawler Crane 100ton/200'	1	265	0.4	8	198	0.1968	2.4424	1.0345	0.0980	0.0902	249.3743	0.0126	0.0058	0.37	4.57	1.93	0.18	0.17	0.0364	0.4520	0.1915	0.0181	0.0167	41.8745
Pump, trash 705gpm/106ft head	1	26	0.9	24	100	0.4890	3.3405	3.3884	0.1623	0.1493	464.5881	0.0242	0.0111	0.61	4.14	4.20	0.20	0.18	0.0303	0.2068	0.2098	0.0100	0.0092	26.0935
HP Conc. pump, traylor 40cy/hr	1	127	0.7	24	60	0.0533	0.9024	1.0779	0.0599	0.0551	170.4003	0.0086	0.0039	0.25	4.24	5.07	0.28	0.26	0.0075	0.1273	0.1521	0.0085	0.0078	21.8158
Total	**8**													2.99	32.75	21.80	1.45	1.33	0.25	1.91	1.21	0.08	0.07	296.16

Rickson Roadway

Duration: Assume 8 months | Single shift, M-F | Starts with Adit & Shaft Excavation. This will be done before the tie-in.

						Emissions Factors (g/hp-hr)							
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O
301 Mini-Exc 3.8k/.04cy	1	17	0.65	8	44	0.2494	1.6956	1.8927	0.0934	0.0859	247.2024	0.0125	0.0057
SK330LC Exc 77.8/2.1cy	1.5	238	0.65	8	176	0.0755	0.8627	0.4778	0.0263	0.0242	222.3667	0.0113	0.0051
Cat 226B / Bobcat Loader	1	54	0.7	8	88	0.0764	1.0124	1.3299	0.0433	0.0398	214.3929	0.0109	0.0050
Wheel Loader Cat 950/3.5cy	1	180	0.65	8	176	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049
Dozer Cat D5/2.9cy	1	90	0.7	8	132	0.1286	1.3070	1.4492	0.0818	0.0752	214.9372	0.0109	0.0050
Grader, Cat 12-H/12' blade	1	140	0.6	8	44	0.2506	2.4459	1.6138	0.1365	0.1256	238.1666	0.0121	0.0055
Hydraulic Crane 30ton/94'	1	130	0.65	8	9	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039
HP Conc. pump, traylor 40cy/hr	1	127	0.7	8	9	0.0533	0.9024	1.0779	0.0599	0.0551	170.4003	0.0086	0.0039
Compactor, BW5AS, 6t/40"	1	50	0.8	8	44	0.3820	1.8713	1.9498	0.1357	0.1248	242.7832	0.0123	0.0056
Compressor, trailer 450cfm	1	170	0.75	8	132	0.1784	1.8890	1.4836	0.0998	0.0918	240.8317	0.0122	0.0056
Compressor, trailer 1600cfm	2	500	0.75	8	132	0.0988	1.1946	0.6928	0.0422	0.0388	241.2555	0.0122	0.0056
Generator, trailer 10.0kW	1	23	0.65	8	44	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110
Light Plant/Genset, 6kW, 4/1000W	1	12	0.85	8	44	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110
Man-Lift 55' articulated boom	1	80	0.65	8	18	0.0331	0.3343	0.9644	0.0109	0.0100	179.2830	0.0091	0.0041
Total	**8**												

	Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
301 Mini-Exc 3.8k/.04cy	0.05	0.33	0.37	0.02	0.02	0.0011	0.0073	0.0081	0.0004	0.0004	0.9616
SK330LC Exc 77.8/2.1cy	0.31	3.53	1.96	0.11	0.10	0.0272	0.3107	0.1721	0.0095	0.0087	72.6592
Cat 226B / Bobcat Loader	0.05	0.67	0.89	0.03	0.03	0.0022	0.0297	0.0390	0.0013	0.0012	5.7057
Wheel Loader Cat 950/3.5cy	0.23	2.65	1.04	0.09	0.08	0.0200	0.2330	0.0920	0.0077	0.0071	34.6027
Dozer Cat D5/2.9cy	0.14	1.45	1.61	0.09	0.08	0.0094	0.0958	0.1063	0.0060	0.0055	14.3005
Grader, Cat 12-H/12' blade	0.37	3.62	2.39	0.20	0.19	0.0082	0.0797	0.0526	0.0045	0.0041	7.0427
Hydraulic Crane 30ton/94'	0.25	2.61	1.68	0.14	0.13	0.0011	0.0118	0.0076	0.0006	0.0006	1.0212
HP Conc. pump, traylor 40cy/hr	0.08	1.41	1.69	0.09	0.09	0.0004	0.0064	0.0076	0.0004	0.0004	1.0908
Compactor, BW5AS, 6t/40"	0.27	1.32	1.38	0.10	0.09	0.0059	0.0290	0.0303	0.0021	0.0019	3.4187
Compressor, trailer 450cfm	0.40	4.25	3.34	0.22	0.21	0.0265	0.2804	0.2202	0.0148	0.0136	32.4283
Compressor, trailer 1600cfm	1.31	15.80	9.16	0.56	0.51	0.0863	1.0430	0.6049	0.0368	0.0339	191.0904
Generator, trailer 10.0kW	0.12	0.97	0.63	0.04	0.04	0.0027	0.0213	0.0139	0.0010	0.0009	2.4390
Light Plant/Genset, 6kW, 4/1000W	0.08	0.66	0.43	0.03	0.03	0.0018	0.0146	0.0095	0.0007	0.0006	1.6640
Man-Lift 55' articulated boom	0.03	0.31	0.88	0.01	0.01	0.0003	0.0028	0.0080	0.0001	0.0001	1.3426
Total	3.70	39.60	27.45	1.73	1.59	0.19	2.17	1.37	0.09	0.08	369.77

Rock Crushing Plant

Duration: Assume 12 to 18 months | Single shift, M-F | Starts with Adit & Shaft Excavation. This will be done before the tie-in.

						Emissions Factors (g/hp-hr)							
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O
Screening and Crushing plant	2	60	0.75	8	396	0.1275	1.2892	1.3840	0.0825	0.0759	199.1148	0.0101	0.0046
Wheel Loader Cat 950/3.5cy	1	180	0.65	8	396	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049
Total	**3**												

	Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Screening and Crushing plant	0.20	2.05	2.20	0.13	0.12	0.0401	0.4052	0.4350	0.0259	0.0239	56.7764
Wheel Loader Cat 950/3.5cy	0.23	2.65	1.04	0.09	0.08	0.0451	0.5243	0.2069	0.0174	0.0160	77.8561
Total	0.43	4.69	3.24	0.22	0.20	0.09	0.93	0.64	0.04	0.04	134.63

FCF Tie-In Outage

Duration: 60 days | 24/7 work | This work is only concurrent with Priest Tie-in (not roads or shaft)

						Emissions Factors (g/hp-hr)							
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O
Load-Haul-Dump 4ton/2.5cy	1	82	0.7	24	60	0.1985	1.6871	1.6761	0.1362	0.1253	221.9848	0.0112	0.0051
Compressor, stationary 1200cfm	2	360	0.75	24	60	0.0988	1.1946	0.6928	0.0422	0.0388	241.2555	0.0122	0.0056
Wheel Loader Cat 950/3.5cy	1	180	0.65	24	60	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049
Genset, skid 545kW	1	817	0.65	24	60	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039
HP Conc. pump, traylor 40cy/hr	1	127	0.7	24	60	0.0533	0.9024	1.0779	0.0599	0.0551	170.4003	0.0086	0.0039
Hydraulic Crane 30ton/94'	1	130	0.65	24	25	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039
Total	**6**												

	Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Load-Haul-Dump 4ton/2.5cy	0.60	5.12	5.09	0.41	0.38	0.0181	0.1537	0.1527	0.0124	0.0114	18.3499
Compressor, stationary 1200cfm	2.82	34.13	19.80	1.21	1.11	0.0847	1.0240	0.5939	0.0362	0.0333	187.6161
Wheel Loader Cat 950/3.5cy	0.68	7.94	3.13	0.26	0.24	0.0205	0.2383	0.0940	0.0079	0.0073	35.3892
Genset, skid 545kW	2.71	24.69	9.95	1.20	1.10	0.0814	0.7408	0.2985	0.0359	0.0330	130.3181
HP Conc. pump, traylor 40cy/hr	0.25	4.24	5.07	0.28	0.26	0.0075	0.1273	0.1521	0.0085	0.0078	21.8158
Hydraulic Crane 30ton/94'	0.76	7.84	5.05	0.42	0.39	0.0095	0.0980	0.0631	0.0053	0.0048	8.5102
Total	7.23	78.85	42.99	3.37	3.10	0.2036	2.2285	1.2015	0.0937	0.0862	383.6493

Priest Portal Support

Duration: Outage (60 days to 100 days) | This equipment will be present for each outage

						Emissions Factors (g/hp-hr)							
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O
Generator, skid 210kW	1	314	0.65	24	100	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039
Wheel Loader Cat 950/3.5cy	1	180	0.65	24	100	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049
Hydraulic Crane 30ton/94'	1	130	0.65	24	100	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039
Pump, trash 705gpm/106ft head	2	26	0.9	24	100	0.4890	3.3405	3.3884	0.1623	0.1493	464.5881	0.0242	0.0111
Cat 226B / Bobcat Loader	1	54	0.7	24	100	0.0764	1.0124	1.3299	0.0433	0.0398	214.3929	0.0109	0.0050
Total	**6**												

	Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Generator, skid 210kW	1.04	9.49	3.82	0.46	0.42	0.0521	0.4745	0.1912	0.0230	0.0212	83.4759
Wheel Loader Cat 950/3.5cy	0.68	7.94	3.13	0.26	0.24	0.0342	0.3972	0.1567	0.0132	0.0121	58.9819
Hydraulic Crane 30ton/94'	0.76	7.84	5.05	0.42	0.39	0.0379	0.3919	0.2523	0.0211	0.0194	34.0406
Pump, trash 705gpm/106ft head	1.21	8.27	8.39	0.40	0.37	0.0605	0.4136	0.4195	0.0201	0.0185	52.1870
Cat 226B / Bobcat Loader	0.15	2.02	2.66	0.09	0.08	0.0076	0.1012	0.1330	0.0043	0.0040	19.4514
Total	3.85	35.57	23.05	1.63	1.50	0.1924	1.7785	1.1527	0.0817	0.0751	248.1369

Conversion Factors:	
grams per pound:	*454*
pounds per ton:	*2,000*
pounds per metric ton:	*2,205*
Global Warming Potential	
CO2	1
CH4	28
N2O	265

*Per IPCC 5th Assessment Report (AR5)

CH4 and N2O emissions estimated based on EPA emission factors for grams per gallon of diesel. Source: EPA 2018. Emission Factors for Greenhouse Gas Inventories: https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

Notes: Load factor data based on client-provided equipment data. Daily emissions based on emission factors from OFFROAD2017 - ORION, applied to horsepower and use data from client-provided equipment data.

Adit 5/6

Effective Duration (non-shutdown, months)	14	Sum of durations of all sub-activities
Phase (shutdown, months)	0	Sum of durations of all sub-activities
Actual Total Duration (Months)	13	Per Construction Schedule Tab
Total Years to Distribute Emissions Over	1.083333333	
Work Days per Month		
Non-Shutdown Period:	22	
Shutdown Period	30.5	
Trip Distances (mi)*		* See email communication from David Tsztoo at SF Water to Rodney Jeung (AECOM) on 6 Aug 2018.
Short Worker Trips	10	"Local Workers"
% of Trips	80%	
Long Worker Trips	30	Assumes to edge of air district.
% of Trips	20%	
(Vendor) Material Deliveries Distance	23	
Short Haul Trips Distance	3	Groveland Transfer Facility
Long Haul Trips Distance	20	Cal Sierra Earth Resource Facility (ERF)
Trip Numbers		
Workers (non-shutdown)	15	Table A-2
workers (shutdown)	0	Table A-2
Short Haul (Daily)	27	Table A-7
Short Haul (Total)	7167	Table A-7
Long Haul (Daily)	5	Table A-7
Long Haul (Total)	1344	Table A-7
(Vendor) Daily Small Deliveries	18	Table A-8
(Vendor) Total Large Deliveries	476	Table A-8
Unpaved Road Distances (mi)		
Workers	1.7	
Haul Trucks	1.7	
Vendors	1.7	
Excavated Material (cy)	11700	Tables A-5 and A-6

Adit 5/6 Construction Emissions Summary

months (max) 14 work days 308

	Emissions Summary (lbs/day)					Emissions Summary (tons per phase)						Emissions Summary (maximum annual emissions - tons/year)					
Construction Activity	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**MT CO_2e**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**MT CO_2e**
On-Road Construction	0.52	16.07	3.53	0.41	0.26	0.06	1.97	0.45	0.05	0.03	380.29	0.06	1.82	0.41	0.05	0.03	351.04
Worker Trips	0.04	0.15	1.51	0.04	0.02	0.01	0.02	0.23	0.01	0.00	46.94	0.01	0.02	0.21	0.01	0.00	43.33
Haul Trips	0.20	5.42	1.09	0.14	0.09	0.01	0.36	0.07	0.01	0.01	69.10	0.01	0.34	0.07	0.01	0.01	63.78
Vendor Trips	0.29	10.50	0.93	0.22	0.15	0.04	1.58	0.14	0.03	0.02	264.25	0.04	1.46	0.13	0.03	0.02	243.93
Fugitive Dust	-	-	-	288.45	29.72	-	-	-	21.63	2.68	-	-	-	-	19.97	2.48	-
Paved Road Dust	-	-	-	0.27	0.07	-	-	-	0.08	0.02	-	-	-	-	0.08	0.02	-
On-Site Construction Vehicles	-	-	-	276.13	23.01	-	-	-	19.70	1.64	-	-	-	-	18.18	1.52	-
Truck Loading	-	-	-	0.01	0.00	-	-	-	0.00	0.00	-	-	-	-	0.00	0.00	-
Earthwork	-	-	-	12.04	6.64	-	-	-	1.85	1.02	-	-	-	-	1.71	0.94	-
Construction Equipment Exhaust	20.3601	207.8186	124.4415	9.1322	8.4016	0.1545	1.4704	0.8099	0.0673	0.0619	202.5920	0.1426	1.3573	0.7476	0.0621	0.0571	187.0080
TOTAL	20.88	223.89	127.97	297.99	38.38	0.22	3.44	1.26	21.75	2.78	582.88	0.20	3.17	1.16	20.08	2.56	538.04

Adit 5/6 On-Road Construction Emissions

Worker Trips months (max) 14 work days 308

						Emissions Summary (lbs/day)						Emissions Summary (tons per phase)						
	Max Daily Trips (one-way)	**Distance (one-way)**	**Average Daily Mileage**	**Calculated Time - Rounded (days)**	**Total Mileage**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO2**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO_2**	**Total GHG Emissions (MT CO2e)**
Worker Trips	15	14	420	308	64,680	0.04	0.15	1.51	0.04	0.02	304.79	0.01	0.02	0.23	0.01	0.00	46.94	0.00
Total						**0.04**	**0.15**	**1.51**	**0.04**	**0.02**	**304.79**	**0.01**	**0.02**	**0.23**	**0.01**	**0.00**	**46.94**	**0.00**

Notes: One-way trip distance per email communication with SF Water - assumes 80% are local workers (10 miles) and 20% (30 miles) are long worker trips

Haul Trips months (max) 14 work days 308

						Emissions Summary (lbs/day)						Emissions Summary (tons per phase)						
	Max Daily Trips (one-way)	**Distance (one-way)**	**Average Daily Mileage**	**Total Trips per Phase**	**Total Mileage per Phase**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO2**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO_2**	**Total GHG Emissions (MT CO2e)**
Spoils Disposal Truck Trips (3cy truck, short-haul)	27	3	162	7,167	21,501	0.07	0.86	0.68	0.04	0.02	268.16	0.00	0.06	0.05	0.00	0.00	17.80	0.02
Spoils Disposal Truck Trips (large-haul)	5	20	200	1,344	26,880	0.12	4.56	0.41	0.10	0.07	763.41	0.01	0.31	0.03	0.01	0.00	51.30	0.01
Total	**32**		**362**	**8511**	**48,381**	**0.20**	**5.42**	**1.09**	**0.14**	**0.09**	**1,031.57**	**0.01**	**0.36**	**0.07**	**0.01**	**0.01**	**69.10**	**0.02**

Notes: Short disposal truck trip distance based on distance to Groveland Transfer Facility and long haul truck trips based on distance to Cal Sierra Earth Resource Facility

Vendor Trips months (max) 14 work days 308

						Emissions Summary (lbs/day)						Emissions Summary (tons per phase)						
	Max Daily Trips (one-way)	**Distance (one-way)**	**Average Daily Mileage**	**Total Trips per Phase**	**Total Mileage per Phase**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO2**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO_2**	**Total GHG Emissions (MT CO2e)**
Material Delivery Truck Trips	20	23	460	6,020	138,460	0.29	10.50	0.93	0.22	0.15	1,755.85	0.04	1.58	0.14	0.03	0.02	264.25	0.13
Total						**0.29**	**10.50**	**0.93**	**0.22**	**0.15**	**1,755.85**	**0.04**	**1.58**	**0.14**	**0.03**	**0.02**	**264.25**	**0.13**

On-Road Construction Emissions Summary

	Emissions Summary (lbs/day)						Emissions Summary (tons per phase)						
Construction Activity	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO2**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO_2**	**Total GHG Emissions (MT CO2e)**
Worker Trips	0.04	0.15	1.51	0.04	0.02	304.79	0.01	0.02	0.23	0.01	0.00	46.94	0.00
Haul Trips	0.20	5.42	1.09	0.14	0.09	1,031.57	0.01	0.36	0.07	0.01	0.01	69.10	0.02
Vendor Trips	0.29	10.50	0.93	0.22	0.15	1,755.85	0.04	1.58	0.14	0.03	0.02	264.25	0.13
Total	**15.00**	**16.07**	**3.53**	**0.41**	**0.26**	**3,092.21**	**0.06**	**1.97**	**0.45**	**0.05**	**0.03**	**380.29**	**0.15**

Adit 5/6 Fugitive Dust Emissions

Paved Road Dust

% Paved Roads 100%

Vehicle Type	Miles per Day	Miles Per Phase	Emissions Summary (lbs/day) PM10	Emissions Summary (lbs/day) PM2.5	Emissions Summary (tons/phase) PM10	Emissions Summary (tons/phase) PM2.5
Worker	420	64,680	0.27	0.0667	0.02	0.01
Haul Trucks	362	48,381	0.23	0.0575	0.02	0.00
Vendor Trucks	460	138,460	0.30	0.0731	0.04	0.01
Total			0.80	0.1974	0.08	0.02

Daily On-Site Construction Motor Vehicle Fugitive Particulate Matter Emissions

Vehicle Type	Miles per Trip	Max Trips per Day (one-way)	Max Trips per Phase (one-way)	Surface Type	Vehicle Weight (tons)	Uncontrolled Emission Factors (lb/mi) PM10	Uncontrolled Emission Factors (lb/mi) PM2.5	Uncontrolled Emissions (lb/day)[a] PM10	Uncontrolled Emissions (lb/day)[a] PM2.5	Uncontrolled Emissions (tons per phase) PM10	Uncontrolled Emissions (tons per phase) PM2.5
Worker	1.70	15	4620	Unpaved	3	0.75	0.06	38.3	3.2	2.9	0.2
Haul Truck - small load, short-haul	1.70	27	7,167	Unpaved	7	1.15	0.10	105.2	8.8	7.0	0.6
Haul Truck - large-haul	1.70	5	1,344	Unpaved	13	1.56	0.13	26.5	2.2	1.8	0.1
Vendor Truck	1.70	20	6,020	Unpaved	13	1.56	0.13	106.2	8.8	8.0	0.7
Total						**5.02**	**0.42**	**276.1**	**23.0**	**19.7**	1.6

* Standard Construction Practices - watering unpaved roads - % reduction in emissions assumed: 0%

[a] Uncontrolled emissions [lb/day] = Emission factor [lb/mi] x Number x Daily miles traveled [mi/vehicle-day]

[b] Per standard construction operations, reduced PM emissions from watering unpaved road twice a day (55%) and limiting maximum speed to 15 mph (57%), from Table XI-A, Mitigation Measure Examples, Fugitive Dust from Construction & Demolition, http://www.aqmd.gov/ceqa/handbook/mitigation/fugitive/MM_fugitive.html
Emissions reductions from watering based upon = Uncontrolled emissions [lb/day] x (1 - emissions reduction factor [%])

* Adit 5/6 is accessed via a steep, single-lane, dirt road (known as Forest Service Road 1S01

Truck Loading Emissions

months (max) 14 work days 308

Total Materials Moved (cy)	Total Materials Moved (tons)	Daily Materials Moved (tons/day)	Unmitigated Daily PM_{10} (lbs/day)	Unmitigated Daily $PM_{2.5}$ (lbs/day)
11,700	14,791	48.02	0.0056	0.0008

Unmitigated PM_{10} (tons / phase)	Unmitigated $PM_{2.5}$ (tons/phase)
0.0009	0.0001

Earthwork Emissions

months (max) 14 work days 308

Number of Earth working Equipment	Daily Activity Level	Total Activity Level	PM10 Emission Factor (lb/activity)	PM2.5 Emission Factor (lb/activity)	Unmitigated Daily PM_{10} (lbs/day)	Unmitigated Daily $PM_{2.5}$ (lbs/day)
2	8	16.00	0.75	0.41	12.04	6.64

Unmitigated PM_{10} (tons)	Unmitigated $PM_{2.5}$ (tons)
1.85	1.02

* Standard Construction Practices - watering disturbed areas - % reduction in emissions assumed: 0%

[b] Per standard construction operations, reduced PM emissions from watering disturbed areas (61%), from Table XI-A,

Fugitive Dust Emissions Summary

Construction Activity	Emissions Summary - Unmitigated (lbs/day) PM10	Emissions Summary - Unmitigated (lbs/day) PM2.5
Paved Road Dust	0.27	0.07
On-Site Construction Vehicles	276.13	23.01
Truck Loading	0.0056	0.0008
Earthwork	12.04	6.64
Total	**288.45**	**29.72**

Emissions Summary - Unmitigated (tons per phase) PM10	Emissions Summary - Unmitigated (tons per phase) PM2.5
0.08	0.02
19.70	1.64
0.0009	0.0001
1.85	1.02
21.63	**2.68**

Adit 5/6 Construction Equipment Exhaust Emissions

		Maximum Daily Emissions (lb/day)				
Concurrent Activities and Emissions:		ROG	NOX	CO	PM10	PM2.5
Group A Activities	Roadways	8.30	86.45	57.71	3.41	3.14
	Adit 5/6 Support	1.88	19.46	9.62	0.81	0.75
	In Tunnel Debris Removal	2.18	21.07	9.33	0.89	0.82
	Total	12.36	126.98	76.66	5.11	4.70
Group B Activities	Roadways	8.30	86.45	57.71	3.41	3.14
	Adit 5/6 Support	1.88	19.46	9.62	0.81	0.75
	In Tunnel Invert Concrete with Setup	10.18	101.91	57.11	4.91	4.52
	In Tunnel Steel Lining	3.09	29.41	16.20	1.35	1.24
	Total	20.36	207.82	124.44	9.13	8.40

	Total Emissions at Adit 5/6 (Tons)					
Construction Activity:	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Roadways	0.39	5.07	2.80	0.18	0.16	744.53
Adit 5/6 Support	0.19	1.95	0.96	0.08	0.07	323.82
In Tunnel Debris Removal	0.11	1.05	0.47	0.04	0.04	163.26
In Tunnel Invert Concrete	0.51	5.10	2.86	0.25	0.23	747.22
In Tunnel Steel Lining	0.15	1.47	0.81	0.07	0.06	202.59
Total	1.35	14.64	7.89	0.61	0.57	2,181.43

Roadways	Duration: 12 months		Single shift, M-F			Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
301 Mini-Exc 3.8k/.04cy	1	17	0.65	8	198	0.2494	1.6956	1.8927	0.0934	0.0859	247.2024	0.0125	0.0057	0.05	0.33	0.37	0.02	0.02	0.0048	0.0327	0.0365	0.0018	0.0017	4.3272
SK330LC Exc 77.8/2.1cy	1	238	0.65	8	264	0.0755	0.8627	0.4778	0.0263	0.0242	222.3667	0.0113	0.0051	0.21	2.35	1.30	0.07	0.07	0.0272	0.3107	0.1721	0.0095	0.0087	72.6592
Hydraulic Hoe Ram	1	100	0.7	8	198	0.1286	1.3070	1.4492	0.0818	0.0752	214.9372	0.0109	0.0050	0.16	1.61	1.79	0.10	0.09	0.0157	0.1597	0.1771	0.0100	0.0092	23.8342
Cat 226B / Bobcat Loader	1	54	0.7	8	264	0.0764	1.0124	1.3299	0.0433	0.0398	214.3929	0.0109	0.0050	0.05	0.67	0.89	0.03	0.03	0.0067	0.0891	0.1170	0.0038	0.0035	17.1172
Wheel Loader Cat 950/3.5cy	1	180	0.65	8	264	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.23	2.65	1.04	0.09	0.08	0.0301	0.3496	0.1379	0.0116	0.0107	51.9041
Dozer Cat D5/2.9cy	1	90	0.7	8	198	0.1286	1.3070	1.4492	0.0818	0.0752	214.9372	0.0109	0.0050	0.14	1.45	1.61	0.09	0.08	0.0142	0.1438	0.1594	0.0090	0.0083	21.4508
Grader, Cat 12-H/12' blade	1	140	0.6	8	27	0.2506	2.4459	1.6138	0.1365	0.1256	238.1666	0.0121	0.0055	0.37	3.62	2.39	0.20	0.19	0.0050	0.0489	0.0323	0.0027	0.0025	4.3217
Hydraulic Crane 30ton/94'	1	130	0.65	8	27	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039	0.25	2.61	1.68	0.14	0.13	0.0034	0.0353	0.0227	0.0019	0.0017	3.0637
Airtrak, 4"-6"/12' feed-900cfm	1	900	0.8	8	198	0.0899	1.7312	0.5057	0.0406	0.0373	241.5118	0.0122	0.0056	1.14	21.98	6.42	0.51	0.47	0.1130	2.1764	0.6358	0.0510	0.0469	275.4626
HP Conc. pump, traylor 40cy/hr	1	127	0.7	8	14	0.0533	0.9024	1.0779	0.0599	0.0551	170.4003	0.0086	0.0039	0.08	1.41	1.69	0.09	0.09	0.0006	0.0099	0.0118	0.0007	0.0006	1.6968
Shotcrete plant, skid 12cy/hr	1	125	0.75	8	27	0.1275	1.2892	1.3840	0.0825	0.0759	199.1148	0.0101	0.0046	0.21	2.13	2.29	0.14	0.13	0.0028	0.0288	0.0309	0.0018	0.0017	4.0324
Transit mixer, 9cy/60k GVR	1	600	0.5	8	27	0.3355	2.5315	1.9610	0.1006	0.0926	342.3171	0.0186	0.0085	1.77	13.39	10.38	0.53	0.49	0.0240	0.1808	0.1401	0.0072	0.0066	22.1841
Grout Pump-Moyno/Mixer	1	600	0.5	8	14	0.3355	2.5315	1.9610	0.1006	0.0926	342.3171	0.0186	0.0085	1.77	13.39	10.38	0.53	0.49	0.0124	0.0938	0.0726	0.0037	0.0034	11.5029
Sinker drill, 100cfm	1	103	0.65	8	66	0.1277	1.4654	1.8226	0.0746	0.0686	287.7812	0.0146	0.0067	0.15	1.73	2.15	0.09	0.08	0.0050	0.0571	0.0710	0.0029	0.0027	10.1738
Jackleg drill, 100cfm	1	100	0.65	8	66	0.1277	1.4654	1.8226	0.0746	0.0686	287.7812	0.0146	0.0067	0.15	1.68	2.09	0.09	0.08	0.0048	0.0554	0.0690	0.0028	0.0026	9.8775
Compactor, BW5AS, 6t/40"	1	50	0.8	8	66	0.3820	1.8713	1.9498	0.1357	0.1248	242.7832	0.0123	0.0056	0.27	1.32	1.38	0.10	0.09	0.0089	0.0436	0.0454	0.0032	0.0029	5.1280
Compressor, trailer 450cfm	1	170	0.75	8	198	0.1784	1.8890	1.4836	0.0998	0.0918	240.8317	0.0122	0.0056	0.40	4.25	3.34	0.22	0.21	0.0397	0.4205	0.3303	0.0222	0.0204	48.6425
Compressor, trailer 1600cfm	1	500	0.75	8	198	0.0988	1.1946	0.6928	0.0422	0.0388	241.2555	0.0122	0.0056	0.65	7.90	4.58	0.28	0.26	0.0647	0.7822	0.4536	0.0276	0.0254	143.3178
Generator, trailer 10.0kW	1	23	0.65	8	27	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110	0.12	0.97	0.63	0.04	0.04	0.0016	0.0131	0.0085	0.0006	0.0006	1.4966
Light Plant/Genset, 6kW, 4/1000W	1	12	0.85	8	66	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110	0.08	0.66	0.43	0.03	0.03	0.0027	0.0218	0.0142	0.0010	0.0009	2.4961
Man-Lift 55' articulated boom	1	80	0.65	8	132	0.0331	0.3343	0.9644	0.0109	0.0100	179.2830	0.0091	0.0041	0.03	0.31	0.88	0.01	0.01	0.0020	0.0202	0.0584	0.0007	0.0006	9.8456
Total	**21**													8.30	86.45	57.71	3.41	3.14	0.39	5.07	2.80	0.18	0.16	744.53

Adit 5/6 Support	Duration: Outage (60 days to 100 days per outage x two outages)		This equipment will be present for each outage			Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Generator, skid 210kW	1	314	0.65	24	200	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039	1.04	9.49	3.82	0.46	0.42	0.1043	0.9491	0.3824	0.0460	0.0423	166.9518
Wheel Loader Cat 950/3.5cy	1	180	0.65	24	200	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.68	7.94	3.13	0.26	0.24	0.0683	0.7944	0.3135	0.0264	0.0243	117.9639
Cat 226B / Bobcat Loader	1	54	0.7	24	200	0.0764	1.0124	1.3299	0.0433	0.0398	214.3929	0.0109	0.0050	0.15	2.02	2.66	0.09	0.08	0.0153	0.2025	0.2660	0.0087	0.0080	38.9027
Total	**3**													1.88	19.46	9.62	0.81	0.75	0.19	1.95	0.96	0.08	0.07	323.82

In-Tunnel Debris Removal	Duration: Outage (100 days) 24/7 for 1 outages					Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Generator, skid 210kW	1	314	0.65	24	100	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039	1.04	9.49	3.82	0.46	0.42	0.0521	0.4745	0.1912	0.0230	0.0212	83.4759
Light Plant/Genset, 6kW, 4/1250W	2	11	0.85	24	100	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110	0.46	3.64	2.37	0.17	0.15	0.0228	0.1819	0.1186	0.0084	0.0077	20.8005
Wheel Loader Cat 950/3.5cy	1	180	0.65	24	100	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.68	7.94	3.13	0.26	0.24	0.0342	0.3972	0.1567	0.0132	0.0121	58.9819
Total	**4**													2.18	21.07	9.33	0.89	0.82	0.11	1.05	0.47	0.04	0.04	163.26

In-Tunnel Invert Concrete with Setup	Duration: Outage (100 days) 24/7 for 1 outages		Single shift, M-F			Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Generator, skid 210kW	2	314	0.65	24	100	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039	2.09	18.98	7.65	0.92	0.85	0.1043	0.9491	0.3824	0.0460	0.0423	166.9518
Wheel Loader Cat 950/3.5cy	1	180	0.65	24	100	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.68	7.94	3.13	0.26	0.24	0.0342	0.3972	0.1567	0.0132	0.0121	58.9819
Hydraulic Crane 30ton/94'	1	130	0.65	24	100	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039	0.76	7.84	5.05	0.42	0.39	0.0379	0.3919	0.2523	0.0211	0.0194	34.0406
Genset, skid 545kW	1	817	0.65	24	100	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039	2.71	24.69	9.95	1.20	1.10	0.1356	1.2347	0.4975	0.0598	0.0550	217.1969
Compressor, trailer 450cfm	2	170	0.75	24	100	0.1784	1.8890	1.4836	0.0998	0.0918	240.8317	0.0122	0.0056	2.41	25.49	20.02	1.35	1.24	0.1203	1.2744	1.0008	0.0673	0.0620	147.4014
Light Plant/Genset, 6kW, 4/1250W	2	11	0.85	24	100	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110	0.46	3.64	2.37	0.17	0.15	0.0228	0.1819	0.1186	0.0084	0.0077	20.8005
HP Conc. pump, traylor 40cy/hr	1	127	0.7	24	100	0.0533	0.9024	1.0779	0.0599	0.0551	170.4003	0.0086	0.0039	0.25	4.24	5.07	0.28	0.26	0.0125	0.2122	0.2535	0.0141	0.0130	36.3597
Wheel Loader Cat 950/3.5cy	1	180	0.65	24	100	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.68	7.94	3.13	0.26	0.24	0.0342	0.3972	0.1567	0.0132	0.0121	58.9819
Generator, trailer 5.0kW	1	9	0.65	24	100	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110	0.14	1.14	0.74	0.05	0.05	0.0071	0.0569	0.0371	0.0026	0.0024	6.5071
Total	**12**													10.18	101.91	57.11	4.91	4.52	0.51	5.10	2.86	0.25	0.23	747.22

In-Tunnel Steel Lining	Duration: Outage (100 days) 24/7 for 1 outages					Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Hydraulic Crane 30ton/94'	1	130	0.65	24	100	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039	0.76	7.84	5.05	0.42	0.39	0.0379	0.3919	0.2523	0.0211	0.0194	34.0406
Wheel Loader Cat 950/3.5cy	1	180	0.65	24	100	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.68	7.94	3.13	0.26	0.24	0.0342	0.3972	0.1567	0.0132	0.0121	58.9819
Pump, trash 705gpm/106ft head	1	26	0.9	24	100	0.4890	3.3405	3.3884	0.1623	0.1493	464.5881	0.0242	0.0111	0.61	4.14	4.20	0.20	0.18	0.0303	0.2068	0.2098	0.0100	0.0092	26.0935
Generator, skid 210kW	1	314	0.65	24	100	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039	1.04	9.49	3.82	0.46	0.42	0.0521	0.4745	0.1912	0.0230	0.0212	83.4759
Total	**4**													3.09	29.41	16.20	1.35	1.24	0.15	1.47	0.81	0.07	0.06	202.59

Conversion Factors:	
grams per pound:	*454*
pounds per ton:	*2.000*
pounds per metric ton:	*2,205*
Global Warming Potential	
CO2	1
CH4	28
N2O	265

*Per IPCC 5th Assessment Report (AR5)

CH4 and N2O emissions estimated based on EPA emission factors for grams per gallon of diesel. Source: EPA 2018. Emission Factors for Greenhouse Gas Inventories: https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

Notes: Load factor data based on client-provided equipment data. Daily emissions based on emission factors from OFFROAD2017 - ORION, applied to horsepower and use data from client-provided equipment data.

Adit 8/9

Effective Duration (non-shutdown, months)	12	Sum of durations of all sub-activities
Phase (shutdown, months)	0	Sum of durations of all sub-activities
Actual Total Duration (Months)	12	Per Construction Schedule Tab
Total Years to Distribute Emissions Over	1	
Work Days per Month		
Non-Shutdown Period:	22	
Shutdown Period	30.5	
Trip Distances (mi)*		* See email communication from David Tsztoo at SF Water to Rodney Jeung (AECOM) on 6 Aug 2018.
Short Worker Trips	10	"Local Workers"
% of Trips	80%	
Long Worker Trips	30	Assumes to edge of air district.
% of Trips	20%	
(Vendor) Material Deliveries Distance	23	
Short Haul Trips Distance	3	Groveland Transfer Facility
Long Haul Trips Distance	20	Cal Sierra Earth Resource Facility (ERF)
Trip Numbers		
Workers (non-shutdown)	15	Table A-2
workers (shutdown)	0	Table A-2
Short Haul (Daily)	19	Table A-7
Short Haul (Total)	3400	Table A-7
Long Haul (Daily)	2	Table A-7
Long Haul (Total)	638	Table A-7
(Vendor) Daily Small Deliveries	18	Table A-8
(Vendor) Total Large Deliveries	934	Table A-8
Unpaved Road Distances (mi)		
Workers	1.8	
Haul Trucks	1.8	
Vendors	1.8	
Excavated Material (cy)	23200	Tables A-5 and A-6

Adit 8/9 Construction Emissions Summary

months (max) 12 work days 264

	Emissions Summary (lbs/day)					Emissions Summary (tons per phase)						Emissions Summary (maximum annual emissions - tons/year)					
Construction Activity	ROG	NO_x	CO	PM10	PM2.5	ROG	NO_x	CO	PM10	PM2.5	MT CO_2e	ROG	NO_x	CO	PM10	PM2.5	MT CO_2e
On-Road Construction	0.45	14.13	3.18	0.36	0.23	0.05	1.68	0.37	0.04	0.03	322.62	0.05	1.68	0.37	0.04	0.03	322.62
Worker Trips	0.04	0.15	1.51	0.04	0.02	0.00	0.02	0.20	0.01	0.00	40.23	0.00	0.02	0.20	0.01	0.00	40.23
Haul Trips	0.10	2.43	0.64	0.07	0.04	0.01	0.17	0.03	0.00	0.00	32.79	0.01	0.17	0.03	0.00	0.00	32.79
Vendor Trips	0.31	11.55	1.03	0.25	0.17	0.04	1.49	0.13	0.03	0.02	249.59	0.04	1.49	0.13	0.03	0.02	249.59
Fugitive Dust	-	-	-	266.08	27.85	-	-	-	16.72	2.15	-	-	-	-	16.72	2.15	-
Paved Road Dust	-	-	-	0.27	0.07	-	-	-	0.07	0.02	-	-	-	-	0.07	0.02	-
On-Site Construction Vehicles	-	-	-	253.75	21.15	-	-	-	15.06	1.26	-	-	-	-	15.06	1.26	-
Truck Loading	-	-	-	0.01	0.00	-	-	-	0.00	0.00	-	-	-	-	0.00	0.00	-
Earthwork	-	-	-	12.04	6.64	-	-	-	1.59	0.88	-	-	-	-	1.59	0.88	-
Construction Equipment Exhaust	17.28	174.43	113.97	7.38	6.79	0.83	8.85	5.32	0.37	0.34	1,268.93	0.83	8.85	5.32	0.37	0.34	1,268.93
TOTAL	17.73	188.56	117.15	273.82	34.87	0.88	10.54	5.69	17.14	2.52	1,591.55	0.88	10.54	5.69	17.14	2.52	1,591.55

Adit 8/9 On-Road Construction Emissions

Worker Trips

months (max) 12 work days 264

						Emissions Summary (lbs/day)						Emissions Summary (tons per phase)						
	Max Daily Trips (one-way)	Distance (one-way)	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	ROG	NO_x	CO	PM10	PM2.5	CO2	ROG	NO_x	CO	PM10	PM2.5	CO_2	Total GHG Emissions (MT CO2e)
Worker Trips	15	14	420	264	55,440	0.04	0.15	1.51	0.04	0.02	304.79	0.00	0.02	0.20	0.01	0.00	40.23	0.00
Total						**0.04**	**0.15**	**1.51**	**0.04**	**0.02**	**304.79**	**0.00**	**0.02**	**0.20**	**0.01**	**0.00**	**40.23**	**0.00**

Haul Trips

months (max) 12 work days 264

						Emissions Summary (lbs/day)						Emissions Summary (tons per phase)						
	Max Daily Trips (one-way)	Distance (one-way)	Average Daily Mileage	Total Trips per Phase	Total Mileage per Phase	ROG	NO_x	CO	PM10	PM2.5	CO2	ROG	NO_x	CO	PM10	PM2.5	CO_2	Total GHG Emissions (MT CO2e)
Spoils Disposal Truck Trips (3cy truck, short-haul)	19	3	114	3,400	10,200	0.05	0.60	0.48	0.03	0.02	188.71	0.00	0.03	0.02	0.00	0.00	8.44	0.00
Spoils Disposal Truck Trips (large-haul)	2	20	80	638	12,760	0.05	1.83	0.16	0.04	0.03	305.36	0.00	0.15	0.01	0.00	0.00	24.35	0.00
Total	**21**		**194**	**4038**	**22,960**	**0.10**	**2.43**	**0.64**	**0.07**	**0.04**	**494.07**	**0.01**	**0.17**	**0.03**	**0.00**	**0.00**	**32.79**	**0.01**

Vendor Trips

months (max) 12 work days 264

						Emissions Summary (lbs/day)						Emissions Summary (tons per phase)						
	Max Daily Trips (one-way)	Distance (one-way)	Average Daily Mileage	Total Trips per Phase	Total Mileage per Phase	ROG	NO_x	CO	PM10	PM2.5	CO2	ROG	NO_x	CO	PM10	PM2.5	CO_2	Total GHG Emissions (MT CO2e)
Material Delivery Truck Trips	22	23	506	5,686	130,778	0.31	11.55	1.03	0.25	0.17	1,931.43	0.04	1.49	0.13	0.03	0.02	249.59	0.12
Total						**0.31**	**11.55**	**1.03**	**0.25**	**0.17**	**1,931.43**	**0.04**	**1.49**	**0.13**	**0.03**	**0.02**	**249.59**	**0.12**

On-Road Construction Emissions Summary

	Emissions Summary (lbs/day)						Emissions Summary (tons per phase)						
Construction Activity	ROG	NO_x	CO	PM10	PM2.5	CO2	ROG	NO_x	CO	PM10	PM2.5	CO_2	Total GHG Emissions (MT CO2e)
Worker Trips	0.04	0.15	1.51	0.04	0.02	304.79	0.00	0.02	0.20	0.01	0.00	40.23	0.00
Haul Trips	0.10	2.43	0.64	0.07	0.04	494.07	0.01	0.17	0.03	0.00	0.00	32.79	0.01
Vendor Trips	0.31	11.55	1.03	0.25	0.17	1,931.43	0.04	1.49	0.13	0.03	0.02	249.59	0.12
Total	**15.00**	**14.13**	**3.18**	**0.36**	**0.23**	**2,730.29**	**0.05**	**1.68**	**0.37**	**0.04**	**0.03**	**322.62**	**0.12**

Adit 8/9 Fugitive Dust Emissions

Paved Road Dust

% Paved Roads: 100%

Vehicle Type	Miles per Day	Miles Per Phase	Emissions Summary (lbs/day) PM10	Emissions Summary (lbs/day) PM2.5	Emissions Summary (tons/phase) PM10	Emissions Summary (tons/phase) PM2.5
Worker	420	55,440	0.27	0.0667	0.02	0.00
Haul Trucks	194	22,960	0.13	0.0308	0.01	0.00
Vendor Trucks	506	130,778	0.33	0.0804	0.04	0.01
Total			0.73	0.1780	0.07	0.02

Daily On-Site Construction Motor Vehicle Fugitive Particulate Matter Emissions

Vehicle Type	Miles per Trip	Max Trips per Day (one-way)	Max Trips per Phase (one-way)	Surface Type	Vehicle Weight (tons)	Uncontrolled Emission Factors (lb/mi) PM10	Uncontrolled Emission Factors (lb/mi) PM2.5	Uncontrolled Emissions (lb/day)[a] PM10	Uncontrolled Emissions (lb/day)[a] PM2.5	Uncontrolled Emissions (tons per phase) PM10	Uncontrolled Emissions (tons per phase) PM2.5
Worker	1.80	15	3960	Unpaved	3	0.75	0.06	40.5	3.4	2.7	0.2
Haul Truck - small load, short-haul	1.80	19	3,400	Unpaved	7	1.15	0.10	78.4	6.5	3.5	0.3
Haul Truck - large-haul	1.80	2	638	Unpaved	13	1.56	0.13	11.2	0.9	0.9	0.1
Vendor Truck	1.80	22	5,686	Unpaved	13	1.56	0.13	123.7	10.3	8.0	0.7
Total						**5.02**	**0.42**	**253.8**	**21.1**	**15.1**	1.3

* Standard Construction Practices - watering unpaved roads - % reduction in emissions assumed: 0%

[a] Uncontrolled emissions [lb/day] = Emission factor [lb/mi] x Number x Daily miles traveled [mi/vehicle-day]

[b] Per standard construction operations, reduced PM emissions from watering unpaved road twice a day (55%) and limiting maximum speed to 15 mph (57%), from Table XI-A, Mitigation Measure Examples, Fugitive Dust from Construction & Demolition, http://www.aqmd.gov/ceqa/handbook/mitigation/fugitive/MM_fugitive.html
Emissions reductions from watering based upon = Uncontrolled emissions [lb/day] x (1 - emissions reduction factor [%])

* Access to Adit 8/9 is via dirt road (known as Forest Service Road 1N10/Lumsden Road

Truck Loading Emissions

months (max): 12 work days: 264

Total Materials Moved (cy)	Total Materials Moved (tons)	Daily Materials Moved (tons/day)	Unmitigated Daily PM_{10} (lbs/day)	Unmitigated Daily $PM_{2.5}$ (lbs/day)
23,200	29,329	111.09	0.0129	0.0019

Unmitigated PM_{10} (tons / phase)	Unmitigated $PM_{2.5}$ (tons/phase)
0.0017	0.0003

Earthwork Emissions

months (max): 12 work days: 264

Number of Earth working Equipment	Daily Activity Level	Total Activity Level	PM10 Emission Factor (lb/activity)	PM2.5 Emission Factor (lb/activity)	Unmitigated Daily PM_{10} (lbs/day)	Unmitigated Daily $PM_{2.5}$ (lbs/day)
2	8	16.00	0.75	0.41	12.04	6.64

Unmitigated PM_{10} (tons)	Unmitigated $PM_{2.5}$ (tons)
1.59	0.88

* Standard Construction Practices - watering disturbed areas - % reduction in emissions assumed: 0%

[b] Per standard construction operations, reduced PM emissions from watering disturbed areas (61%), from Table XI-A, Mitigation Measure Examples, Fugitive Dust from Construction & Demolition, http://www.aqmd.gov/ceqa/handbook/mitigation/fugitive/MM_fugitive.html
Emissions reductions from watering based upon = Uncontrolled emissions [lb/day] x (1 - emissions reduction factor [%])

Fugitive Dust Emissions Summary

Construction Activity	Emissions Summary - Unmitigated (lbs/day) PM10	Emissions Summary - Unmitigated (lbs/day) PM2.5	Emissions Summary - Unmitigated (tons per phase) PM10	Emissions Summary - Unmitigated (tons per phase) PM2.5
Paved Road Dust	0.27	0.07	0.07	0.02
On-Site Construction Vehicles	253.75	21.15	15.06	1.26
Truck Loading	0.0129	0.0019	0.0017	0.0003
Earthwork	12.04	6.64	1.59	0.88
Total	**266.08**	**27.85**	**16.72**	**2.15**

Adit 8/9 Construction Equipment Exhaust Emissions

Concurrent Activities and Emissions:		Maximum Daily Emissions (lb/day) ROG	NOX	CO	PM10	PM2.5
Group A Activities	Roadways	8.33	86.75	58.60	3.42	3.15
	Adit 8/9 Support	1.88	19.46	9.62	0.81	0.75
	In Tunnel Repairs	6.38	60.27	42.62	2.88	2.65
	In Tunnel Steel Lining	0.68	7.94	3.13	0.26	0.24
	Total	17.28	174.43	113.97	7.38	6.79

Construction Activity:	Total Emissions at Adit 8/9 (Tons) ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Roadways	0.26	3.39	1.90	0.12	0.11	502.61
Adit 5/6 Support	0.09	0.97	0.48	0.04	0.04	161.91
In Tunnel Repairs	0.32	3.01	2.13	0.14	0.13	401.82
In Tunnel Steel Lining	0.15	1.47	0.81	0.07	0.06	202.59
Total	0.83	8.85	5.32	0.37	0.34	1,268.93

Roadways

Duration: 8 months — Single shift, M-F

Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	Emissions Factors (g/hp-hr) ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O
301 Mini-Exc 3.8k/.04cy	1	17	0.65	8	132	0.2494	1.6956	1.8927	0.0934	0.0859	247.2024	0.0125	0.0057
SK330LC Exc 77.8/2.1cy	1	238	0.65	8	176	0.0755	0.8627	0.4778	0.0263	0.0242	222.3667	0.0113	0.0051
Hydraulic Hoe Ram	1	100	0.7	8	132	0.1286	1.3070	1.4492	0.0818	0.0752	214.9372	0.0109	0.0050
Cat 226B / Bobcat Loader	1	54	0.7	8	176	0.0764	1.0124	1.3299	0.0433	0.0398	214.3929	0.0109	0.0050
Wheel Loader Cat 950/3.5cy	1	180	0.65	8	176	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049
Dozer Cat D5/2.9cy	1	90	0.7	8	132	0.1286	1.3070	1.4492	0.0818	0.0752	214.9372	0.0109	0.0050
Grader, Cat 12-H/12' blade	1	140	0.6	8	18	0.2506	2.4459	1.6138	0.1365	0.1256	238.1666	0.0121	0.0055
Hydraulic Crane 30ton/94'	1	130	0.65	8	18	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039
Airtrak, 4"-6"/12' feed-900cfm	1	900	0.8	8	132	0.0899	1.7312	0.5057	0.0406	0.0373	241.5118	0.0122	0.0056
HP Conc. pump, traylor 40cy/hr	1	127	0.7	8	9	0.0533	0.9024	1.0779	0.0599	0.0551	170.4003	0.0086	0.0039
Shotcrete plant, skid 12cy/hr	1	125	0.75	8	18	0.1275	1.2892	1.3840	0.0825	0.0759	199.1148	0.0101	0.0046
Transit mixer, 9cy/60k GVR	1	600	0.5	8	18	0.3355	2.5315	1.9610	0.1006	0.0926	342.3171	0.0186	0.0085
Grout Pump-Moyno/Mixer	1	600	0.5	8	9	0.3355	2.5315	1.9610	0.1006	0.0926	342.3171	0.0186	0.0085
Sinker drill, 100cfm	1	103	0.65	8	44	0.1277	1.4654	1.8226	0.0746	0.0686	287.7812	0.0146	0.0067
Jackleg drill, 100cfm	1	100	0.65	8	44	0.1277	1.4654	1.8226	0.0746	0.0686	287.7812	0.0146	0.0067
Compactor, BW5AS, 6t/40"	1	50	0.8	8	44	0.3820	1.8713	1.9498	0.1357	0.1248	242.7832	0.0123	0.0056
Compressor, trailer 450cfm	1	170	0.75	8	132	0.1784	1.8890	1.4836	0.0998	0.0918	240.8317	0.0122	0.0056
Compressor, trailer 1600cfm	1	500	0.75	8	132	0.0988	1.1946	0.6928	0.0422	0.0388	241.2555	0.0122	0.0056
Generator, trailer 10.0kW	1	23	0.65	8	18	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110
Light Plant/Genset, 6kW, 4/1000W	1	12	0.85	8	44	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110
Man-Lift 55' articulated boom	2	80	0.65	8	88	0.0331	0.3343	0.9644	0.0109	0.0100	179.2830	0.0091	0.0041
Total	**22**												

Equipment Name	Emissions Summary (lb/day) ROG	NOX	CO	PM10	PM2.5	Emissions Summary (tons/year) ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
301 Mini-Exc 3.8k/.04cy	0.05	0.33	0.37	0.02	0.02	0.0032	0.0218	0.0243	0.0012	0.0011	2.8848
SK330LC Exc 77.8/2.1cy	0.21	2.35	1.30	0.07	0.07	0.0181	0.2071	0.1147	0.0063	0.0058	48.4394
Hydraulic Hoe Ram	0.16	1.61	1.79	0.10	0.09	0.0105	0.1065	0.1181	0.0067	0.0061	15.8895
Cat 226B / Bobcat Loader	0.05	0.67	0.89	0.03	0.03	0.0045	0.0594	0.0780	0.0025	0.0023	11.4115
Wheel Loader Cat 950/3.5cy	0.23	2.65	1.04	0.09	0.08	0.0200	0.2330	0.0920	0.0077	0.0071	34.6027
Dozer Cat D5/2.9cy	0.14	1.45	1.61	0.09	0.08	0.0094	0.0958	0.1063	0.0060	0.0055	14.3005
Grader, Cat 12-H/12' blade	0.37	3.62	2.39	0.20	0.19	0.0033	0.0326	0.0215	0.0018	0.0017	2.8811
Hydraulic Crane 30ton/94'	0.25	2.61	1.68	0.14	0.13	0.0023	0.0235	0.0151	0.0013	0.0012	2.0424
Airtrak, 4"-6"/12' feed-900cfm	1.14	21.98	6.42	0.51	0.47	0.0753	1.4510	0.4238	0.0340	0.0313	183.6417
HP Conc. pump, traylor 40cy/hr	0.08	1.41	1.69	0.09	0.09	0.0004	0.0064	0.0076	0.0004	0.0004	1.0908
Shotcrete plant, skid 12cy/hr	0.21	2.13	2.29	0.14	0.13	0.0019	0.0192	0.0206	0.0012	0.0011	2.6883
Transit mixer, 9cy/60k GVR	1.77	13.39	10.38	0.53	0.49	0.0160	0.1206	0.0934	0.0048	0.0044	14.7894
Grout Pump-Moyno/Mixer	1.77	13.39	10.38	0.53	0.49	0.0080	0.0603	0.0467	0.0024	0.0022	7.3947
Sinker drill, 100cfm	0.15	1.73	2.15	0.09	0.08	0.0033	0.0381	0.0473	0.0019	0.0018	6.7825
Jackleg drill, 100cfm	0.15	1.68	2.09	0.09	0.08	0.0032	0.0370	0.0460	0.0019	0.0017	6.5850
Compactor, BW5AS, 6t/40"	0.27	1.32	1.38	0.10	0.09	0.0059	0.0290	0.0303	0.0021	0.0019	3.4187
Compressor, trailer 450cfm	0.40	4.25	3.34	0.22	0.21	0.0265	0.2804	0.2202	0.0148	0.0136	32.4283
Compressor, trailer 1600cfm	0.65	7.90	4.58	0.28	0.26	0.0431	0.5215	0.3024	0.0184	0.0169	95.5452
Generator, trailer 10.0kW	0.12	0.97	0.63	0.04	0.04	0.0011	0.0087	0.0057	0.0004	0.0004	0.9978
Light Plant/Genset, 6kW, 4/1000W	0.08	0.66	0.43	0.03	0.03	0.0018	0.0146	0.0095	0.0007	0.0006	1.6640
Man-Lift 55' articulated boom	0.06	0.61	1.77	0.02	0.02	0.0027	0.0270	0.0778	0.0009	0.0008	13.1275
Total	8.33	86.75	58.60	3.42	3.15	0.26	3.39	1.90	0.12	0.11	502.61

Adit 8/9 Support

Duration: Outage (60 days to 100 days per outage) — This equipment will be present for each outage

Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	Emissions Factors (g/hp-hr) ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O
Generator, skid 210kW	1	314	0.65	24	100	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039
Wheel Loader Cat 950/3.5cy	1	180	0.65	24	100	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049
Cat 226B / Bobcat Loader	1	54	0.7	24	100	0.0764	1.0124	1.3299	0.0433	0.0398	214.3929	0.0109	0.0050
Total	**3**												

Equipment Name	Emissions Summary (lb/day) ROG	NOX	CO	PM10	PM2.5	Emissions Summary (tons/year) ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Generator, skid 210kW	1.04	9.49	3.82	0.46	0.42	0.0521	0.4745	0.1912	0.0230	0.0212	83.4759
Wheel Loader Cat 950/3.5cy	0.68	7.94	3.13	0.26	0.24	0.0342	0.3972	0.1567	0.0132	0.0121	58.9819
Cat 226B / Bobcat Loader	0.15	2.02	2.66	0.09	0.08	0.0076	0.1012	0.1330	0.0043	0.0040	19.4514
Total	1.88	19.46	9.62	0.81	0.75	0.09	0.97	0.48	0.04	0.04	161.91

In-Tunnel Repairs

Duration: Outage (100 days) 24/7 for 1 outages

Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	Emissions Factors (g/hp-hr) ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O
Generator, skid 210kW	1	314	0.65	24	100	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039
Compressor, trailer 450cfm	2	170	0.75	24	100	0.1784	1.8890	1.4836	0.0998	0.0918	240.8317	0.0122	0.0056
Light Plant/Genset, 6kW, 4/1250W	2	11	0.85	24	100	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110
Cat 226B / Bobcat Loader	1	54	0.7	24	100	0.0764	1.0124	1.3299	0.0433	0.0398	214.3929	0.0109	0.0050
Wheel Loader Cat 950/3.5cy	1	180	0.65	24	100	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049
Pump, trash 705gpm/106ft head	2	26	0.9	24	100	0.4890	3.3405	3.3884	0.1623	0.1493	464.5881	0.0242	0.0111
Generator, trailer 5.0kW	3	9	0.65	24	100	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110
Total	**12**												

Equipment Name	Emissions Summary (lb/day) ROG	NOX	CO	PM10	PM2.5	Emissions Summary (tons/year) ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Generator, skid 210kW	1.04	9.49	3.82	0.46	0.42	0.0521	0.4745	0.1912	0.0230	0.0212	83.4759
Compressor, trailer 450cfm	2.41	25.49	20.02	1.35	1.24	0.1203	1.2744	1.0008	0.0673	0.0620	147.4014
Light Plant/Genset, 6kW, 4/1250W	0.46	3.64	2.37	0.17	0.15	0.0228	0.1819	0.1186	0.0084	0.0077	20.8005
Cat 226B / Bobcat Loader	0.15	2.02	2.66	0.09	0.08	0.0076	0.1012	0.1330	0.0043	0.0040	19.4514
Wheel Loader Cat 950/3.5cy	0.68	7.94	3.13	0.26	0.24	0.0342	0.3972	0.1567	0.0132	0.0121	58.9819
Pump, trash 705gpm/106ft head	1.21	8.27	8.39	0.40	0.37	0.0605	0.4136	0.4195	0.0201	0.0185	52.1870
Generator, trailer 5.0kW	0.43	3.42	2.23	0.16	0.14	0.0214	0.1708	0.1113	0.0078	0.0072	19.5213
Total	6.38	60.27	42.62	2.88	2.65	0.32	3.01	2.13	0.14	0.13	401.82

In-Tunnel Steel Lining

Duration: Outage (100 days) 24/7 for 1 outages — Single shift, M-F

Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	Emissions Factors (g/hp-hr) ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O
Hydraulic Crane 30ton/94'	1	130	0.65	24	100	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039
Wheel Loader Cat 950/3.5cy	1	180	0.65	24	100	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049
Pump, trash 705gpm/106ft head	1	26	0.9	24	100	0.4890	3.3405	3.3884	0.1623	0.1493	464.5881	0.0242	0.0111
Generator, skid 210kW	1	314	0.65	24	100	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039
Total	**4**												

Equipment Name	Emissions Summary (lb/day) ROG	NOX	CO	PM10	PM2.5	Emissions Summary (tons/year) ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Hydraulic Crane 30ton/94'	0.76	7.84	5.05	0.42	0.39	0.0379	0.3919	0.2523	0.0211	0.0194	34.0406
Wheel Loader Cat 950/3.5cy	0.68	7.94	3.13	0.26	0.24	0.0342	0.3972	0.1567	0.0132	0.0121	58.9819
Pump, trash 705gpm/106ft head	0.61	4.14	4.20	0.20	0.18	0.0303	0.2068	0.2098	0.0100	0.0092	26.0935
Generator, skid 210kW	1.04	9.49	3.82	0.46	0.42	0.0521	0.4745	0.1912	0.0230	0.0212	83.4759
Total	3.09	29.41	16.20	1.35	1.24	0.15	1.47	0.81	0.07	0.06	202.59

Conversion Factors:	
grams per pound:	*454*
pounds per ton:	*2,000*
pounds per metric ton:	*2,205*
Global Warming Potential	
CO2	1
CH4	28
N2O	265

*Per IPCC 5th Assessment Report (AR5)

CH4 and N2O emissions estimated based on EPA emission factors for grams per gallon of diesel. Source: EPA 2018. Emission Factors for Greenhouse Gas Inventories: https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors mar 2018 0.pdf

Notes: Load factor data based on client-provided equipment data. Daily emissions based on emission factors from OFFROAD2017 - ORION, applied to horsepower and use data from client-provided equipment data.

Big Creek

Effective Duration (non-shutdown, months)	0	Sum of durations of all sub-activities
Phase (shutdown, months)	3	Sum of durations of all sub-activities
Actual Total Duration (Months)	6	Per Construction Schedule Tab
Total Years to Distribute Emissions Over	1	
Work Days per Month		
Non-Shutdown Period:	22	
Shutdown Period	30.5	
Trip Distances (mi)*		* See email communication from David Tsztoo at SF Water to Rodney Jeung (AECOM) on 6 Aug 2018.
Short Worker Trips	10	"Local Workers"
% of Trips	80%	
Long Worker Trips	30	Assumes to edge of air district.
% of Trips	20%	
(Vendor) Material Deliveries Distance	23	
Short Haul Trips Distance	3	Groveland Transfer Facility
Long Haul Trips Distance	20	Cal Sierra Earth Resource Facility (ERF)
Trip Numbers		
Workers (non-shutdown)	0	Table A-2
workers (shutdown)	9	Table A-2
Short Haul (Daily)	0	Table A-7
Short Haul (Total)	0	Table A-7
Long Haul (Daily)	3	Table A-7
Long Haul (Total)	69	Table A-7
(Vendor) Daily Small Deliveries	0	Table A-8
(Vendor) Total Large Deliveries	405	Table A-8
Unpaved Road Distances (mi)		
Workers	-	
Haul Trucks	-	
Vendors	-	
Excavated Material (cy)	0	Tables A-5 and A-6

Big Creek Construction Emissions Summary

months (max)	work days
3	92

	Emissions Summary (lbs/day)					Emissions Summary (tons per phase)						Emissions Summary (maximum annual emissions - tons/year)					
Construction Activity	ROG	NO_x	CO	PM10	PM2.5	ROG	NO_x	CO	PM10	PM2.5	MT CO_2e	ROG	NO_x	CO	PM10	PM2.5	MT CO_2e
On-Road Construction	0.19	5.55	2.29	0.17	0.10	0.01	0.13	0.09	0.01	0.00	37.24	0.01	0.13	0.09	0.01	0.00	37.24
Worker Trips	0.04	0.18	1.81	0.05	0.02	0.00	0.01	0.08	0.00	0.00	16.82	0.00	0.01	0.08	0.00	0.00	16.82
Haul Trips	0.07	2.74	0.24	0.06	0.04	0.00	0.02	0.00	0.00	0.00	2.63	0.00	0.02	0.00	0.00	0.00	2.63
Vendor Trips	0.07	2.62	0.23	0.06	0.04	0.00	0.11	0.01	0.00	0.00	17.78	0.00	0.11	0.01	0.00	0.00	17.78
Fugitive Dust	-	-	-	0.33	0.12	-	-	-	0.01	0.00	-	-	-	-	0.01	0.00	-
Paved Road Dust	-	-	-	0.33	0.12	-	-	-	0.01	0.00	-	-	-	-	0.01	0.00	-
On-Site Construction Vehicles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Truck Loading	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Earthwork	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Construction Equipment Exhaust	12.93	124.84	76.16	5.88	5.41	0.65	6.24	3.81	0.29	0.27	902.57	0.65	6.24	3.81	0.29	0.27	902.57
TOTAL	13.12	130.39	78.45	6.37	5.63	0.65	6.37	3.90	0.31	0.28	939.80	0.65	6.37	3.90	0.31	0.28	939.80

Big Creek On-Road Construction Emissions

Worker Trips

months (max)	work days
3	92

						Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
	Max Daily Trips (one-way)	Distance (one-way)	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	ROG	NO_x	CO	PM10	PM2.5 (Exhaust)	PM2.5 (Total)	CO2	ROG	NO_x	CO	PM10	PM2.5 (Exhaust)	PM2.5 (Total)	CO_2	Total GHG Emissions (MT CO2e)
Worker Trips	18	14	504	92	23,058	0.0444	0.1849	1.8108	0.0524	0.0025	0.0222	365.7447	0.0020	0.0085	0.0833	0.0024	0.0001	0.0010	16.8243	0.0001
Total						**0.0444**	**0.1849**	**1.8108**	**0.0524**	**0.0025**	**0.0222**	**365.7447**	**0.0020**	**0.0085**	**0.0833**	**0.0024**	**0.0001**	**0.0010**	**16.8243**	**0.0001**

Haul Trips

months (max)	work days
3	92

						Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
	Max Daily Trips (one-way)	Distance (one-way)	Average Daily Mileage	Total Trips per Phase	Total Mileage per Phase	ROG	NO_x	CO	PM10	PM2.5 (Exhaust)	PM2.5 (Total)	CO2	ROG	NO_x	CO	PM10	PM2.5 (Exhaust)	PM2.5 (Total)	CO_2	Total GHG Emissions (MT CO2e)
Spoils Disposal Truck Trips (3cy truck, short-haul)	0	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spoils Disposal Truck Trips (large-haul)	3	20	120	69	1,380	0.0745	2.7380	0.2436	0.0582	0.0310	0.0403	458.0465	0.0004	0.0157	0.0014	0.0003	0.0002	0.0002	2.6338	0.0000
Total	**3**		**120**	**69**	**1,380**	**0.0745**	**2.7380**	**0.2436**	**0.0582**	**0.0310**	**0.0403**	**458.0465**	**0.0004**	**0.0157**	**0.0014**	**0.0003**	**0.0002**	**0.0002**	**2.6338**	**0.0000**

Vendor Trips

months (max)	work days
3	92

						Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
	Max Daily Trips (one-way)	Distance (one-way)	Average Daily Mileage	Total Trips per Phase	Total Mileage per Phase	ROG	NO_x	CO	PM10	PM2.5 (Exhaust)	PM2.5 (Total)	CO2	ROG	NO_x	CO	PM10	PM2.5 (Exhaust)	PM2.5 (Total)	CO_2	Total GHG Emissions (MT CO2e)
Material Delivery Truck Trips	5	23	115	405	9,315	0.0714	2.6239	0.2334	0.0557	0.0297	0.0386	438.9613	0.0029	0.1063	0.0095	0.0023	0.0012	0.0016	17.7779	0.0006
Total						**0.0714**	**2.6239**	**0.2334**	**0.0557**	**0.0297**	**0.0386**	**438.9613**	**0.0029**	**0.1063**	**0.0095**	**0.0023**	**0.0012**	**0.0016**	**17.7779**	**0.0006**

On-Road Construction Emissions Summary

	Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
Construction Activity	ROG	NO_x	CO	PM10	PM2.5 (Exhaust)	PM2.5 (Total)	CO2	ROG	NO_x	CO	PM10	PM2.5 (Exhaust)	PM2.5 (Total)	CO_2	Total GHG Emissions (MT CO2e)
Worker Trips	0.0444	0.1849	1.8108	0.0524	0.0025	0.0222	365.7447	0.0020	0.0085	0.0833	0.0024	0.0001	0.0010	16.8243	0.0001
Haul Trips	0.0745	2.7380	0.2436	0.0582	0.0310	0.0403	458.0465	0.0004	0.0157	0.0014	0.0003	0.0002	0.0002	2.6338	0.0000
Vendor Trips	0.0714	2.6239	0.2334	0.0557	0.0297	0.0386	438.9613	0.0029	0.1063	0.0095	0.0023	0.0012	0.0016	17.7779	0.0006
Total	**18.0000**	**5.5468**	**2.2878**	**0.1663**	**0.0632**	**0.1012**	**1,262.7525**	**0.0054**	**0.1305**	**0.0942**	**0.0050**	**0.0015**	**0.0028**	**37.2360**	**0.0007**

Big Creek Fugitive Dust Emissions

Paved Road Dust

% Paved Roads: 100%

Vehicle Type	Miles per Day	Miles Per Phase	Emissions Summary (lbs/day) PM10	Emissions Summary (lbs/day) PM2.5	Emissions Summary (tons/phase) PM10	Emissions Summary (tons/phase) PM2.5
Worker	504	23,058	0.33	0.0801	0.01	0.00
Haul Trucks	120	1,380	0.08	0.0191	0.00	0.00
Vendor Trucks	115	9,315	0.07	0.0183	0.00	0.00
Total			0.48	0.1174	0.01	0.00

Daily On-Site Construction Motor Vehicle Fugitive Particulate Matter Emissions

Vehicle Type	Miles per Trip	Max Trips per Day (one-way)	Max Trips per Phase (one-way)	Surface Type	Vehicle Weight (tons)	Uncontrolled Emission Factors (lb/mi) PM10	Uncontrolled Emission Factors (lb/mi) PM2.5	Uncontrolled Emissions (lb/day)[a] PM10	Uncontrolled Emissions (lb/day)[a] PM2.5	Uncontrolled Emissions (tons per phase) PM10	Uncontrolled Emissions (tons per phase) PM2.5
Worker	-	18	1656	Unpaved	3	0.75	0.06	0.0	0.0	-	-
Haul Truck - small load, short-haul	-	0	-	Unpaved	7	1.15	0.10	0.0	0.0	-	-
Haul Truck - large-haul	-	3	69	Unpaved	13	1.56	0.13	0.0	0.0	-	-
Vendor Truck	-	5	405	Unpaved	13	1.56	0.13	0.0	0.0	-	-
Total						**5.02**	**0.42**	**0.0**	**0.0**	**0.0**	-

* Standard Construction Practices - watering unpaved roads - % reduction in emissions assumed: 0%

[a] Uncontrolled emissions [lb/day] = Emission factor [lb/mi] x Number x Daily miles traveled [mi/vehicle-day]

[b] Per standard construction operations, reduced PM emissions from watering unpaved road twice a day (55%) and limiting maximum speed to 15 mph (57%), from Table XI-A, Mitigation Measure Examples, Fugitive Dust from Construction & Demolition, http://www.aqmd.gov/ceqa/handbook/mitigation/fugitive/MM_fugitive.html
Emissions reductions from watering based upon = Uncontrolled emissions [lb/day] x (1 - emissions reduction factor [%])

* Big Creek Shaft is accessed from Big Creek Shaft Road off Highway 120.

Truck Loading Emissions

months (max): 3 work days: 92

Total Materials Moved (cy)	Total Materials Moved (tons)	Daily Materials Moved (tons/day)	Unmitigated Daily PM_{10} (lbs/day)	Unmitigated Daily $PM_{2.5}$ (lbs/day)
-	-	-	0.0000	0.0000

Unmitigated PM_{10} (tons / phase)	Unmitigated $PM_{2.5}$ (tons/phase)
0.0000	0.0000

Earthwork Emissions

months (max): 3 work days: 92

Number of Earth working Equipment	Daily Activity Level	Total Activity Level	PM10 Emission Factor (lb/activity)	PM2.5 Emission Factor (lb/activity)	Unmitigated Daily PM_{10} (lbs/day)	Unmitigated Daily $PM_{2.5}$ (lbs/day)
-	24	-	0.75	0.41	0.00	0.00

Unmitigated PM_{10} (tons)	Unmitigated $PM_{2.5}$ (tons)
-	-

* Standard Construction Practices - watering disturbed areas - % reduction in emissions assumed: 0%

[b] Per standard construction operations, reduced PM emissions from watering disturbed areas (61%), from Table XI-A, Mitigation Measure Examples, Fugitive Dust from Construction & Demolition, http://www.aqmd.gov/ceqa/handbook/mitigation/fugitive/MM_fugitive.html
Emissions reductions from watering based upon = Uncontrolled emissions [lb/day] x (1 - emissions reduction factor [%])

Fugitive Dust Emissions Summary

Construction Activity	Emissions Summary - Unmitigated (lbs/day) PM10	Emissions Summary - Unmitigated (lbs/day) PM2.5	Emissions Summary - Unmitigated (tons per phase) PM10	Emissions Summary - Unmitigated (tons per phase) PM2.5
Paved Road Dust	0.33	0.12	0.01	0.00
On-Site Construction Vehicles	-	-	-	-
Truck Loading	0.0000	0.0000	0.0000	0.0000
Earthwork	-	-	-	-
Total	**0.33**	**0.12**	**0.01**	**0.00**

Big Creek Construction Equipment Exhaust Emissions

Concurrent Activities and Emissions:		Maximum Daily Emissions (lb/day) ROG	NOX	CO	PM10	PM2.5
Group A Activities	Roadways	4.67	45.11	23.92	2.19	2.01
	Adit 8/9 Support	1.88	19.46	9.62	0.81	0.75
	In Tunnel Debris Removal	6.38	60.27	42.62	2.88	2.65
	Total	12.93	124.84	76.16	5.88	5.41

Construction Activity:	Total Emissions at Big Creek (Tons) ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Roadways	0.23	2.26	1.20	0.11	0.10	338.84
Adit 5/6 Support	0.09	0.97	0.48	0.04	0.04	161.91
In Tunnel Debris Removal	0.32	3.01	2.13	0.14	0.13	401.82
Total	0.65	6.24	3.81	0.29	0.27	902.57

Contact Grouting (Top of Shaft/Outside of Tunnel)

Duration: 100 days Outage 24/7

Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	Emissions Factors (g/hp-hr) ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O
Genset, skid 545kW	1	817	0.65	24	100	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039
Light Plant/Genset, 6kW, 4/1250W	2	11	0.65	15	100	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110
Wheel Loader Cat 950/3.5cy	1	180	0.65	12	100	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049
Hydraulic Crane 30ton/94'	1	130	0.65	6	100	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039
Compressor, trailer 450cfm	1	170	0.75	24	100	0.1784	1.8890	1.4836	0.0998	0.0918	240.8317	0.0122	0.0056
Sub-total (Loader, Crane, Compressor)													
Total	**6**												

Equipment Name	Emissions Summary (lb/day) ROG	NOX	CO	PM10	PM2.5	Emissions Summary (tons/year) ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Genset, skid 545kW	2.71	24.69	9.95	1.20	1.10	0.1356	1.2347	0.4975	0.0598	0.0550	217.1969
Light Plant/Genset, 6kW, 4/1250W	0.22	1.74	1.13	0.08	0.07	0.0109	0.0870	0.0567	0.0040	0.0037	9.9414
Wheel Loader Cat 950/3.5cy	0.34	3.97	1.57	0.13	0.12	0.0171	0.1986	0.0784	0.0066	0.0061	29.4910
Hydraulic Crane 30ton/94'	0.19	1.96	1.26	0.11	0.10	0.0095	0.0980	0.0631	0.0053	0.0048	8.5102
Compressor, trailer 450cfm	1.20	12.74	10.01	0.67	0.62	0.0602	0.6372	0.5004	0.0337	0.0310	73.7007
Sub-total (Loader, Crane, Compressor)	*1.73*	*18.68*	*12.84*	*0.91*	*0.84*	*0.0867*	*0.9338*	*0.6418*	*0.0455*	*0.0419*	*111.7018*
Total	4.67	45.11	23.92	2.19	2.01	0.23	2.26	1.20	0.11	0.10	338.84

Priest Portal Support (Open during Big Creek Outage)

Duration: Outage (60 days to 100 days per outage)

Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	Emissions Factors (g/hp-hr) ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O
Generator, skid 210kW	1	314	0.65	24	100	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039
Wheel Loader Cat 950/3.5cy	1	180	0.65	24	100	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049
Cat 226B / Bobcat Loader	1	54	0.7	24	100	0.0764	1.0124	1.3299	0.0433	0.0398	214.3929	0.0109	0.0050
Sub-total (Wheel Loader, Bobcat Loader)													
Total	**3**												

Equipment Name	Emissions Summary (lb/day) ROG	NOX	CO	PM10	PM2.5	Emissions Summary (tons/year) ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Generator, skid 210kW	1.04	9.49	3.82	0.46	0.42	0.0521	0.4745	0.1912	0.0230	0.0212	83.4759
Wheel Loader Cat 950/3.5cy	0.68	7.94	3.13	0.26	0.24	0.0342	0.3972	0.1567	0.0132	0.0121	58.9819
Cat 226B / Bobcat Loader	0.15	2.02	2.66	0.09	0.08	0.0076	0.1012	0.1330	0.0043	0.0040	19.4514
Sub-total (Wheel Loader, Bobcat Loader)	*0.84*	*9.97*	*5.79*	*0.35*	*0.32*	*0.0418*	*0.4985*	*0.2897*	*0.0175*	*0.0161*	*78.4333*
Total	1.88	19.46	9.62	0.81	0.75	0.09	0.97	0.48	0.04	0.04	161.91

In-Tunnel Repairs

Duration: Outage (100 days) 24/7 for 1 outages

Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	Emissions Factors (g/hp-hr) ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O
Generator, skid 210kW	1	314	0.65	24	100	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039
Generator, trailer 5.0kW	3	9	0.65	24	100	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110
Sub-total (Generators)													
Light Plant/Genset, 6kW, 4/1250W	2	11	0.85	24	100	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110
Compressor, trailer 450cfm	2	170	0.75	24	100	0.1784	1.8890	1.4836	0.0998	0.0918	240.8317	0.0122	0.0056
Cat 226B / Bobcat Loader	1	54	0.7	24	100	0.0764	1.0124	1.3299	0.0433	0.0398	214.3929	0.0109	0.0050
Wheel Loader Cat 950/3.5cy	1	180	0.65	24	100	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049
Pump, trash 705gpm/106ft head	2	26	0.9	24	100	0.4890	3.3405	3.3884	0.1623	0.1493	464.5881	0.0242	0.0111
Sub-total (Compressor, Bobcat Loader, Wheel Loader, Pump)													
Total	**12**												

Equipment Name	Emissions Summary (lb/day) ROG	NOX	CO	PM10	PM2.5	Emissions Summary (tons/year) ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Generator, skid 210kW	1.04	9.49	3.82	0.46	0.42	0.0521	0.4745	0.1912	0.0230	0.0212	83.4759
Generator, trailer 5.0kW	0.43	3.42	2.23	0.16	0.14	0.0214	0.1708	0.1113	0.0078	0.0072	19.5213
Sub-total (Generators)	*1.47*	*12.91*	*6.05*	*0.62*	*0.57*	*0.0736*	*0.6453*	*0.3025*	*0.0308*	*0.0284*	*102.9972*
Light Plant/Genset, 6kW, 4/1250W	0.46	3.64	2.37	0.17	0.15	0.0228	0.1819	0.1186	0.0084	0.0077	20.8005
Compressor, trailer 450cfm	2.41	25.49	20.02	1.35	1.24	0.1203	1.2744	1.0008	0.0673	0.0620	147.4014
Cat 226B / Bobcat Loader	0.15	2.02	2.66	0.09	0.08	0.0076	0.1012	0.1330	0.0043	0.0040	19.4514
Wheel Loader Cat 950/3.5cy	0.68	7.94	3.13	0.26	0.24	0.0342	0.3972	0.1567	0.0132	0.0121	58.9819
Pump, trash 705gpm/106ft head	1.21	8.27	8.39	0.40	0.37	0.0605	0.4136	0.4195	0.0201	0.0185	52.1870
Sub-total (Compressor, Bobcat Loader, Wheel Loader, Pump)	4.45	43.73	34.20	2.10	1.93	0.2227	2.1864	1.7101	0.1050	0.0966	278.0217
Total	6.38	60.27	42.62	2.88	2.65	0.32	3.01	2.13	0.14	0.13	401.82

Emissions Summary for HRA:

Construction Activity	Equipment	Emissions Summary (lb/day) ROG	NOX	CO	PM10	PM2.5	Emissions Summary (tons/year) ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Contact Grouting	Genset, skid 545kW	2.7129	24.6946	9.9492	1.1966	1.1009	0.1356	1.2347	0.4975	0.0598	0.0550	217.1969
Priest Portal Support	Generator, skid 210kW	1.0427	9.4910	3.8238	0.4599	0.4231	0.0521	0.4745	0.1912	0.0230	0.0212	83.4759
In-Tunnel Repairs	Generator, skid 210kW	1.0427	9.4910	3.8238	0.4599	0.4231	0.0521	0.4745	0.1912	0.0230	0.0212	83.4759
In-Tunnel Repairs	Generator, trailer 5.0kW	0.4286	3.4150	2.2261	0.1567	0.1442	0.0214	0.1708	0.1113	0.0078	0.0072	19.5213
	Sub-total (Generators)	5.2268	47.0915	19.8228	2.2731	2.0913	0.2613	2.3546	0.9911	0.1137	0.1046	403.6701
Contact Grouting	Light Plant/Genset, 6kW, 4/1250W	0.22	1.74	1.13	0.08	0.07	0.01	0.09	0.06	0.00	0.00	9.94
In-Tunnel Repairs	Light Plant/Genset, 6kW, 4/1250W	0.46	3.64	2.37	0.17	0.15	0.02	0.18	0.12	0.01	0.01	20.80
	Sub-total (Light Plant/Genset)	0.6749	5.3779	3.5056	0.2468	0.2271	0.0337	0.2689	0.1753	0.0123	0.0114	30.7419
Contact Grouting	Wheel Loader Cat 950/3.5cy	0.34	3.97	1.57	0.13	0.12	0.02	0.20	0.08	0.01	0.01	29.49
Contact Grouting	Hydraulic Crane 30ton/94'	0.19	1.96	1.26	0.11	0.10	0.01	0.10	0.06	0.01	0.00	8.51
Contact Grouting	Compressor, trailer 450cfm	1.20	12.74	10.01	0.67	0.62	0.06	0.64	0.50	0.03	0.03	73.70
Priest Portal Support	Wheel Loader Cat 950/3.5cy	0.68	7.94	3.13	0.26	0.24	0.03	0.40	0.16	0.01	0.01	58.98
Priest Portal Support	Cat 226B / Bobcat Loader	0.15	2.02	2.66	0.09	0.08	0.01	0.10	0.13	0.00	0.00	19.45
In-Tunnel Repairs	Compressor, trailer 450cfm	2.41	25.49	20.02	1.35	1.24	0.12	1.27	1.00	0.07	0.06	147.40
In-Tunnel Repairs	Cat 226B / Bobcat Loader	0.15	2.02	2.66	0.09	0.08	0.01	0.10	0.13	0.00	0.00	19.45
In-Tunnel Repairs	Wheel Loader Cat 950/3.5cy	0.68	7.94	3.13	0.26	0.24	0.03	0.40	0.16	0.01	0.01	58.98
In-Tunnel Repairs	Pump, trash 705gpm/106ft head	1.21	8.27	8.39	0.40	0.37	0.06	0.41	0.42	0.02	0.02	52.19
	Sub-total (Other Equip)	7.02	72.37	52.83	3.36	3.09	0.35	3.62	2.64	0.17	0.15	468.16

Conversion Factors:	
grams per pound:	*454*
pounds per ton:	*2,000*
pounds per metric ton:	*2,205*
Global Warming Potential	
CO2	1
CH4	28
N2O	265

*Per IPCC 5th Assessment Report (AR5)

CH_4 and N_2O emissions estimated based on EPA emission factors for grams per gallon of diesel. Source: EPA 2018. Emission Factors for Greenhouse Gas Inventories: https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

Notes: Load factor data based on client-provided equipment data. Daily emissions based on emission factors from OFFROAD2017 - ORION, applied to horsepower and use data from client-provided equipment data.

Big Creek - Mitigated: Includes use of Tier 4 Final Construction Equipment for Compressor Trailer

Emissions Summary for HRA:

		Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Construction Activity	Equipment	**ROG**	**NOX**	**CO**	**PM10**	**PM2.5**	**ROG**	**NOX**	**CO**	**PM10**	**PM2.5**	**CO2e (MT/yr)**
Contact Grouting	Compressor, trailer 450cfm	0.40	1.75	24.96	0.05	0.05	0.02	0.09	1.25	0.00	0.00	73.70

Conversion Factors:	
grams per pound:	*454*
pounds per ton:	*2,000*
pounds per metric ton:	*2,205*
Global Warming Potential	
CO2	1
CH4	28
N2O	265

*Per IPCC 5th Assessment Report (AR5)

CH4 and N2O emissions estimated based on EPA emission factors for grams per gallon of diesel. Source: EPA 2018. Emission Factors for Greenhouse Gas Inventories: https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

Notes: Load factor data based on client-provided equipment data. Daily emissions based on emission factors from OFFROAD2017 - ORION, applied to horsepower and use data from client-provided equipment data.

Second Garrote

Effective Duration (non-shutdown, months)	0	Sum of durations of all sub-activities
Phase (shutdown, months)	1	Sum of durations of all sub-activities
Actual Total Duration (Months)	1	Per Construction Schedule Tab
Total Years to Distribute Emissions Over	1	
Work Days per Month		
Non-Shutdown Period:	22	
Shutdown Period	30.5	
Trip Distances (mi)*		* See email communication from David Tsztoo at SF Water to Rodney Jeung (AECOM) on 6 Aug 2018.
Short Worker Trips	10	"Local Workers"
% of Trips	80%	
Long Worker Trips	30	Assumes to edge of air district.
% of Trips	20%	
(Vendor) Material Deliveries Distance	23	
Short Haul Trips Distance	3	Groveland Transfer Facility
Long Haul Trips Distance	20	Cal Sierra Earth Resource Facility (ERF)
Trip Numbers		
Workers (non-shutdown)	0	Table A-2
workers (shutdown)	9	Table A-2
Short Haul (Daily)	0	Table A-7
Short Haul (Total)	0	Table A-7
Long Haul (Daily)	3	Table A-7
Long Haul (Total)	63	Table A-7
(Vendor) Daily Small Deliveries	0	Table A-8
(Vendor) Total Large Deliveries	405	Table A-8
Unpaved Road Distances (mi)		
Workers	0.51	
Haul Trucks	0.51	
Vendors	0.51	
Excavated Material (cy)	1100	Tables A-5 and A-6

Second Garrote Construction Emissions Summary

months (max) 1 — work days 31

Construction Activity	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	Emissions Summary (maximum annual emissions - tons/year) ROG	NO_x	CO	PM10	PM2.5	CO_2
On-Road Construction	0.32	10.27	2.71	0.27	0.17	0.00	0.12	0.04	0.00	0.00	25.85	0.00	0.12	0.04	0.00	0.00	25.85
Worker Trips	0.04	0.18	1.81	0.05	0.02	0.00	0.00	0.03	0.00	0.00	5.67	0.00	0.00	0.03	0.00	0.00	5.67
Haul Trips	0.07	2.74	0.24	0.06	0.04	0.00	0.01	0.00	0.00	0.00	2.40	0.00	0.01	0.00	0.00	0.00	2.40
Vendor Trips	0.20	7.35	0.65	0.16	0.11	0.00	0.11	0.01	0.00	0.00	17.78	0.00	0.11	0.01	0.00	0.00	17.78
Fugitive Dust	-	-	-	36.09	10.15	-	-	-	0.53	0.15	-	-	-	-	0.53	0.15	-
Paved Road Dust	-	-	-	0.61	0.15	-	-	-	0.01	0.00	-	-	-	-	0.01	0.00	-
On-Site Construction Vehicles	-	-	-	20.42	1.70	-	-	-	0.29	0.02	-	-	-	-	0.29	0.02	-
Truck Loading	-	-	-	0.01	0.00	-	-	-	0.00	0.00	-	-	-	-	0.00	0.00	-
Earthwork	-	-	-	15.06	8.30	-	-	-	0.23	0.13	-	-	-	-	0.23	0.13	-
Construction Equipment Exhaust	21.42	207.65	120.50	9.31	8.56	0.96	9.29	5.61	0.44	0.40	1,348.00	0.96	9.29	5.61	0.44	0.40	1,348.00
TOTAL	21.74	217.92	123.20	45.67	18.88	0.96	9.42	5.65	0.98	0.56	1,373.85	0.96	9.42	5.65	0.98	0.56	1,373.85

Second Garrote On-Road Construction Emissions

Worker Trips — months (max) 1 — work days 31

	Max Daily Trips (one-way)	Distance (one-way)	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5 (Exhaust)	PM2.5 (Total)	CO2	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5 (Exhaust)	PM2.5 (Total)	CO_2	Total GHG Emissions (MT CO2e)
Worker Trips	18	14	504	31	7,686	0.0444	0.1849	1.8108	0.0524	0.0025	0.0222	365.7447	0.0007	0.0029	0.0281	0.0008	0.0000	0.0003	5.6690	0.0000
Total						**0.0444**	**0.1849**	**1.8108**	**0.0524**	**0.0025**	**0.0222**	**365.7447**	**0.0007**	**0.0029**	**0.0281**	**0.0008**	**0.0000**	**0.0003**	**5.6690**	**0.0000**

Notes: One-way trip distance per email communication with SF Water - assumes 80% are local workers (10 miles) and 20% (30 miles) are long worker trips

Haul Trips — months (max) 1 — work days 31

	Max Daily Trips (one-way)	Distance (one-way)	Average Daily Mileage	Total Trips per Phase	Total Mileage per Phase	Emissions Summary (lbs/day) ROG	NOx	CO	PM10	PM2.5 (Exhaust)	PM2.5 (Total)	CO2	Emissions Summary (tons per phase) ROG	NOx	CO	PM10	PM2.5 (Exhaust)	PM2.5 (Total)	CO2	Total GHG Emissions (MT CO2e)
Spoils Disposal Truck Trips (3cy truck, short-haul)	0	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spoils Disposal Truck Trips (large-haul)	3	20	120	63	1,260	0.0745	2.7380	0.2436	0.0582	0.0310	0.0403	458.0465	0.0004	0.0144	0.0013	0.0003	0.0002	0.0002	2.4047	0.0000
Total	**3**		**120**	**63**	**1,260**	**0.0745**	**2.7380**	**0.2436**	**0.0582**	**0.0310**	**0.0403**	**458.0465**	**0.0004**	**0.0144**	**0.0013**	**0.0003**	**0.0002**	**0.0002**	**2.4047**	**0.0000**

Notes: Short disposal truck trip distance based on distance to Groveland Transfer Facility and long haul truck trips based on distance to Cal Sierra Earth Resource Facility

Vendor Trips — months (max) 1 — work days 31

	Max Daily Trips (one-way)	Distance (one-way)	Average Daily Mileage	Total Trips per Phase	Total Mileage per Phase	Emissions Summary (lbs/day) ROG	NOx	CO	PM10	PM2.5 (Exhaust)	PM2.5 (Total)	CO2	Emissions Summary (tons per phase) ROG	NOx	CO	PM10	PM2.5 (Exhaust)	PM2.5 (Total)	CO2	Total GHG Emissions (MT CO2e)
Material Delivery Truck Trips	14	23	322	405	9,315	0.1999	7.3470	0.6536	0.1561	0.0831	0.1082	1,229.0915	0.0029	0.1063	0.0095	0.0023	0.0012	0.0016	17.7779	0.0006
Total						**0.1999**	**7.3470**	**0.6536**	**0.1561**	**0.0831**	**0.1082**	**1,229.0915**	**0.0029**	**0.1063**	**0.0095**	**0.0023**	**0.0012**	**0.0016**	**17.7779**	**0.0006**

On-Road Construction Emissions Summary

Construction Activity	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5 (Exhaust)	PM2.5 (Total)	CO2	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5 (Exhaust)	PM2.5 (Total)	CO_2	Total GHG Emissions (MT CO2e)
Worker Trips	0.0444	0.1849	1.8108	0.0524	0.0025	0.0222	365.7447	0.0007	0.0029	0.0281	0.0008	0.0000	0.0003	5.6690	0.0000
Haul Trips	0.0745	2.7380	0.2436	0.0582	0.0310	0.0403	458.0465	0.0004	0.0144	0.0013	0.0003	0.0002	0.0002	2.4047	0.0000
Vendor Trips	0.1999	7.3470	0.6536	0.1561	0.0831	0.1082	1,229.0915	0.0029	0.1063	0.0095	0.0023	0.0012	0.0016	17.7779	0.0006
Total	**18.0000**	**10.2699**	**2.7080**	**0.2666**	**0.1166**	**0.1707**	**2,052.8828**	**0.0040**	**0.1235**	**0.0388**	**0.0034**	**0.0014**	**0.0021**	**25.8517**	**0.0006**

Second Garrote Fugitive Dust Emissions

Paved Road Dust — % Paved Roads: 100%

Vehicle Type	Miles per Day	Miles Per Phase	Emissions Summary (lbs/day) PM10	Emissions Summary (lbs/day) PM2.5	Emissions Summary (tons/phase) PM10	Emissions Summary (tons/phase) PM2.5
Worker	504	7,686	0.33	0.0801	0.00	0.00
Haul Trucks	120	1,260	0.08	0.0191	0.00	0.00
Vendor Trucks	322	9,315	0.21	0.0512	0.00	0.00
Total			0.61	0.1503	0.01	0.00

Daily On-Site Construction Motor Vehicle Fugitive Particulate Matter Emissions

Vehicle Type	Miles per Trip	Max Trips per Day (one-way)	Max Trips per Phase (one-way)	Surface Type	Vehicle Weight (tons)	Uncontrolled Emission Factors (lb/mi) PM10	Uncontrolled Emission Factors (lb/mi) PM2.5	Uncontrolled Emissions (lb / day) PM10	Uncontrolled Emissions (lb / day) PM2.5	Uncontrolled Emissions (tons per phase) PM10	Uncontrolled Emissions (tons per phase) PM2.5
Worker	0.51	18	558	Unpaved	3	0.75	0.06	6.9	0.6	0.1	0.0
Haul Truck - small load, short-haul	0.51	0	-	Unpaved	7	1.15	0.10	-	-	-	-
Haul Truck - large-haul	0.51	3	63	Unpaved	13	1.56	0.13	2.4	0.2	0.0	0.0
Vendor Truck	0.51	14	405	Unpaved	13	1.56	0.13	11.1	0.9	0.2	0.0
Total						**5.02**	**0.42**	20.4	1.7	0.3	0.0

* Standard Construction Practices - watering unpaved roads - % reduction in emissions assumed: 0%

[a] Uncontrolled emissions [lb/day] = Emission factor [lb/mi] x Number x Daily miles traveled [mi/vehicle-day]

[b] Control efficiency from watering unpaved road twice a day (55%) and limiting maximum speed to 15 mph (57%), from Table XI-A, Mitigation Measure Examples, Fugitive Dust from Construction & Demolition, http://www.aqmd.gov/ceqa/handbook/mitigation/fugitive/MM_fugitive.html

[c] Controlled emissions [lb/day] = Uncontrolled emissions [lb/day] x (1 - Control efficiency [%])

*Second Garrote Shaft is accessed from unpaved Second Garrote Shaft Road off Highway 120

Truck Loading Emissions — months (max): 1 — work days: 31

Total Materials Moved (cy)	Total Materials Moved (tons)	Daily Materials Moved (tons/day)	Unmitigated Daily PM_{10} (lbs/day)	Unmitigated Daily $PM_{2.5}$ (lbs/day)
1,100	1,391	44.86	0.0052	0.0008

Unmitigated PM_{10} (tons / phase)	Unmitigated $PM_{2.5}$ (tons/phase)
0.0001	0.0000

* Standard Construction Practices - watering - % reduction in emissions assumed: -

Earthwork Emissions — months (max): 1 — work days: 31

Number of Earth working Equipment	Daily Activity Level	Total Activity Level	PM10 Emission Factor (lb/activity)	PM2.5 Emission Factor (lb/activity)	Unmitigated Daily PM_{10} (lbs/day)	Unmitigated Daily $PM_{2.5}$ (lbs/day)
1	20	20.00	0.75	0.41	15.06	8.30

Unmitigated PM_{10} (tons)	Unmitigated $PM_{2.5}$ (tons)
0.23	0.13

* Standard Construction Practices - watering disturbed areas - % reduction in emissions assumed: 0%

* Emission reductions due to standard watering practices are based upon WRAP Fugitive Dust Handbook, September 7, 2006 (http://www.wrapair.org/forums/dejf/fdh/content/FDHandbook_Rev_06.pdf), as detaile in the SCAQMD Air Quality Analysis Handbook, Tables XI-A (http://www.aqmd.gov/home/rules-compliance/ceqa/air-quality-analysis-handbook/mitigation-measures-and-control-efficiencies/fugitive-dust), for estimates of emission reductions of fugitive dust for construction and demolition activities.

Fugitive Dust Emissions Summary

Construction Activity	Emissions Summary - Unmitigated (lbs/day) PM10	Emissions Summary - Unmitigated (lbs/day) PM2.5	Emissions Summary - Unmitigated (tons per phase) PM10	Emissions Summary - Unmitigated (tons per phase) PM2.5
Paved Road Dust	0.61	0.15	0.01	0.00
On-Site Construction Vehicles	20.42	1.70	0.29	0.02
Truck Loading	0.0052	0.0008	0.0001	0.0000
Earthwork	15.06	8.30	0.23	0.13
Total	**36.09**	**10.15**	**0.53**	**0.15**

Second Garrote Construction Equipment Exhaust Emissions

Concurrent Activities and Emissions:		Maximum Daily Emissions (lb/day)				
		ROG	NOX	CO	PM10	PM2.5
Group A Activities	Roadways	1.38	12.72	9.59	0.60	0.55
	Contact Grouting	5.22	50.27	19.79	1.91	1.75
	Priest Portal Support (open during Second Garotte Outage)	1.88	19.46	9.62	0.81	0.75
	In Tunnel Repairs	6.38	60.27	42.62	2.88	2.65
	In Tunnel Water Cutoff	6.56	64.93	38.87	3.11	2.86
	Total	21.42	207.65	120.50	9.31	8.56

Construction Activity:	Total Emissions at Second Garrote (Tons)					
	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Roadways	0.01	0.09	0.07	0.00	0.00	12.99
Contact Grouting	0.21	1.97	0.99	0.10	0.09	300.94
Priest Portal Support (open during Second Garotte Outage)	0.09	0.97	0.48	0.04	0.04	161.91
In Tunnel Repairs	0.32	3.01	2.13	0.14	0.13	401.82
In Tunnel Water Cutoff	0.33	3.25	1.94	0.16	0.14	470.34
Total	0.96	9.29	5.61	0.44	0.40	1,348.00

Roadways

Duration: 1 month   Single shift, M-F

						Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
301 Mini-Exc 3.8k/.04cy	1	17	0.65	8	6	0.2494	1.6956	1.8927	0.0934	0.0859	247.2024	0.0125	0.0057	0.0486	0.3305	0.3689	0.0182	0.0167	0.0001	0.0010	0.0011	0.0001	0.0001	0.1311
SK330LC Exc 77.8/2.1cy	1	238	0.65	8	6	0.0755	0.8627	0.4778	0.0263	0.0242	222.3667	0.0113	0.0051	0.2060	2.3538	1.3036	0.0718	0.0660	0.0006	0.0071	0.0039	0.0002	0.0002	1.6513
Cat 226B / Bobcat Loader	1	54	0.7	8	17	0.0764	1.0124	1.3299	0.0433	0.0398	214.3929	0.0109	0.0050	0.0510	0.6750	0.8866	0.0288	0.0265	0.0004	0.0057	0.0075	0.0002	0.0002	1.1022
Wheel Loader Cat 950/3.5cy	1	180	0.65	8	22	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.2278	2.6482	1.0449	0.0879	0.0809	0.0025	0.0291	0.0115	0.0010	0.0009	4.3253
Grader, Cat 12-H/12' blade	1	140	0.6	8	17	0.2506	2.4459	1.6138	0.1365	0.1256	238.1666	0.0121	0.0055	0.3712	3.6236	2.3909	0.2023	0.1861	0.0032	0.0308	0.0203	0.0017	0.0016	2.7210
Compactor, BW5AS, 6t/40"	1	50	0.8	8	17	0.3820	1.8713	1.9498	0.1357	0.1248	242.7832	0.0123	0.0056	0.2695	1.3201	1.3755	0.0957	0.0881	0.0023	0.0112	0.0117	0.0008	0.0007	1.3209
Mechanic's truck, F350	1	137	0.65	8	11	0.1326	1.1231	1.4129	0.0589	0.0542	221.8222	0.0112	0.0051	0.2082	1.7640	2.2191	0.0924	0.0851	0.0011	0.0097	0.0122	0.0005	0.0005	1.7384
Total	7													1.3823	12.7151	9.5896	0.5972	0.5494	0.0103	0.0946	0.0683	0.0045	0.0042	12.9904

Contact Grouting (Top of Shaft/Outside of Tunnel)

Duration: 100 days   Outage 24/7

						Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Genset, skid 545kW	1	817	0.65	24	100	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039	2.7129	24.6946	9.9492	1.1966	1.1009	0.1356	1.2347	0.4975	0.0598	0.0550	217.1969
Light Plant/Genset, 6kW, 4/1250W	2	11	0.85	24	100	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110	0.4567	3.6388	2.3719	0.1670	0.1537	0.0228	0.1819	0.1186	0.0084	0.0077	20.8005
Compressor, trailer 450cfm	1	170	0.75	12	100	0.1784	1.8890	1.4836	0.0998	0.0918	240.8317	0.0122	0.0056	0.6016	6.3719	5.0041	0.3367	0.3098	0.0301	0.3186	0.2502	0.0168	0.0155	36.8504
Wheel Loader Cat 950/3.5cy	1	180	0.65	6	100	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.1708	1.9861	0.7837	0.0659	0.0607	0.0085	0.0993	0.0392	0.0033	0.0030	14.7455
Hydraulic Crane 30ton/94'	1	130	0.65	8	100	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039	0.2529	2.6124	1.6817	0.1404	0.1292	0.0126	0.1306	0.0841	0.0070	0.0065	11.3469
Sub-total (Compressor, Loader, Crane)														*1.0253*	*10.9705*	*7.4695*	*0.5431*	*0.4996*	*0.0513*	*0.5485*	*0.3735*	*0.0272*	*0.0250*	*62.9427*
Total	6													5.2202	50.2743	19.7906	1.9067	1.7541	0.2097	1.9652	0.9895	0.0953	0.0877	300.9401

Priest Portal Support (Open during Second Garrote Outage)

Duration: Outage (60 days to 100 days per outage)

						Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Generator, skid 210kW	1	314	0.65	24	100	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039	1.0427	9.4910	3.8238	0.4599	0.4231	0.0521	0.4745	0.1912	0.0230	0.0212	83.4759
Wheel Loader Cat 950/3.5cy	1	180	0.65	24	100	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.6833	7.9445	3.1348	0.2637	0.2426	0.0342	0.3972	0.1567	0.0132	0.0121	58.9819
Cat 226B / Bobcat Loader	1	54	0.7	24	100	0.0764	1.0124	1.3299	0.0433	0.0398	214.3929	0.0109	0.0050	0.1529	2.0249	2.6599	0.0865	0.0796	0.0076	0.1012	0.1330	0.0043	0.0040	19.4514
Sub-total (Loaders)														*0.8361*	*9.9693*	*5.7948*	*0.3503*	*0.3222*	*0.0418*	*0.4985*	*0.2897*	*0.0175*	*0.0161*	*78.4333*
Total	3													1.8788	19.4603	9.6186	0.8102	0.7453	0.0939	0.9730	0.4809	0.0405	0.0373	161.9092

In-Tunnel Repairs

Duration: Outage (100 days) 24/7 for 1 outages

						Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Generator, skid 210kW	1	314	0.65	24	100	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039	1.0427	9.4910	3.8238	0.4599	0.4231	0.0521	0.4745	0.1912	0.0230	0.0212	83.4759
Generator, trailer 5.0kW	3	9	0.65	24	100	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110	0.4286	3.4150	2.2261	0.1567	0.1442	0.0214	0.1708	0.1113	0.0078	0.0072	19.5213
Sub-total (Generators)														*1.4713*	*12.9060*	*6.0499*	*0.6166*	*0.5673*	*0.0736*	*0.6453*	*0.3025*	*0.0308*	*0.0284*	*102.9972*
Light Plant/Genset, 6kW, 4/1250W	2	11	0.85	24	100	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110	0.4567	3.6388	2.3719	0.1670	0.1537	0.0228	0.1819	0.1186	0.0084	0.0077	20.8005
Compressor, trailer 450cfm	2	170	0.75	24	100	0.1784	1.8890	1.4836	0.0998	0.0918	240.8317	0.0122	0.0056	2.4064	25.4876	20.0165	1.3469	1.2391	0.1203	1.2744	1.0008	0.0673	0.0620	147.4014
Cat 226B / Bobcat Loader	1	54	0.7	24	100	0.0764	1.0124	1.3299	0.0433	0.0398	214.3929	0.0109	0.0050	0.1529	2.0249	2.6599	0.0865	0.0796	0.0076	0.1012	0.1330	0.0043	0.0040	19.4514
Wheel Loader Cat 950/3.5cy	1	180	0.65	24	100	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.6833	7.9445	3.1348	0.2637	0.2426	0.0342	0.3972	0.1567	0.0132	0.0121	58.9819
Pump, trash 705gpm/106ft head	2	26	0.9	24	100	0.4890	3.3405	3.3884	0.1623	0.1493	464.5881	0.0242	0.0111	1.2108	8.2720	8.3904	0.4020	0.3698	0.0605	0.4136	0.4195	0.0201	0.0185	52.1870
Drill Rig	1	175	0.5	12	100	0.0968	1.0364	1.6308	0.0459	0.0422	293.2256	0.0149	0.0068	0.2241	2.3990	3.7752	0.1063	0.0978	0.0112	0.1200	0.1888	0.0053	0.0049	30.7913
Sub-total (Compressor, Loaders, Pump)														*4.4534*	*43.7289*	*34.2017*	*2.0991*	*1.9312*	*0.2227*	*2.1864*	*1.7101*	*0.1050*	*0.0966*	*278.0217*
Total	13													6.3814	60.2736	42.6235	2.8827	2.6521	0.3191	3.0137	2.1312	0.1441	0.1326	401.8195

In-Tunnel Water Cutoff

Duration: Outage (100 days) 24/7 for 1 outages

						Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Genset, skid 545kW	1	817	0.65	24	100	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039	2.7129	24.6946	9.9492	1.1966	1.1009	0.1356	1.2347	0.4975	0.0598	0.0550	217.1969
Generator, trailer 5.0kW	1	9	0.65	24	100	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110	0.1429	1.1383	0.7420	0.0522	0.0481	0.0071	0.0569	0.0371	0.0026	0.0024	6.5071
Sub-total (Generators)														*2.8558*	*25.8330*	*10.6912*	*1.2488*	*1.1489*	*0.1428*	*1.2916*	*0.5346*	*0.0624*	*0.0574*	*223.7040*
Light Plant/Genset, 6kW, 4/1250W	2	11	0.85	24	100	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110	0.4567	3.6388	2.3719	0.1670	0.1537	0.0228	0.1819	0.1186	0.0084	0.0077	20.8005
Compressor, trailer 450cfm	2	170	0.75	24	100	0.1784	1.8890	1.4836	0.0998	0.0918	240.8317	0.0122	0.0056	2.4064	25.4876	20.0165	1.3469	1.2391	0.1203	1.2744	1.0008	0.0673	0.0620	147.4014
Cat 226B / Bobcat Loader	1	54	0.7	24	100	0.0764	1.0124	1.3299	0.0433	0.0398	214.3929	0.0109	0.0050	0.1529	2.0249	2.6599	0.0865	0.0796	0.0076	0.1012	0.1330	0.0043	0.0040	19.4514
Wheel Loader Cat 950/3.5cy	1	180	0.65	24	100	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.6833	7.9445	3.1348	0.2637	0.2426	0.0342	0.3972	0.1567	0.0132	0.0121	58.9819
Sub-total (Compressor, Loaders)														*3.2426*	*35.4569*	*25.8113*	*1.6971*	*1.5614*	*0.1621*	*1.7728*	*1.2906*	*0.0849*	*0.0781*	*225.8347*
Total	8													6.5550	64.9287	38.8744	3.1130	2.8639	0.3278	3.2464	1.9437	0.1556	0.1432	470.3392

Second Garrote

Emissions Summary for HRA:

		Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Construction Activity	Equipment	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Contact Grouting	Genset, skid 545kW	2.7129	24.6946	9.9492	1.1966	1.1009	0.1356	1.2347	0.4975	0.0598	0.0550	217.1969
Priest Portal Support	Generator, skid 210kW	1.0427	9.4910	3.8238	0.4599	0.4231	0.0521	0.4745	0.1912	0.0230	0.0212	83.4759
In-Tunnel Repairs	Generator, skid 210kW	1.0427	9.4910	3.8238	0.4599	0.4231	0.0521	0.4745	0.1912	0.0230	0.0212	83.4759
In-Tunnel Repairs	Generator, trailer 5.0kW	0.4286	3.4150	2.2261	0.1567	0.1442	0.0214	0.1708	0.1113	0.0078	0.0072	19.5213
In-Tunnel Water Cutoff	Genset, skid 545kW	2.7129	24.6946	9.9492	1.1966	1.1009	0.1356	1.2347	0.4975	0.0598	0.0550	217.1969
In-Tunnel Water Cutoff	Generator, trailer 5.0kW	0.1429	1.1383	0.7420	0.0522	0.0481	0.0071	0.0569	0.0371	0.0026	0.0024	6.5071
	Sub-total (Generators)	8.0826	72.9245	30.5140	3.5220	3.2402	0.4041	3.6462	1.5257	0.1761	0.1620	627.3741
Contact Grouting	Light Plant/Genset, 6kW, 4/1250W	0.4567	3.6388	2.3719	0.1670	0.1537	0.0228	0.1819	0.1186	0.0084	0.0077	20.8005
In-Tunnel Repairs	Light Plant/Genset, 6kW, 4/1250W	0.4567	3.6388	2.3719	0.1670	0.1537	0.0228	0.1819	0.1186	0.0084	0.0077	20.8005
In-Tunnel Water Cutoff	Light Plant/Genset, 6kW, 4/1250W	0.4567	3.6388	2.3719	0.1670	0.1537	0.0228	0.1819	0.1186	0.0084	0.0077	20.8005
	Sub-total (Light Plant/Genset)	1.3700	10.9163	7.1158	0.5010	0.4610	0.0685	0.5458	0.3558	0.0251	0.0230	62.4015
Roadways	301 Mini-Exc 3.8k/.04cy	0.0486	0.3305	0.3689	0.0182	0.0167	0.0001	0.0010	0.0011	0.0001	0.0001	0.1311
Roadways	SK330LC Exc 77.8/2.1cy	0.2060	2.3538	1.3036	0.0718	0.0660	0.0006	0.0071	0.0039	0.0002	0.0002	1.6513
Roadways	Cat 226B / Bobcat Loader	0.0510	0.6750	0.8866	0.0288	0.0265	0.0004	0.0057	0.0075	0.0002	0.0002	1.1022
Roadways	Wheel Loader Cat 950/3.5cy	0.2278	2.6482	1.0449	0.0879	0.0809	0.0025	0.0291	0.0115	0.0010	0.0009	4.3253
Roadways	Grader, Cat 12-H/12' blade	0.3712	3.6236	2.3909	0.2023	0.1861	0.0032	0.0308	0.0203	0.0017	0.0016	2.7210
Roadways	Compactor, BW5AS, 6t/40"	0.2695	1.3201	1.3755	0.0957	0.0881	0.0023	0.0112	0.0117	0.0008	0.0007	1.3209
Roadways	Mechanic's truck, F350	0.2082	1.7640	2.2191	0.0924	0.0851	0.0011	0.0097	0.0122	0.0005	0.0005	1.7384
	Sub-total (Roadway Improvement Equip)	1.3823	12.7151	9.5896	0.5972	0.5494	0.0103	0.0946	0.0683	0.0045	0.0042	12.9904
Contact Grouting	Compressor, trailer 450cfm	0.6016	6.3719	5.0041	0.3367	0.3098	0.0301	0.3186	0.2502	0.0168	0.0155	36.8504
Contact Grouting	Wheel Loader Cat 950/3.5cy	0.1708	1.9861	0.7837	0.0659	0.0607	0.0085	0.0993	0.0392	0.0033	0.0030	14.7455
Contact Grouting	Hydraulic Crane 30ton/94'	0.2529	2.6124	1.6817	0.1404	0.1292	0.0126	0.1306	0.0841	0.0070	0.0065	11.3469
Priest Portal Support	Wheel Loader Cat 950/3.5cy	0.6833	7.9445	3.1348	0.2637	0.2426	0.0342	0.3972	0.1567	0.0132	0.0121	58.9819
Priest Portal Support	Cat 226B / Bobcat Loader	0.1529	2.0249	2.6599	0.0865	0.0796	0.0076	0.1012	0.1330	0.0043	0.0040	19.4514
In-Tunnel Repairs	Compressor, trailer 450cfm	2.4064	25.4876	20.0165	1.3469	1.2391	0.1203	1.2744	1.0008	0.0673	0.0620	147.4014
In-Tunnel Repairs	Cat 226B / Bobcat Loader	0.1529	2.0249	2.6599	0.0865	0.0796	0.0076	0.1012	0.1330	0.0043	0.0040	19.4514
In-Tunnel Repairs	Wheel Loader Cat 950/3.5cy	0.6833	7.9445	3.1348	0.2637	0.2426	0.0342	0.3972	0.1567	0.0132	0.0121	58.9819
In-Tunnel Repairs	Pump, trash 705gpm/106ft head	1.2108	8.2720	8.3904	0.4020	0.3698	0.0605	0.4136	0.4195	0.0201	0.0185	52.1870
In-Tunnel Repairs	Drill Rig	0.2241	2.3990	3.7752	0.1063	0.0978	0.0112	0.1200	0.1888	0.0053	0.0049	30.7913
In-Tunnel Water Cutoff	Compressor, trailer 450cfm	2.4064	25.4876	20.0165	1.3469	1.2391	0.1203	1.2744	1.0008	0.0673	0.0620	147.4014
In-Tunnel Water Cutoff	Cat 226B / Bobcat Loader	0.1529	2.0249	2.6599	0.0865	0.0796	0.0076	0.1012	0.1330	0.0043	0.0040	19.4514
In-Tunnel Water Cutoff	Wheel Loader Cat 950/3.5cy	0.6833	7.9445	3.1348	0.2637	0.2426	0.0342	0.3972	0.1567	0.0132	0.0121	58.9819
	Sub-total (Other Equip)	9.7816	102.5246	77.0525	4.7958	4.4122	0.4891	5.1262	3.8526	0.2398	0.2206	676.0237

Conversion Factors:	
grams per pound:	*454*
pounds per ton:	*2,000*
pounds per metric ton:	*2,205*
Global Warming Potential	
CO2	1
CH4	28
N2O	265

*Per IPCC 5th Assessment Report (AR5)

CH4 and N2O emissions estimated based on EPA emission factors for grams per gallon of diesel. Source: EPA 2018. Emission Factors for Greenhouse Gas Inventories: https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors mar 2018 0.pdf

Notes: Load factor data based on client-provided equipment data. Daily emissions based on emission factors from OFFROAD2017 - ORION, applied to horsepower and use data from client-provided equipment data.

South Fork Siphon and Crossing Improvements

Effective Duration (non-shutdown, months)	12	Sum of durations of all sub-activities
Phase (shutdown, months)	3	Sum of durations of all sub-activities
Actual Total Duration (Months)	14	Per Construction Schedule Tab
Total Years to Distribute Emissions Over	1.166666667	
Work Days per Month		
Non-Shutdown Period:	22	
Shutdown Period	30.5	
Trip Distances (mi)*		* See email communication from David Tsztoo at SF Water to Rodney Jeung (AECOM) on 6 Aug 2018.
Short Worker Trips	10	"Local Workers"
% of Trips	80%	
Long Worker Trips	30	Assumes to edge of air district.
% of Trips	20%	
(Vendor) Material Deliveries Distance	23	
Short Haul Trips Distance	3	Groveland Transfer Facility
Long Haul Trips Distance	20	Cal Sierra Earth Resource Facility (ERF)
Trip Numbers		
Workers (non-shutdown)	15	Table A-2
workers (shutdown)	12	Table A-2
Short Haul (Daily)	28	Table A-7
Short Haul (Total)	4767	Table A-7
Long Haul (Daily)	5	Table A-7
Long Haul (Total)	882	Table A-7
(Vendor) Daily Small Deliveries	4	Table A-8
(Vendor) Total Large Deliveries	226	Table A-8
Unpaved Road Distances (mi)		
Workers		
Haul Trucks		
Vendors		
Excavated /Fill Material (cy)	14200	Tables A-5 and A-6

South Fork Siphon and Crossing Improvements Construction Emissions Summary

months (max) 15 work days 356

	Emissions Summary (lbs/day)					Emissions Summary (tons per phase)						Emissions Summary (maximum annual emissions - tons/year)					
Construction Activity	ROG	NO_x	CO	PM10	PM2.5	ROG	NO_x	CO	PM10	PM2.5	MT CO_2e	ROG	NO_x	CO	PM10	PM2.5	MT CO_2e
On-Road Construction	0.37	8.48	5.27	0.31	0.18	0.04	0.74	0.78	0.04	0.02	258.99	0.03	0.64	0.67	0.03	0.02	221.99
Worker Trips	0.10	0.40	3.92	0.11	0.05	0.02	0.07	0.70	0.02	0.01	141.06	0.01	0.06	0.60	0.02	0.01	120.90
Haul Trips	0.20	5.45	1.11	0.14	0.09	0.01	0.24	0.05	0.01	0.00	45.50	0.01	0.20	0.04	0.01	0.00	39.00
Vendor Trips	0.07	2.62	0.23	0.06	0.04	0.01	0.43	0.04	0.01	0.01	72.43	0.01	0.37	0.03	0.01	0.01	62.08
Fugitive Dust	-	-	-	12.76	6.81	-	-	-	2.20	1.19	-	-	-	-	1.88	1.02	-
Paved Road Dust	-	-	-	0.71	0.17	-	-	-	0.05	0.01	-	-	-	-	0.04	0.01	-
On-Site Construction Vehicles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Truck Loading	-	-	-	0.01	0.00	-	-	-	0.00	0.00	-	-	-	-	0.00	0.00	-
Earthwork	-	-	-	12.04	6.64	-	-	-	2.14	1.18	-	-	-	-	1.84	1.01	-
Construction Equipment Exhaust	17.11	173.64	103.57	7.59	6.98	1.53	16.64	9.96	0.69	0.64	2,558.64	1.3146	14.2595	8.5379	0.5930	0.5455	2,193.1205
TOTAL	17.47	182.12	108.84	20.66	13.97	1.57	17.38	10.75	2.92	1.85	2,817.63	1.35	14.90	9.21	2.51	1.59	2,415.11

South Fork Siphon and Crossing Improvements On-Road Construction Emissions

Worker Trips months (max) 15 work days 356

						Emissions Summary (lbs/day)						Emissions Summary (tons per phase)						
	Max Daily Trips (one-way)	Distance (one-way)	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	ROG	NO_x	CO	PM10	PM2.5	CO2	ROG	NO_x	CO	PM10	PM2.5	CO_2	Total GHG Emissions (MT CO2e)
Worker Trips	39	14	1,092	356	86,184	0.10	0.40	3.92	0.11	0.05	792.45	0.02	0.07	0.70	0.02	0.01	141.06	0.00
Total						**0.10**	**0.40**	**3.92**	**0.11**	**0.05**	**792.45**	**0.02**	**0.07**	**0.70**	**0.02**	**0.01**	**141.06**	**0.00**

Notes: One-way trip distance per email communication with SF Water - assumes 80% are local workers (10 miles) and 20% (30 miles) are long worker trips

Haul Trips months (max) 15 work days 356

						Emissions Summary (lbs/day)						Emissions Summary (tons per phase)						
	Max Daily Trips (one-way)	Distance (one-way)	Average Daily Mileage	Total Trips per Phase	Total Mileage per Phase	ROG	NO_x	CO	PM10	PM2.5	CO2	ROG	NO_x	CO	PM10	PM2.5	CO_2	Total GHG Emissions (MT CO2e)
Spoils Disposal Truck Trips (3cy truck, short-haul)	28	3	168	4,767	14,301	0.08	0.89	0.71	0.05	0.02	278.09	0.00	0.04	0.03	0.00	0.00	11.84	0.01
Spoils Disposal Truck Trips (large-haul)	5	20	200	882	17,640	0.12	4.56	0.41	0.10	0.07	763.41	0.01	0.20	0.02	0.00	0.00	33.67	0.00
Total	**33**		**368**	**5649**	**31,941**	**0.20**	**5.45**	**1.11**	**0.14**	**0.09**	**1,041.51**	**0.01**	**0.24**	**0.05**	**0.01**	**0.00**	**45.50**	**0.01**

Notes: Short disposal truck trip distance based on distance to Groveland Transfer Facility and long haul truck trips based on distance to Cal Sierra Earth Resource Facility

Vendor Trips months (max) 15 work days 356

						Emissions Summary (lbs/day)						Emissions Summary (tons per phase)						
	Max Daily Trips (one-way)	Distance (one-way)	Average Daily Mileage	Total Trips per Phase	Total Mileage per Phase	ROG	NO_x	CO	PM10	PM2.5	CO2	ROG	NO_x	CO	PM10	PM2.5	CO_2	Total GHG Emissions (MT CO2e)
Material Delivery Truck Trips	5	23	115	1,650	37,950	0.07	2.62	0.23	0.06	0.04	438.96	0.01	0.43	0.04	0.01	0.01	72.43	0.01
Total						**0.07**	**2.62**	**0.23**	**0.06**	**0.04**	**438.96**	**0.01**	**0.43**	**0.04**	**0.01**	**0.01**	**72.43**	**0.01**

On-Road Construction Emissions Summary

	Emissions Summary (lbs/day)						Emissions Summary (tons per phase)						
Construction Activitiy	ROG	NO_x	CO	PM10	PM2.5	CO2	ROG	NO_x	CO	PM10	PM2.5	CO_2	Total GHG Emissions (MT CO2e)
Worker Trips	0.10	0.40	3.92	0.11	0.05	792.45	0.02	0.07	0.70	0.02	0.01	141.06	0.00
Haul Trips	0.20	5.45	1.11	0.14	0.09	1,041.51	0.01	0.24	0.05	0.01	0.00	45.50	0.01
Vendor Trips	0.07	2.62	0.23	0.06	0.04	438.96	0.01	0.43	0.04	0.01	0.01	72.43	0.01
Total	**24.00**	**8.48**	**5.27**	**0.31**	**0.18**	**2,272.91**	**0.04**	**0.74**	**0.78**	**0.04**	**0.02**	**258.99**	**0.02**

South Fork Siphon and Crossing Improvements Fugitive Dust Emissions

Paved Road Dust

% Paved Roads: 100%

Vehicle Type	Miles per Day	Miles Per Phase	Emissions Summary (lbs/day) PM10	Emissions Summary (lbs/day) PM2.5	Emissions Summary (tons/phase) PM10	Emissions Summary (tons/phase) PM2.5
Worker	1,092	86,184	0.71	0.1735	0.03	0.01
Haul Trucks	368	31,941	0.24	0.0585	0.01	0.00
Vendor Trucks	115	37,950	0.07	0.0183	0.01	0.00
Total			1.02	0.2503	0.05	0.01

Daily On-Site Construction Motor Vehicle Fugitive Particulate Matter Emissions

Vehicle Type	Miles per Trip	Max Trips per Day (one-way)	Max Trips per Phase (one-way)	Surface Type	Vehicle Weight (tons)	Uncontrolled Emission Factors (lb/mi) PM10	Uncontrolled Emission Factors (lb/mi) PM2.5	Uncontrolled Emissions (lb/day)[a] PM10	Uncontrolled Emissions (lb/day)[a] PM2.5	Uncontrolled Emissions (tons per phase) PM10	Uncontrolled Emissions (tons per phase) PM2.5
Worker	-	39	13884	Unpaved	3	0.75	0.06	0.0	0.0	-	-
Haul Truck - small load, short-haul	-	28	4,767	Unpaved	7	1.15	0.10	0.0	0.0	-	-
Haul Truck - large-haul	-	5	882	Unpaved	13	1.56	0.13	0.0	0.0	-	-
Vendor Truck	-	5	1,650	Unpaved	13	1.56	0.13	0.0	0.0	-	-
Total						**5.02**	**0.42**	**0.0**	**0.0**	**0.0**	-

* Standard Construction Practices - watering
unpaved roads - % reduction in emissions assumed: 0%

[a] Uncontrolled emissions [lb/day] = Emission factor [lb/mi] x Number x Daily miles traveled [mi/vehicle-day]

[b] Per standard construction operations, reduced PM emissions from watering unpaved road twice a day (55%) and limiting maximum speed to 15 mph (57%), from Table XI-A, Mitigation Measure Examples, Fugitive Dust from Construction & Demolition, http://www.aqmd.gov/ceqa/handbook/mitigation/fugitive/MM_fugitive.html
Emissions reductions from watering based upon = Uncontrolled emissions [lb/day] x (1 - emissions reduction factor [%])

*Access to South Fork is via Forest Service Road 1S28B, off of Old Big Oak Flat Road near Cherry Lake Road. It is paved and graveled -gravelled portion is 0.48 miles.

Truck Loading Emissions

months (max): 15 work days: 356

Total Materials Moved (cy)	Total Materials Moved (tons)	Daily Materials Moved (tons/day)	Unmitigated Daily PM_{10} (lbs/day)	Unmitigated Daily $PM_{2.5}$ (lbs/day)	Unmitigated PM_{10} (tons / phase)	Unmitigated $PM_{2.5}$ (tons/phase)
14,200	17,951	50.42	0.0058	0.0009	0.0010	0.0002

Earthwork Emissions

months (max): 15 work days: 356

Number of Earthworking Equipment	Daily Activity Level	Total Activity Level	PM10 Emission Factor (lb/activity)	PM2.5 Emission Factor (lb/activity)	Unmitigated Daily PM_{10} (lbs/day)	Unmitigated Daily $PM_{2.5}$ (lbs/day)	Unmitigated PM_{10} (tons)	Unmitigated $PM_{2.5}$ (tons)
2	8	16.00	0.75	0.41	12.04	6.64	2.14	1.18

* Standard Construction Practices - watering
disturbed areas - % reduction in emissions assumed: 0%

[b] Per standard construction operations, reduced PM emissions from watering disturbed areas (61%), from Table XI-A, Mitigation Measure Examples, Fugitive Dust from Construction & Demolition, http://www.aqmd.gov/ceqa/handbook/mitigation/fugitive/MM_fugitive.html
Emissions reductions from watering based upon = Uncontrolled emissions [lb/day] x (1 - emissions reduction factor [%])

Fugitive Dust Emissions Summary

Construction Activitiy	Emissions Summary - Unmitigated (lbs/day) PM10	Emissions Summary - Unmitigated (lbs/day) PM2.5	Emissions Summary - Unmitigated (tons per phase) PM10	Emissions Summary - Unmitigated (tons per phase) PM2.5
Paved Road Dust	0.71	0.17	0.05	0.01
On-Site Construction Vehicles	-	-	-	-
Truck Loading	0.0058	0.0009	0.0010	0.0002
Earthwork	12.04	6.64	2.14	1.18
Total	**12.76**	**6.81**	**2.20**	**1.19**

South Fork Siphon and Crossing Improvements Construction Equipment Exhaust Emissions

Concurrent Acticities and Emissions:		Maximum Daily Emissions (lb/day) ROG	NOX	CO	PM10	PM2.5
Group A Activities	Roadways	8.51	88.21	59.93	3.50	3.22
Group B Activities	Siphon Extension non-outage	2.66	29.20	18.33	1.24	1.14
Group C Activities	Siphon Extension Outage	7.99	87.59	54.98	3.72	3.42
	Outage Support	3.85	35.57	23.05	1.63	1.50
	In Tunnel Debris Removal	2.18	21.07	9.33	0.89	0.82
	In Tunnel Steel Lining	3.09	29.41	16.20	1.35	1.24
	Group Total	17.11	173.64	103.57	7.59	6.98

Construction Activity:		Total Emissions at South Fork (Tons) ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Group A Activities	Roadways	0.27	3.46	1.96	0.12	0.11	509.95
Group B Activities	Siphon Extension non-outage	0.41	4.50	2.82	0.19	0.18	726.79
Group C Activities	Siphon Extension Outage	0.40	4.38	2.75	0.19	0.17	707.91
	Outage Support	0.19	1.78	1.15	0.08	0.08	248.14
	In Tunnel Debris Removal	0.11	1.05	0.47	0.04	0.04	163.26
	In Tunnel Steel Lining	0.15	1.47	0.81	0.07	0.06	202.59
	Group Total	1.53	16.64	9.96	0.69	0.64	2,558.64

Roadways	Duration: 8 months		Single shift, M-F	Occurs before Siphon Work		Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
301 Mini-Exc 3.8k/.04cy	1	17	0.65	8	132	0.2494	1.6956	1.8927	0.0934	0.0859	247.2024	0.0125	0.0057	0.05	0.33	0.37	0.02	0.02	0.0032	0.0218	0.0243	0.0012	0.0011	2.8848
SK330LC Exc 77.8/2.1cy	1	238	0.65	8	176	0.0755	0.8627	0.4778	0.0263	0.0242	222.3667	0.0113	0.0051	0.21	2.35	1.30	0.07	0.07	0.0181	0.2071	0.1147	0.0063	0.0058	48.4394
Hydraulic Hoe Ram	1	100	0.7	8	132	0.1286	1.3070	1.4492	0.0818	0.0752	214.9372	0.0109	0.0050	0.16	1.61	1.79	0.10	0.09	0.0105	0.1065	0.1181	0.0067	0.0061	15.8895
Cat 226B / Bobcat Loader	1	54	0.7	8	176	0.0764	1.0124	1.3299	0.0433	0.0398	214.3929	0.0109	0.0050	0.05	0.67	0.89	0.03	0.03	0.0045	0.0594	0.0780	0.0025	0.0023	11.4115
Wheel Loader Cat 950/3.5cy	1	180	0.65	8	176	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.23	2.65	1.04	0.09	0.08	0.0200	0.2330	0.0920	0.0077	0.0071	34.6027
Dozer Cat D5/2.9cv	1	90	0.7	8	132	0.1286	1.3070	1.4492	0.0818	0.0752	214.9372	0.0109	0.0050	0.14	1.45	1.61	0.09	0.08	0.0094	0.0958	0.1063	0.0060	0.0055	14.3005
Grader, Cat 12-H/12' blade	1	140	0.6	8	18	0.2506	2.4459	1.6138	0.1365	0.1256	238.1666	0.0121	0.0055	0.37	3.62	2.39	0.20	0.19	0.0033	0.0326	0.0215	0.0018	0.0017	2.8811
Hydraulic Crane 30ton/94'	1	130	0.65	8	18	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039	0.25	2.61	1.68	0.14	0.13	0.0023	0.0235	0.0151	0.0013	0.0012	2.0424
Airtrak, 4"-6"/12' feed-900cfm	1	900	0.8	8	132	0.0899	1.7312	0.5057	0.0406	0.0373	241.5118	0.0122	0.0056	1.14	21.98	6.42	0.51	0.47	0.0753	1.4510	0.4238	0.0340	0.0313	183.6417
HP Conc. pump, traylor 40cy/hr	1	127	0.7	8	9	0.0533	0.9024	1.0779	0.0599	0.0551	170.4003	0.0086	0.0039	0.08	1.41	1.69	0.09	0.09	0.0004	0.0064	0.0076	0.0004	0.0004	1.0908
Shotcrete plant, skid 12cy/hr	1	125	0.75	8	18	0.1275	1.2892	1.3840	0.0825	0.0759	199.1148	0.0101	0.0046	0.21	2.13	2.29	0.14	0.13	0.0019	0.0192	0.0206	0.0012	0.0011	2.6883
Transit mixer, 9cy/60k GVR	1	600	0.5	8	18	0.3355	2.5315	1.9610	0.1006	0.0926	342.3171	0.0186	0.0085	1.77	13.39	10.38	0.53	0.49	0.0160	0.1206	0.0934	0.0048	0.0044	14.7894
Grout Pump-Moyno/Mixer	1	600	0.5	8	9	0.3355	2.5315	1.9610	0.1006	0.0926	342.3171	0.0186	0.0085	1.77	13.39	10.38	0.53	0.49	0.0080	0.0603	0.0467	0.0024	0.0022	7.3947
Sinker drill, 100cfm	1	103	0.65	8	44	0.1277	1.4654	1.8226	0.0746	0.0686	287.7812	0.0146	0.0067	0.15	1.73	2.15	0.09	0.08	0.0033	0.0381	0.0473	0.0019	0.0018	6.7825
Jackleg drill, 100cfm	1	100	0.65	8	44	0.1277	1.4654	1.8226	0.0746	0.0686	287.7812	0.0146	0.0067	0.15	1.68	2.09	0.09	0.08	0.0032	0.0370	0.0460	0.0019	0.0017	6.5850
Compactor, BW5AS, 6t/40"	1	50	0.8	8	44	0.3820	1.8713	1.9498	0.1357	0.1248	242.7832	0.0123	0.0056	0.27	1.32	1.38	0.10	0.09	0.0059	0.0290	0.0303	0.0021	0.0019	3.4187
Compressor, trailer 450cfm	1	170	0.75	8	132	0.1784	1.8890	1.4836	0.0998	0.0918	240.8317	0.0122	0.0056	0.40	4.25	3.34	0.22	0.21	0.0265	0.2804	0.2202	0.0148	0.0136	32.4283
Compressor, trailer 1600cfm	1	500	0.75	8	132	0.0988	1.1946	0.6928	0.0422	0.0388	241.2555	0.0122	0.0056	0.65	7.90	4.58	0.28	0.26	0.0431	0.5215	0.3024	0.0184	0.0169	95.5452
Generator, trailer 10.0kW	1	23	0.65	8	18	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110	0.12	0.97	0.63	0.04	0.04	0.0011	0.0087	0.0057	0.0004	0.0004	0.9978
Light Plant/Genset, 6kW, 4/1000W	1	12	0.85	8	44	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110	0.08	0.66	0.43	0.03	0.03	0.0018	0.0146	0.0095	0.0007	0.0006	1.6640
Mechanic's truck, F350	1	137	0.65	8	88	0.1326	1.1231	1.4129	0.0589	0.0542	221.8222	0.0112	0.0051	0.21	1.76	2.22	0.09	0.09	0.0092	0.0776	0.0976	0.0041	0.0037	13.9075
Man-Lift 55' articulated boom	1	80	0.65	8	88	0.0331	0.3343	0.9644	0.0109	0.0100	179.2830	0.0091	0.0041	0.03	0.31	0.88	0.01	0.01	0.0013	0.0135	0.0389	0.0004	0.0004	6.5637
Total	22													8.51	88.21	59.93	3.50	3.22	0.27	3.46	1.96	0.12	0.11	509.95

Siphon Extension (Non-Outage Period)	Duration: 8 to 14 months for single shift, M-F and one shutdown of 100 days with24/7					Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
SK330LC Exc 77.8/2.1cy	1	238	0.65	8	308	0.0755	0.8627	0.4778	0.0263	0.0242	222.3667	0.0113	0.0051	0.21	2.35	1.30	0.07	0.07	0.0317	0.3625	0.2007	0.0111	0.0102	84.7690
Hydraulic Crane 30ton/94'	1	130	0.65	8	308	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039	0.25	2.61	1.68	0.14	0.13	0.0389	0.4023	0.2590	0.0216	0.0199	34.9484
Compressor, stationary 1200cfm	2	360	0.75	8	308	0.0988	1.1946	0.6928	0.0422	0.0388	241.2555	0.0122	0.0056	0.94	11.38	6.60	0.40	0.37	0.1449	1.7522	1.0162	0.0619	0.0570	321.0319
Pump, trash 705gpm/106ft head	1	26	0.9	8	308	0.4890	3.3405	3.3884	0.1623	0.1493	464.5881	0.0242	0.0111	0.20	1.38	1.40	0.07	0.06	0.0311	0.2123	0.2154	0.0103	0.0095	26.7893
Wheel Loader Cat 950/3.5cy	1	180	0.65	8	308	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.23	2.65	1.04	0.09	0.08	0.0351	0.4078	0.1609	0.0135	0.0125	60.5548
Generator, skid 210kW	1	314	0.65	8	308	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039	0.35	3.16	1.27	0.15	0.14	0.0535	0.4872	0.1963	0.0236	0.0217	85.7019
HP Conc. pump, traylor 40cy/hr	1	127	0.7	8	308	0.0533	0.9024	1.0779	0.0599	0.0551	170.4003	0.0086	0.0039	0.08	1.41	1.69	0.09	0.09	0.0129	0.2179	0.2603	0.0145	0.0133	37.3293
Compressor, trailer 450cfm	1	170	0.75	8	308	0.1784	1.8890	1.4836	0.0998	0.0918	240.8317	0.0122	0.0056	0.40	4.25	3.34	0.22	0.21	0.0618	0.6542	0.5138	0.0346	0.0318	75.6661
Total	9													2.66	29.20	18.33	1.24	1.14	0.41	4.50	2.82	0.19	0.18	726.79

Siphon Extension (Outage Period)	Duration: Outage (100 days) 24/7 for 1 outages					Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
SK330LC Exc 77.8/2.1cy	1	238	0.65	24	100	0.0755	0.8627	0.4778	0.0263	0.0242	222.3667	0.0113	0.0051	0.62	7.06	3.91	0.22	0.20	0.0309	0.3531	0.1955	0.0108	0.0099	82.5672
Hydraulic Crane 30ton/94'	1	130	0.65	24	100	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039	0.76	7.84	5.05	0.42	0.39	0.0379	0.3919	0.2523	0.0211	0.0194	34.0406
Compressor, stationary 1200cfm	2	360	0.75	24	100	0.0988	1.1946	0.6928	0.0422	0.0388	241.2555	0.0122	0.0056	2.82	34.13	19.80	1.21	1.11	0.1412	1.7067	0.9898	0.0603	0.0555	312.6934
Pump, trash 705gpm/106ft head	1	26	0.9	24	100	0.4890	3.3405	3.3884	0.1623	0.1493	464.5881	0.0242	0.0111	0.61	4.14	4.20	0.20	0.18	0.0303	0.2068	0.2098	0.0100	0.0092	26.0935
Wheel Loader Cat 950/3.5cy	1	180	0.65	24	100	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.68	7.94	3.13	0.26	0.24	0.0342	0.3972	0.1567	0.0132	0.0121	58.9819
Generator, skid 210kW	1	314	0.65	24	100	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039	1.04	9.49	3.82	0.46	0.42	0.0521	0.4745	0.1912	0.0230	0.0212	83.4759
HP Conc. pump, traylor 40cy/hr	1	127	0.7	24	100	0.0533	0.9024	1.0779	0.0599	0.0551	170.4003	0.0086	0.0039	0.25	4.24	5.07	0.28	0.26	0.0125	0.2122	0.2535	0.0141	0.0130	36.3597
Compressor, trailer 450cfm	1	170	0.75	24	100	0.1784	1.8890	1.4836	0.0998	0.0918	240.8317	0.0122	0.0056	1.20	12.74	10.01	0.67	0.62	0.0602	0.6372	0.5004	0.0337	0.0310	73.7007
Total	9													7.99	87.59	54.98	3.72	3.42	0.40	4.38	2.75	0.19	0.17	707.91

Priest Portal Support	Duration: Outage (60 days to 100 days)		This equipment will be present for each outage			Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Generator, skid 210kW	1	314	0.65	24	100	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039	1.04	9.49	3.82	0.46	0.42	0.0521	0.4745	0.1912	0.0230	0.0212	83.4759
Wheel Loader Cat 950/3.5cy	1	180	0.65	24	100	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.68	7.94	3.13	0.26	0.24	0.0342	0.3972	0.1567	0.0132	0.0121	58.9819
Hydraulic Crane 30ton/94'	1	130	0.65	24	100	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039	0.76	7.84	5.05	0.42	0.39	0.0379	0.3919	0.2523	0.0211	0.0194	34.0406
Pump, trash 705gpm/106ft head	2	26	0.9	24	100	0.4890	3.3405	3.3884	0.1623	0.1493	464.5881	0.0242	0.0111	1.21	8.27	8.39	0.40	0.37	0.0605	0.4136	0.4195	0.0201	0.0185	52.1870
Cat 226B / Bobcat Loader	1	54	0.7	24	100	0.0764	1.0124	1.3299	0.0433	0.0398	214.3929	0.0109	0.0050	0.15	2.02	2.66	0.09	0.08	0.0076	0.1012	0.1330	0.0043	0.0040	19.4514
Total	6													3.85	35.57	23.05	1.63	1.50	0.1924	1.7785	1.1527	0.0817	0.0751	248.1369

In-Tunnel Debris Removal	Duration: Outage (100 days) 24/7 for 1 outages					Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Generator, skid 210kW	1	314	0.65	24	100	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039	1.04	9.49	3.82	0.46	0.42	0.0521	0.4745	0.1912	0.0230	0.0212	83.4759
Light Plant/Genset, 6kW, 4/1250W	2	11	0.85	24	100	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110	0.46	3.64	2.37	0.17	0.15	0.0228	0.1819	0.1186	0.0084	0.0077	20.8005
Wheel Loader Cat 950/3.5cy	1	180	0.65	24	100	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.68	7.94	3.13	0.26	0.24	0.0342	0.3972	0.1567	0.0132	0.0121	58.9819
Total	4													2.18	21.07	9.33	0.89	0.82	0.11	1.05	0.47	0.04	0.04	163.26

In-Tunnel Steel Lining	Duration: Outage (100 days) 24/7 for 1 outages		Single shift, M-F			Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Hydraulic Crane 30ton/94'	1	130	0.65	24	100	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039	0.76	7.84	5.05	0.42	0.39	0.0379	0.3919	0.2523	0.0211	0.0194	34.0406
Wheel Loader Cat 950/3.5cy	1	180	0.65	24	100	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.68	7.94	3.13	0.26	0.24	0.0342	0.3972	0.1567	0.0132	0.0121	58.9819
Pump, trash 705gpm/106ft head	1	26	0.9	24	100	0.4890	3.3405	3.3884	0.1623	0.1493	464.5881	0.0242	0.0111	0.61	4.14	4.20	0.20	0.18	0.0303	0.2068	0.2098	0.0100	0.0092	26.0935
Generator, skid 210kW	1	314	0.65	24	100	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039	1.04	9.49	3.82	0.46	0.42	0.0521	0.4745	0.1912	0.0230	0.0212	83.4759
Total	4													3.09	29.41	16.20	1.35	1.24	0.15	1.47	0.81	0.07	0.06	202.59

Conversion Factors:	
grams per pound:	*454*
pounds per ton:	*2,000*
pounds per metric ton:	*2,205*
Global Warming Potential	
CO2	1
CH4	28
N2O	265

*Per IPCC 5th Assessment Report (AR5)

CH4 and N2O emissions estiamted based on EPA emission factores for grams per gallon of diesel. Source: EPA 2018. Emission Factors for Greenhouse Gas Inventories: https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

Notes: Load factor data based on client-provided equipment data. Daily emissions based on emission factors from OFFROAD2017 - ORION, applied to horsepower and use data from client-provided equipment data.

Early Intake Adit Improvements

Effective Duration (non-shutdown, months)	6	Sum of durations of all sub-activities
Phase (shutdown, months)	2	Sum of durations of all sub-activities
Actual Total Duration (Months)	4	Per Construction Schedule Tab
Total Years to Distribute Emissions Over	1	
Work Days per Month		
Non-Shutdown Period:	22	
Shutdown Period	30.5	
Trip Distances (mi)*		* See email communication from David Tsztoo at SF Water to Rodney Jeung (AECOM) on 6 Aug 2018.
Short Worker Trips	10	"Local Workers"
% of Trips	80%	
Long Worker Trips	30	Assumes to edge of air district.
% of Trips	20%	
(Vendor) Material Deliveries Distance	23	
Short Haul Trips Distance	3	Groveland Transfer Facility
Long Haul Trips Distance	20	Cal Sierra Earth Resource Facility (ERF)
Trip Numbers		
Workers (non-shutdown)	14	Table A-2
workers (shutdown)	9	Table A-2
Short Haul (Daily)	0	Table A-7
Short Haul (Total)	0	Table A-7
Long Haul (Daily)	1	Table A-7
Long Haul (Total)	7	Table A-7
(Vendor) Daily Small Deliveries	0	Table A-8
(Vendor) Total Large Deliveries	619	Table A-8
Unpaved Road Distances (mi)		
Workers	1	
Haul Trucks	1	
Vendors	1	
Excavated Material (cy)	110	Tables A-5 and A-6

Early Intake Adit Improvements Construction Emissions Summary

months (max) 8 work days 193

Construction Activity	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	Emissions Summary (maximum annual emissions - tons/year) ROG	NO_x	CO	PM10	PM2.5	CO_2
On-Road Construction	0.16	3.34	3.49	0.16	0.08	0.01	0.20	0.33	0.01	0.01	90.18	0.01	0.20	0.33	0.01	0.01	90.18
Worker Trips	0.08	0.33	3.22	0.09	0.04	0.01	0.03	0.31	0.01	0.00	62.75	0.01	0.03	0.31	0.01	0.00	62.75
Haul Trips	0.02	0.91	0.08	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.27
Vendor Trips	0.06	2.10	0.19	0.04	0.03	0.00	0.16	0.01	0.00	0.00	27.17	0.00	0.16	0.01	0.00	0.00	27.17
Fugitive Dust	-	-	-	0.58	0.14	-	-	-	0.02	0.00	-	-	-	-	0.02	0.00	-
Paved Road Dust	-	-	-	0.58	0.14	-	-	-	0.02	0.00	-	-	-	-	0.02	0.00	-
On-Site Construction Vehicles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Truck Loading	-	-	-	0.00	0.00	-	-	-	0.00	0.00	-	-	-	-	0.00	0.00	-
Earthwork	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Construction Equipment Exhaust	10.87	106.20	67.06	4.96	4.57	0.43	4.28	2.77	0.20	0.19	598.99	0.43	4.28	2.77	0.20	0.19	598.99
TOTAL	11.03	109.54	70.55	5.70	4.79	0.44	4.47	3.10	0.23	0.20	689.18	0.44	4.47	3.10	0.23	0.20	689.18

Early Intake Adit Improvements On-Road Construction Emissions

Worker Trips months (max) 8 work days 193

	Max Daily Trips (one-way)	Distance (one-way)	Max Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	Total GHG Emissions (MT CO2e)
Worker Trips	32	14	896	193	41,244	0.08	0.33	3.22	0.09	0.04	650.21	0.01	0.03	0.31	0.01	0.00	62.75	0.00
Total						**0.08**	**0.33**	**3.22**	**0.09**	**0.04**	**650.21**	**0.01**	**0.03**	**0.31**	**0.01**	**0.00**	**62.75**	**0.00**

Notes: One-way trip distance per email communication with SF Water - assumes 80% are local workers (10 miles) and 20% (30 miles) are long worker trips

Haul Trips months (max) 8 work days 193

	Max Daily Trips (one-way)	Distance (one-way)	Max Daily Mileage	Total Trips per Phase	Total Mileage per Phase	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	Total GHG Emissions (MT CO2e)
Spoils Disposal Truck Trips (3cy truck, short-haul)	0	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spoils Disposal Truck Trips (large-haul)	1	20	40	7	140	0.02	0.91	0.08	0.02	0.01	152.68	0.00	0.00	0.00	0.00	0.00	0.27	0.00
Total	**1**		**40**	**7**	**140**	**0.02**	**0.91**	**0.08**	**0.02**	**0.01**	**152.68**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.27**	**0.00**

Notes: Short disposal truck trip distance based on distance to Groveland Transfer Facility and long haul truck trips based on distance to Cal Sierra Earth Resource Facility

Vendor Trips months (max) 8 work days 193

	Max Daily Trips (one-way)	Distance (one-way)	Average Daily Mileage	Total Trips per Phase	Total Mileage per Phase	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	Total GHG Emissions (MT CO2e)
Material Delivery Truck Trips	4	23	92	619	14,237	0.06	2.10	0.19	0.04	0.03	351.17	0.00	0.16	0.01	0.00	0.00	27.17	0.00
Total						**0.06**	**2.10**	**0.19**	**0.04**	**0.03**	**351.17**	**0.00**	**0.16**	**0.01**	**0.00**	**0.00**	**27.17**	**0.00**

On-Road Construction Emissions Summary

Construction Activitiy	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	Total GHG Emissions (MT CO2e)
Worker Trips	0.08	0.33	3.22	0.09	0.04	650.21	0.01	0.03	0.31	0.01	0.00	62.75	0.00
Haul Trips	0.02	0.91	0.08	0.02	0.01	152.68	0.00	0.00	0.00	0.00	0.00	0.27	0.00
Vendor Trips	0.06	2.10	0.19	0.04	0.03	351.17	0.00	0.16	0.01	0.00	0.00	27.17	0.00
Total	**18.00**	**3.34**	**3.49**	**0.16**	**0.08**	**1,154.06**	**0.01**	**0.20**	**0.33**	**0.01**	**0.01**	**90.18**	**0.00**

Early Intake Adit Improvements Fugitive Dust Emissions

Paved Road Dust

% Paved Roads	100%

Vehicle Type	Miles per Day	Miles Per Phase	Emissions Summary (lbs/day) PM10	Emissions Summary (lbs/day) PM2.5	Emissions Summary (tons/phase) PM10	Emissions Summary (tons/phase) PM2.5
Worker	896	41,244	0.58	0.1424	0.0134	0.0033
Haul Trucks	40	140	0.03	0.0064	0.0000	0.0000
Vendor Trucks	92	14,237	0.06	0.0146	0.0046	0.0011
Total			0.67	0.1634	0.02	0.00

Daily On-Site Construction Motor Vehicle Fugitive Particulate Matter Emissions

Vehicle Type	Miles per Trip	Max Trips per Day (one-way)	Max Trips per Phase (one-way)	Surface Type	Vehicle Weight	Uncontrolled Emission Factors (lb/mi)		Uncontrolled Emissions (lb/day)[a]		Uncontrolled Emissions (tons per phase)	Uncontrolled Emissions (tons per phase)
					(tons)	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5
Worker	-	32	2946	Unpaved	3	0.75	0.06	0.0	0.0	-	-
Haul Truck - small load, short-haul	-	0	-	Unpaved	7	1.15	0.10	0.0	0.0	-	-
HaultTruck - large-haul	-	1	7	Unpaved	13	1.56	0.13	0.0	0.0	-	-
Vendor Truck	-	4	619	Unpaved	13	1.56	0.13	0.0	0.0	-	-
Total						**5.02**	**0.42**	**0.0**	**0.0**	**0.0**	-

* Standard Construction Practices - watering unpaved roads - % reduction in emissions assumed: 0%

[a] Uncontrolled emissions [lb/day] = Emission factor [lb/mi] x Number x Daily miles traveled [mi/vehicle-day]

[b] Per standard construction operations, reduced PM emissions from watering unpaved road twice a day (55%) and limiting maximum speed to 15 mph (57%), from Table XI-A, Mitigation Measure Examples, Fugitive Dust from Construction & Demolition, http://www.aqmd.gov/ceqa/handbook/mitigation/fugitive/MM_fugitive.html
Emissions reductions from watering based upon = Uncontrolled emissions [lb/day] x (1 - emissions reduction factor [%])

*Access to Early Intake is via paved road - Cherry Lake Road (Forest Service Road 1N07) off of Highway 120

Truck Loading Emissions

months (max)	work days
8	193

Total Materials Moved (cy)	Total Materials Moved (tons)	Daily Materials Moved (tons/day)	Unmitigated Daily PM_{10} (lbs/day)	Unmitigated Daily $PM_{2.5}$ (lbs/day)	Unmitigated PM_{10} (tons / phase)	Unmitigated $PM_{2.5}$ (tons/phase)
110	139	0.72	0.0001	0.0000	0.0000	0.0000

Earthwork Emissions

months (max)	work days
8	193

Number of Earthworking Equipment	Max Daily Activity Level	Total Activity Level	PM10 Emission Factor (lb/activity)	PM2.5 Emission Factor (lb/activity)	Unmitigated Daily Max: Daily PM_{10} (lbs/day)	Unmitigated Daily Max: Daily $PM_{2.5}$ (lbs/day)	Unmitigated Total for Phase: PM_{10} (tons)	Unmitigated Total for Phase: $PM_{2.5}$ (tons)
-	24	-	0.75	0.41	0.00	0.00	-	-

* Standard Construction Practices - watering disturbed areas - % reduction in emissions assumed: 0%

[b] Per standard construction operations, reduced PM emissions from watering disturbed areas (61%), from Table XI-A, Mitigation Measure Examples, Fugitive Dust from Construction & Demolition, http://www.aqmd.gov/ceqa/handbook/mitigation/fugitive/MM_fugitive.html
Emissions reductions from watering based upon = Uncontrolled emissions [lb/day] x (1 - emissions reduction factor [%])

Fugitive Dust Emissions Summary

Construction Activitiy	Emissions Summary - Unmitigated (lbs/day) PM10	Emissions Summary - Unmitigated (lbs/day) PM2.5	Emissions Summary - Unmitigated (tons per phase) PM10	Emissions Summary - Unmitigated (tons per phase) PM2.5
Paved Road Dust	0.58	0.14	0.02	0.00
On-Site Construction Vehicles	-	-	-	-
Truck Loading	0.0001	0.0000	0.0000	0.0000
Earthwork	-	-	-	-
Total	**0.58**	**0.14**	**0.02**	**0.00**

Early Intake Adit Improvements Construction Equipment Exhaust Emissions

Concurrent Acticities and Emissions:		Maximum Daily Emissions (lb/day) ROG	NOX	CO	PM10	PM2.5
Group A Activities	Early Intake - non-outage	1.61	16.52	11.56	0.81	0.75
Group C Activities	Early Intake - outage	4.84	49.56	34.68	2.44	2.24
	Outage Support	3.85	35.57	23.05	1.63	1.50
	In Tunnel Debris Removal	2.18	21.07	9.33	0.89	0.82
	Group Total	10.87	106.20	67.06	4.96	4.57

Construction Activity:		Total Emissions at Early Intake (Tons) ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Group A Activities	Roadways	0.11	1.09	0.76	0.05	0.05	148.99
Group C Activities	Early Intake - outage	0.15	1.49	1.04	0.07	0.07	203.17
	Outage Support	0.12	1.07	0.69	0.05	0.05	148.88
	In Tunnel Debris Removal	0.07	0.63	0.28	0.03	0.02	97.96
Total		0.43	4.28	2.77	0.20	0.19	598.99

Early Intake (Non-outage period)

Duration: 3 to 6 months for single shift, M-F and one shutdown of 2 months with 24/7

Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	Emissions Factors (g/hp-hr) ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O
HP Conc. pump, traylor 40cy/hr	1	127	0.7	8	132	0.0533	0.9024	1.0779	0.0599	0.0551	170.4003	0.0086	0.0039
Hydraulic Crane 30ton/94'	1	130	0.65	8	132	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039
Pump, trash 705gpm/106ft head	1	26	0.9	8	132	0.4890	3.3405	3.3884	0.1623	0.1493	464.5881	0.0242	0.0111
Wheel Loader Cat 950/3.5cy	1	180	0.65	8	132	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049
Generator, skid 210kW	1	314	0.65	8	132	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039
Compressor, trailer 450cfm	1	170	0.75	8	132	0.1784	1.8890	1.4836	0.0998	0.0918	240.8317	0.0122	0.0056
Cat 226B / Bobcat Loader	1	54	0.7	8	132	0.0764	1.0124	1.3299	0.0433	0.0398	214.3929	0.0109	0.0050
Generator, trailer 5.0kW	1	9	0.65	8	132	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110
Total		**8**											

Equipment Name	Emissions Summary (lb/day) ROG	NOX	CO	PM10	PM2.5	Emissions Summary (tons/year) ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
HP Conc. pump, traylor 40cy/hr	0.08	1.41	1.69	0.09	0.09	0.0055	0.0934	0.1115	0.0062	0.0057	15.9983
Hydraulic Crane 30ton/94'	0.25	2.61	1.68	0.14	0.13	0.0167	0.1724	0.1110	0.0093	0.0085	14.9779
Pump, trash 705gpm/106ft head	0.20	1.38	1.40	0.07	0.06	0.0133	0.0910	0.0923	0.0044	0.0041	11.4811
Wheel Loader Cat 950/3.5cy	0.23	2.65	1.04	0.09	0.08	0.0150	0.1748	0.0690	0.0058	0.0053	25.9520
Generator, skid 210kW	0.35	3.16	1.27	0.15	0.14	0.0229	0.2088	0.0841	0.0101	0.0093	36.7294
Compressor, trailer 450cfm	0.40	4.25	3.34	0.22	0.21	0.0265	0.2804	0.2202	0.0148	0.0136	32.4283
Cat 226B / Bobcat Loader	0.05	0.67	0.89	0.03	0.03	0.0034	0.0445	0.0585	0.0019	0.0018	8.5586
Generator, trailer 5.0kW	0.05	0.38	0.25	0.02	0.02	0.0031	0.0250	0.0163	0.0011	0.0011	2.8631
Total	1.61	16.52	11.56	0.81	0.75	0.11	1.09	0.76	0.05	0.05	148.99

Early Intake (Outage Period)

Duration: 3 to 6 months for single shift, M-F and one shutdown of 2 months with 24/7

Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	Emissions Factors (g/hp-hr) ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O
HP Conc. pump, traylor 40cy/hr	1	127	0.7	24	60	0.0533	0.9024	1.0779	0.0599	0.0551	170.4003	0.0086	0.0039
Hydraulic Crane 30ton/94'	1	130	0.65	24	60	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039
Pump, trash 705gpm/106ft head	1	26	0.9	24	60	0.4890	3.3405	3.3884	0.1623	0.1493	464.5881	0.0242	0.0111
Wheel Loader Cat 950/3.5cy	1	180	0.65	24	60	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049
Generator, skid 210kW	1	314	0.65	24	60	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039
Compressor, trailer 450cfm	1	170	0.75	24	60	0.1784	1.8890	1.4836	0.0998	0.0918	240.8317	0.0122	0.0056
Cat 226B / Bobcat Loader	1	54	0.7	24	60	0.0764	1.0124	1.3299	0.0433	0.0398	214.3929	0.0109	0.0050
Generator, trailer 5.0kW	1	9	0.65	24	60	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110
Total		**8**											

Equipment Name	Emissions Summary (lb/day) ROG	NOX	CO	PM10	PM2.5	Emissions Summary (tons/year) ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
HP Conc. pump, traylor 40cy/hr	0.25	4.24	5.07	0.28	0.26	0.0075	0.1273	0.1521	0.0085	0.0078	21.8158
Hydraulic Crane 30ton/94'	0.76	7.84	5.05	0.42	0.39	0.0228	0.2351	0.1514	0.0126	0.0116	20.4244
Pump, trash 705gpm/106ft head	0.61	4.14	4.20	0.20	0.18	0.0182	0.1241	0.1259	0.0060	0.0055	15.6561
Wheel Loader Cat 950/3.5cy	0.68	7.94	3.13	0.26	0.24	0.0205	0.2383	0.0940	0.0079	0.0073	35.3892
Generator, skid 210kW	1.04	9.49	3.82	0.46	0.42	0.0313	0.2847	0.1147	0.0138	0.0127	50.0856
Compressor, trailer 450cfm	1.20	12.74	10.01	0.67	0.62	0.0361	0.3823	0.3002	0.0202	0.0186	44.2204
Cat 226B / Bobcat Loader	0.15	2.02	2.66	0.09	0.08	0.0046	0.0607	0.0798	0.0026	0.0024	11.6708
Generator, trailer 5.0kW	0.14	1.14	0.74	0.05	0.05	0.0043	0.0342	0.0223	0.0016	0.0014	3.9043
Total	4.84	49.56	34.68	2.44	2.24	0.15	1.49	1.04	0.07	0.07	203.17

Priest Portal Support

Duration: 24/7 for 1 outages - total outage for Early Intake is 2 months. This equipment will be present for each outage

Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	Emissions Factors (g/hp-hr) ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O
Generator, skid 210kW	1	314	0.65	24	60	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039
Wheel Loader Cat 950/3.5cy	1	180	0.65	24	60	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049
Hydraulic Crane 30ton/94'	1	130	0.65	24	60	0.1697	1.7529	1.1284	0.0942	0.0867	167.8390	0.0085	0.0039
Pump, trash 705gpm/106ft head	2	26	0.9	24	60	0.4890	3.3405	3.3884	0.1623	0.1493	464.5881	0.0242	0.0111
Cat 226B / Bobcat Loader	1	54	0.7	24	60	0.0764	1.0124	1.3299	0.0433	0.0398	214.3929	0.0109	0.0050
Total		**6**											

Equipment Name	Emissions Summary (lb/day) ROG	NOX	CO	PM10	PM2.5	Emissions Summary (tons/year) ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Generator, skid 210kW	1.04	9.49	3.82	0.46	0.42	0.0313	0.2847	0.1147	0.0138	0.0127	50.0856
Wheel Loader Cat 950/3.5cy	0.68	7.94	3.13	0.26	0.24	0.0205	0.2383	0.0940	0.0079	0.0073	35.3892
Hydraulic Crane 30ton/94'	0.76	7.84	5.05	0.42	0.39	0.0228	0.2351	0.1514	0.0126	0.0116	20.4244
Pump, trash 705gpm/106ft head	1.21	8.27	8.39	0.40	0.37	0.0363	0.2482	0.2517	0.0121	0.0111	31.3122
Cat 226B / Bobcat Loader	0.15	2.02	2.66	0.09	0.08	0.0046	0.0607	0.0798	0.0026	0.0024	11.6708
Total	3.85	35.57	23.05	1.63	1.50	0.1155	1.0671	0.6916	0.0490	0.0451	148.8821

In-Tunnel Debris Removal

Duration: Outage 24/7 for 1 outages - total outage for Early Intake is 2 months.

Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	Emissions Factors (g/hp-hr) ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O
Generator, skid 210kW	1	314	0.65	24	60	0.0966	0.8789	0.3541	0.0426	0.0392	170.4003	0.0086	0.0039
Light Plant/Genset, 6kW, 4/1250W	2	11	0.85	24	60	0.4616	3.6776	2.3973	0.1688	0.1553	463.4294	0.0241	0.0110
Wheel Loader Cat 950/3.5cy	1	180	0.65	24	60	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049
Total		**4**											

Equipment Name	Emissions Summary (lb/day) ROG	NOX	CO	PM10	PM2.5	Emissions Summary (tons/year) ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Generator, skid 210kW	1.04	9.49	3.82	0.46	0.42	0.0313	0.2847	0.1147	0.0138	0.0127	50.0856
Light Plant/Genset, 6kW, 4/1250W	0.46	3.64	2.37	0.17	0.15	0.0137	0.1092	0.0712	0.0050	0.0046	12.4803
Wheel Loader Cat 950/3.5cy	0.68	7.94	3.13	0.26	0.24	0.0205	0.2383	0.0940	0.0079	0.0073	35.3892
Total	2.18	21.07	9.33	0.89	0.82	0.07	0.63	0.28	0.03	0.02	97.96

Conversion Factors:	
grams per pound:	*454*
pounds per ton:	*2,000*
pounds per metric ton:	*2,205*
Global Warming Potential	
CO2	1
CH4	28
N2O	265

*Per IPCC 5th Assessment Report (AR5)

CH4 and N2O emissions estiamted based on EPA emission factores for grams per gallon of diesel. Source: EPA 2018. Emission Factors for Greenhouse Gas Inventories: https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

Notes: Load factor data based on client-provided equipment data. Daily emissions based on emission factors from OFFROAD2017 - ORION, applied to horsepower and use data from client-provided equipment data.

Rickson Road Improvements

Effective Duration (non-shutdown, months)	1	
Phase (shutdown, months)	0	
Actual Total Duration (Months)	1	
Total Years to Distribute Emissions Over	1	
Work Days per Month		
Non-Shutdown Period:	22	
Shutdown Period	0	
Trip Distances (mi)*		* See email communication from David Tsztoo at SF Water to Rodney Jeung (AECOM) on 6 Aug 2018.
Short Worker Trips	10	"Local Workers"
% of Trips	80%	
Long Worker Trips	30	Assumes to edge of air district.
% of Trips	20%	
(Vendor) Material Deliveries Distance	23	
Short Haul Trips Distance	3	Groveland Transfer Facility
Long Haul Trips Distance	20	Cal Sierra Earth Resource Facility (ERF)
Trip Numbers		
Workers (non-shutdown)	10.00	Table A-2
workers (shutdown)	0	Table A-2
Short Haul (Daily)	0	Table A-7
Short Haul (Total)	0	Table A-7
Long Haul (Daily)		Table A-7
Long Haul (Total)		Table A-7
(Vendor) Daily Small Deliveries	3	Table A-8
(Vendor) Total Large Deliveries	0	Table A-8
Unpaved Road Distances (mi)		
Workers	0	
Haul Trucks	0	
Vendors	0	
Excavated Material (cy)	0	Tables A-5 and A-6

Rickson Road Improvements Construction Emissions Summary

months (max) 1 work days 22

Non-Shutdown Period

Construction Activity	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	MT CO_{2e}	Emissions Summary (maximum annual emissions - tons/year) ROG	NO_x	CO	PM10	PM2.5	MT CO_{2e}
On-Road Construction	0.07	1.68	1.15	0.06	0.04	0.00	0.02	0.01	0.00	0.00	5.13	0.00	0.02	0.01	0.00	0.00	5.13
Worker Trips	0.02	0.10	1.01	0.03	0.01	0.00	0.00	0.01	0.00	0.00	2.24	0.00	0.00	0.01	0.00	0.00	2.24
Haul Trips	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vendor Trips	0.04	1.57	0.14	0.03	0.02	0.00	0.02	0.00	0.00	0.00	2.90	0.00	0.02	0.00	0.00	0.00	2.90
Fugitive Dust	-	-	-	0.18	0.04	-	-	-	0.00	0.00	-	-	-	-	0.00	0.00	-
Paved Road Dust	-	-	-	0.18	0.04	-	-	-	0.00	0.00	-	-	-	-	0.00	0.00	-
On-Site Construction Vehicles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Truck Loading	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Earthwork	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Construction Equipment	4.15	36.11	22.23	1.43	1.32	0.05	0.40	0.24	0.02	0.01	57.15	0.0456	0.3972	0.2445	0.0157	0.0145	57.1545
TOTAL	4.22	37.79	23.37	1.67	1.40	0.05	0.42	0.26	0.02	0.02	62.29	0.05	0.42	0.26	0.02	0.02	62.29

Rickson Road Improvements On-Road Construction Emissions

Worker Trips months (max) 1 work days 22

	Max Daily Trips (one-way)	Distance (one-way)	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	Total GHG Emissions (MT CO2e)
Worker Trips	10	14	280	22	3,080	0.02	0.10	1.01	0.03	0.01	203.19	0.00	0.00	0.01	0.00	0.00	2.24	0.00
Total						**0.02**	**0.10**	**1.01**	**0.03**	**0.01**	**203.19**	**0.00**	**0.00**	**0.01**	**0.00**	**0.00**	**2.24**	**0.00**

Notes: One-way trip distance per email communication with SF Water - assumes 80% are local workers (10 miles) and 20% (30 miles) are long worker trips

Haul Trips months (max) 1 work days 22

	Max Daily Trips (one-way)	Distance (one-way)	Average Daily Mileage	Total Trips per Phase	Total Mileage per Phase	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	Total GHG Emissions (MT CO2e)
Haul Truck Trips (3cy truck, short-haul)	0	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Haul Truck Trips (large-haul)	0	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**0**		-	**0**	-	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Notes: Short disposal truck trip distance based on distance to Groveland Transfer Facility and long haul truck trips based on distance to Cal Sierra Earth Resource Facility

Vendor Trips months (max) 1 work days 22

	Max Daily Trips (one-way)	Distance (one-way)	Average Daily Mileage	Total Trips per Phase	Total Mileage per Phase	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	Total GHG Emissions (MT CO2e)
Material Delivery Truck Trips	3	23	69	66	1,518	0.04	1.57	0.14	0.03	0.02	263.38	0.00	0.02	0.00	0.00	0.00	2.90	0.00
Total						**0.04**	**1.57**	**0.14**	**0.03**	**0.02**	**263.38**	**0.00**	**0.02**	**0.00**	**0.00**	**0.00**	**2.90**	**0.00**

On-Road Construction Emissions Summary

Construction Activity	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	Total GHG Emissions (MT CO2e)
Worker Trips	0.02	0.10	1.01	0.03	0.01	203.19	0.00	0.00	0.01	0.00	0.00	2.24	0.00
Haul Trips	-	-	-	-	-	-	-	-	-	-	-	-	-
Vendor Trips	0.04	1.57	0.14	0.03	0.02	263.38	0.00	0.02	0.00	0.00	0.00	2.90	0.00
Total	**0.07**	**1.68**	**1.15**	**0.06**	**0.04**	**466.57**	**0.00**	**0.02**	**0.01**	**0.00**	**0.00**	**5.13**	**0.00**

Rickson Road Improvements Fugitive Dust Emissions

Paved Road Dust % Paved Roads 100%

Vehicle Type	Miles per Day	Miles Per Phase	Emissions Summary (lbs/day) PM10	PM2.5	Emissions Summary (tons/phase) PM10	Emissions Summary (tons/phase) PM2.5
Worker	280	3,080	0.18	0.0445	0.00	0.00
Haul Trucks	-	-	-	-	-	-
Vendor Trucks	69	1,518	0.04	0.0110	0.00	0.00
Total			0.23	0.0555	0.00	0.00

Daily On-Site Construction Motor Vehicle Fugitive Particulate Matter Emissions

Vehicle Type	Miles per Trip	Max Trips per Day (one-way)	Max Trips per Phase (one-way)	Surface Type	Vehicle Weight (tons)	Uncontrolled Emission Factors (lb/mi) PM10	PM2.5	Uncontrolled Emissions (lb/day)[a] PM10	PM2.5	Uncontrolled Emissions (tons per phase) PM10	Uncontrolled Emissions (tons per phase) PM2.5
Worker	-	10	220	Unpaved	3	0.75	0.06	0.0	0.0	-	-
Haul Truck - small load, short-haul	-	0	-	Unpaved	7	1.15	0.10	0.0	0.0	-	-
Haul Truck - large-haul	-	0	-	Unpaved	13	1.56	0.13	0.0	0.0	-	-
Vendor Truck	-	3	66	Unpaved	13	1.56	0.13	0.0	0.0	-	-
Total						**5.02**	**0.42**	**0.0**	**0.0**	**0.0**	-

* Standard Construction Practices - watering unpaved roads - % reduction in emissions assumed: 0%

[a] Uncontrolled emissions [lb/day] = Emission factor [lb/mi] x Number x Daily miles traveled [mi/vehicle-day]

[b] Per standard construction operations, reduced PM emissions from watering unpaved road twice a day (55%) and limiting maximum speed to 15 mph (57%), from Table XI-A, Mitigation Measure Examples, Fugitive Dust from Construction & Demolition, http://www.aqmd.gov/ceqa/handbook/mitigation/fugitive/MM_fugitive.html
Emissions reductions from watering based upon = Uncontrolled emissions [lb/day] x (1 - emissions reduction factor [%])

* Access Via Rickson Road (WILL BE PAVED - no unpaved road dust)

Truck Loading Emissions months (max) 1 work days 22

Total Materials Moved (cy)	Total Materials Moved (tons)	Daily Materials Moved (tons/day)	Unmitigated Daily PM_{10} (lbs/day)	Unmitigated Daily $PM_{2.5}$ (lbs/day)	Unmitigated PM_{10} (tons / phase)	Unmitigated $PM_{2.5}$ (tons/phase)
-	-	-	0.0000	0.0000	0.0000	0.0000

* Standard Construction Practices - watering - % reduction in emissions assumed: -

Earthwork Emissions months (max) 1 work days 22

Number of Earth working Equipment	Daily Activity Level	Total Activity Level	PM10 Emission Factor (lb/activity)	PM2.5 Emission Factor (lb/activity)	Unmitigated Daily PM_{10} (lbs/day)	Unmitigated Daily $PM_{2.5}$ (lbs/day)	Unmitigated PM_{10} (tons)	Unmitigated $PM_{2.5}$ (tons)
-	8	-	0.75	0.41	0.00	0.00	-	-

* Standard Construction Practices - watering disturbed areas - % reduction in emissions assumed: 0%

[b] Per standard construction operations, reduced PM emissions from watering disturbed areas (61%), from Table XI-A, Mitigation Measure Examples, Fugitive Dust from Construction & Demolition, http://www.aqmd.gov/ceqa/handbook/mitigation/fugitive/MM_fugitive.html
Emissions reductions from watering based upon = Uncontrolled emissions [lb/day] x (1 - emissions reduction factor [%])

Fugitive Dust Emissions Summary

Construction Activity	Emissions Summary - Unmitigated (lbs/day) PM10	PM2.5	Emissions Summary - Unmitigated (tons per phase) PM10	PM2.5
Paved Road Dust	0.18	0.04	0.00	0.00
On-Site Construction Vehicles	-	-	-	-
Truck Loading	0.0000	0.0000	0.0000	0.0000
Earthwork	-	-	-	-
Total	**0.18**	**0.04**	**0.00**	**0.00**

Rickson Road Improvements Construction Equipment Exhaust Emissions

Concurrent Activities and Emissions:	Maximum Daily Emissions (lb/day) ROG	NOX	CO	PM10	PM2.5
Rickson Road Paving	4.15	36.11	22.23	1.43	1.32

Construction Activity:	Total Emissions at Priest Portal (Tons) ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Rickson Road Paving	0.05	0.40	0.24	0.02	0.01	57.15

Rickson Road Paving — Duration: 1 months — Single shift, M-F

Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	Emissions Factors (g/hp-hr) ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	Emissions Summary (lb/day) ROG	NOX	CO	PM10	PM2.5	Emissions Summary (tons/year) ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Asphalt Milling Machine	1	500	0.75	8	22	0.0827	0.9873	0.5129	0.0323	0.0297	240.9329	0.0122	0.0056	0.55	6.53	3.39	0.21	0.20	0.0060	0.0718	0.0373	0.0023	0.0022	15.9029
Dump truck 7.5cy, hwy	3	210	0.35	8	22	0.1155	1.0543	0.5849	0.0411	0.0378	221.1465	0.0112	0.0051	0.45	4.10	2.27	0.16	0.15	0.0049	0.0451	0.0250	0.0018	0.0016	8.5830
Asphalt Paver	1	238	0.65	8	22	0.4137	3.1682	1.7060	0.1223	0.1125	414.3128	0.0237	0.0108	1.13	8.64	4.65	0.33	0.31	0.0124	0.0951	0.0512	0.0037	0.0034	11.2816
Street Sweeper (Auxilliary Engine)	1	175	0.85	8	22	0.2313	2.3091	1.6832	0.1188	0.1093	265.1841	0.0134	0.0061	0.61	6.06	4.42	0.31	0.29	0.0067	0.0666	0.0486	0.0034	0.0032	6.9431
Roller	2	180	0.65	8	22	0.3431	2.6113	1.8143	0.0999	0.0919	350.6849	0.0183	0.0083	1.42	10.78	7.49	0.41	0.38	0.0156	0.1185	0.0824	0.0045	0.0042	14.4438
Total	8													4.15	36.11	22.23	1.43	1.32	0.0456	0.3972	0.2445	0.0157	0.0145	57.1545

Conversion Factors:	
grams per pound:	*454*
pounds per ton:	*2,000*
pounds per metric ton:	*2.205*
Global Warming Potential	
CO2	1
CH4	28
N2O	265

*Per IPCC 5th Assessment Report (AR5)

CH4 and N2O emissions estimated based on EPA emission factors for grams per gallon of diesel. Source: EPA 2018. Emission Factors for Greenhouse Gas Inventories: https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

Notes: Load factor data based on client-provided equipment data. Daily emissions based on emission factors from OFFROAD2017 - ORION, applied to horsepower and use data from client-provided equipment data.

Tree Removal On-Road Construction Emissions 1

	Emissions Summary (lbs/day)					Emissions Summary (tons per phase)						Emissions Summary (maximum annual emissions - tons/year)					
Construction Activity	ROG	NO_x	CO	PM10	PM2.5	ROG	NO_x	CO	PM10	PM2.5	CO2e (MT/yr)	ROG	NO_x	CO	PM10	PM2.5	CO2e (MT/yr)
On-Road Construction	2.28	48.26	15.80	1.52	0.91	0.01	0.24	0.08	0.01	0.00	48.47	0.01	0.24	0.08	0.01	0.00	48.47
Tree Removal Truck Trips	2.28	48.26	15.80	1.52	0.91	0.01	0.24	0.08	0.01	0.00	48.47	0.01	0.24	0.08	0.01	0.00	48.47
Fugitive Dust	-	-	-	294.79	24.71	-	-	-	1.46	0.12	-	-	-	-	1.46	0.12	-
Paved Road Dust	-	-	-	0.91	0.22	-	-	-	0.00	0.00	-	-	-	-	0.00	0.00	-
Unpaved Road Dust	-	-	-	293.88	24.49	-	-	-	1.46	0.12	-	-	-	-	1.46	0.12	-
Construction Equipment Exhaust	2.96	22.32	24.24	1.11	1.02	0.04	0.33	0.36	0.02	0.02	48.80	0.04	0.33	0.36	0.02	0.02	48.80
TOTAL	5.24	70.57	40.04	297.41	26.65	0.06	0.57	0.44	1.48	0.14	97.28	0.06	0.57	0.44	1.48	0.14	97.28

						Emissions Summary (lbs/day)					Emissions Summary (tons per phase)								
	Max Daily Trips (one-way)	Distance (one-way)	Average Daily Mileage (total for both ways - one way empty and one way hauling)	Total Trips per Phase (one-way)	Total Mileage per Phase (total for both ways - one way empty and one way hauling)	ROG	NO_x	CO	PM10	PM2.5	ROG	NO_x	CO	PM10	PM2.5	CO_2	CH4	N2O	Total GHG Emissions (MT CO2e)
Tree Removal Truck Trips (small-haul - 3 cy)	44	35	3,080	440	30,800	1.41	16.31	12.96	0.84	0.44	0.01	0.08	0.06	0.00	0.00	25.49	0.0006	0.0029	23.85
Tree Removal Truck Trips (large-haul - 8 cy)	20	35	1,400	195	13,650	0.87	31.94	2.84	0.68	0.47	0.00	0.16	0.01	0.00	0.00	26.05	0.0002	0.0041	24.62
Total	**64**		**4,480**	**635**	**44,450**	**2.28**	**48.26**	**15.80**	**1.52**	**0.91**	**0.01**	**0.24**	**0.08**	**0.01**	**0.00**	**51.54**	**0.0008**	**0.0070**	**48.47**

Notes: Assumes haul to Cal Sierra Earth Resource Facility (30 miles one-way distance)

* Minimum duration of hauling phase of tree removal (days): 10

* If chipping is used, truck hauling would be less (likely 8 trips), but used estimate for log hauling for conservative max daily estimate.

* Haul distance based on use of Tuolumne County Wood Sort Yard, the biomass plant in Chinese Camp, or the biomass plant in Sonora. Used the maximum travel distance to estimate maximum potential emissions.

Tree Removal Mobile Fugitive Dust Emissions

Paved Road Dust   % Paved Roads 100%

			Emissions Summary (lbs/day)		Emissions Summary (tons/phase)	Emissions Summary (tons/phase)
Vehicle Type	Miles per Day	Miles Per Phase	PM10	PM2.5	PM10	PM2.5
Haul Trucks	1,400	13,650	0.91	0.2225	0.00	0.00
Total			0.91	0.2225	0.00	0.00

Unpaved Road Dust - Daily On-Site Construction Motor Vehicle Fugitive Particulate Matter Emissions

Vehicle Type	Miles per Trip	Max Trips per Day (one-way)	Max Trips per Phase (one-way)	Surface Type	Vehicle Weight	Uncontrolled Emission Factors (lb/mi)		Uncontrolled Emissions (lb/day)[a]		Uncontrolled Emissions (tons per phase)	Uncontrolled Emissions (tons per phase)
					(tons)	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5
Haul Truck - small haul (3 cy)	1.8	44	440	Unpaved	7	1.15	0.10	181.5	15.1	0.9	0.1
Haul Truck - large-haul (8 cy)	1.8	20	195	Unpaved	13	1.56	0.13	112.4	9.4	0.5	0.0
Total						**2.71**	**0.23**	**293.9**	**24.5**	**1.5**	0.1

* Standard Construction Practices - watering unpaved roads - % reduction in emissions assumed: 0%

[a] Uncontrolled emissions [lb/day] = Emission factor [lb/mi] x Number x Daily miles traveled [mi/vehicle-day]

[b] Per standard construction operations, reduced PM emissions from watering unpaved road twice a day (55%) and limiting maximum speed to 15 mph (57%), from Table XI-A, Mitigation Measure Examples, Fugitive Dust from Construction & Demolition, http://www.aqmd.gov/ceqa/handbook/mitigation/fugitive/MM_fugitive.html Emissions reductions from watering based upon = Uncontrolled emissions [lb/day] x (1 - emissions reduction factor [%])

* If chipping is used, truck hauling would be less (likely 8 trips), but used estimate for log hauling for conservative max daily estimate.

Tree Removal Equipment						Emissions Factors (g/hp-hr)								Emissions Summary (lb/day)					Emissions Summary (tons/year)					
Equipment Name	Quantity	HP	HPF	Hours/Day	Days Used	ROG	NOX	CO	PM10	PM2.5	CO2	CH4	N2O	ROG	NOX	CO	PM10	PM2.5	ROG	NOX	CO	PM10	PM2.5	CO2e (MT/yr)
Dozer Cat D5/2.9cy	1	100	0.7	8	30	0.1286	1.3070	1.4492	0.0818	0.0752	214.9372	0.0109	0.0050	0.16	1.61	1.79	0.10	0.09	0.0024	0.0242	0.0268	0.0015	0.0014	3.6112
301 Mini-Exc 3.8k/.04cy	1	314	0.65	8	30	0.2494	1.6956	1.8927	0.0934	0.0859	247.2024	0.0125	0.0057	0.90	6.10	6.81	0.34	0.31	0.0135	0.0916	0.1022	0.0050	0.0046	12.1100
Logging skidder (small)	1	100	0.85	8	30	0.2094	1.7876	2.9980	0.0631	0.0581	463.6883	0.0241	0.0110	0.31	2.68	4.49	0.09	0.09	0.0047	0.0402	0.0674	0.0014	0.0013	9.4601
Medium-Large Heel-boom loader wit	1	100	0.7	8	30	0.1286	1.3070	1.4492	0.0818	0.0752	214.9372	0.0109	0.0050	0.16	1.61	1.79	0.10	0.09	0.0024	0.0242	0.0268	0.0015	0.0014	3.6112
Wheel Loader Cat 950/3.5cy	1	180	0.65	8	30	0.1104	1.2833	0.5064	0.0426	0.0392	210.0320	0.0106	0.0049	0.23	2.65	1.04	0.09	0.08	0.0034	0.0397	0.0157	0.0013	0.0012	5.8982
Saw	1	180	0.65	8	30	0.5834	3.7112	4.0260	0.1875	0.1725	502.5753	0.0238	0.0108	1.20	7.66	8.31	0.39	0.36	0.0181	0.1149	0.1246	0.0058	0.0053	14.1134
Total	**6**													2.96	22.32	24.24	1.11	1.02	0.04	0.33	0.36	0.02	0.02	48.80

*Equipment includes that potentially used for tree removal, loading into trucks, and chipping.

Conversion Factors:	
grams per pound:	*454*
pounds per ton:	*2,000*
pounds per metric ton:	*2,205*
Global Warming Potential	
CO2	1
CH4	28
N2O	265

*Per IPCC 5th Assessment Report (AR5)

CH4 and N2O emissions estimated based on EPA emission factors for grams per gallon of diesel. Source: EPA 2018. Emission Factors for Greenhouse Gas Inventories: https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

Notes: Load factor data based on client-provided equipment data. Daily emissions based on emission factors from OFFROAD2017 - ORION, applied to horsepower and use data from client-provided equipment data.

Title: Mountain Tunnel Staging Site and Roadway Improvement Trees Summary

GREEN indicates staging areas/roadway where trees and vegetation can be removed.

	REQUIRED to be Removed for Project Improvements		POTENTIALLY Removed Due to Contractor's use of Staging Area		
Staging Site	Oak Trees	Other Trees	Oak Trees	Other Trees	Total
PP-S5	0	0	0	0	0
PP-S9	0	0	1	0	1
PP-S13	0	0	0	0	0
PP-S15 (FCF)	11	4	0	0	15
PP-S6 (PRIEST ADIT & SPOILS AREA)	194	0	72	5	271
A89-S1	0	0	0	0	0
A89-S4	1	0	0	0	1
A56-S1	0	0	0	0	0
A56-S2	0	0	0	0	0
SF-S6	0	0	0	0	0
EI-S3	0	0	0	5	5
			Total Staging Site Improvements including FCF Pad, Priest Portal and Spoils Site		293
Access Road					
ADIT 5/6 ROAD	13	112	0	0	125
ADIT 8/9 ROAD	14	18	0	0	32
RICKSON ROAD	58	44	0	0	102
SOUTH FORK ROAD	12	45	0	0	57
				Total Roadway Improvements	316
				Grand Total	609

Total Truck Trips	Total Trees	Total 8-CY Truck Trips	Total 3-CY Truck Trips
Priest Site (Including Rickson Road)	389	195	
All other sites	220		440

Blasting Emissions

Table from Project Engineers - Anticipated Blasting Activities (light green indicate calculations outside of provided data)

Location	Depth	Total Quantity of Explosive (lbs) (Contingency)	Number of Blasts (Min)	Number of Blasts (Max)	Number of Rounds (Contingency)
FCF Pad	0 to 30 ft	93132	20	30	N/A
		1758			N/A
Priest Portal	0 to 47 ft	189756	25	50	N/A
		2286.25			N/A
Rickson Road	0 to 10 feet	1706.25	50	70	N/A
		97.5			N/A
Adit 5/6	0 to 10 feet	1837.5	50	75	N/A
		105			N/A
Adit 8/9	0 to 10 feet	1312.5	30	50	N/A
		75			N/A
South Fork Road	0 to 10 feet	288.75	20	25	N/A
		16.5			N/A
FCF Shaft	0 to 160 ft	15314.55			32
		3146.25			32
FCF Bypass Tunnels	160 ft	16762.35			25
		3298.68			25
Priest Adit	0 to 220	53188.35			100
		11866.32			100
Priest Bulkhead	220 ft	6616.05			5
		720.72			5
Priest Rock Trap	220 ft	960.3			7
		216			7
South Fork Shaft	0 to 105 ft	4575			100
		1683			100
South Fork Siphon Extension	105 ft	32688			185
		7413.12			185
Early Intake	25 feet	340.5			1
		77.22			1
		127.5			1

Daily Emissions (blasts per day vary by project activity, see "Assumed Blasts per Day" and "Assumed Days of Blasting" columns for details.

Location	Assumed Blasts per Day	Assumed Days of Blasting	NOx (from explosives; lb)	CO (from explosives; lb)	PM10 (from rock; lb)	PM2.5 (from rock; lb)	SOx (from explosives; lb)
FCF Pad	2	15	53.77	211.92	0.01	0.01	6.33
Priest Portal	2	25	65.294365	257.336615	0.014	0.014	7.68169
Rickson Road	10	7	2.190267857	8.632232143	0.07	0.07	0.257678571
Adit 5/6	10	8	2.06390625	8.13421875	0.065625	0.065625	0.2428125
Adit 8/9	10	5	2.35875	9.29625	0.07	0.07	0.2775
South Fork Road	10	3	0.864875	3.408625	0.058333333	0.058333333	0.10175
FCF Shaft	4	8	16.27170938	64.12967813	0.02835	0.02835	1.91431875
	4	8	3.342890625	13.17492188	0.02835	0.02835	0.39328125
FCF Bypass Tunnels	10	3	47.493325	187.179575	0.058333333	0.058333333	5.58745
	10	3	9.34626	36.83526	0.058333333	0.058333333	1.09956
Priest Adit	5	20	22.60504875	89.09048625	0.035	0.035	2.6594175
	5	20	5.043186	19.876086	0.035	0.035	0.593316
Priest Bulkhead	5	1	56.236425	221.637675	0.035	0.035	6.61605
	5	1	6.12612	24.14412	0.035	0.035	0.72072
Priest Rock Trap	7	1	8.16255	32.17005	0.0504	0.0504	0.9603
	7	1	1.836	7.236	0.0504	0.0504	0.216
South Fork Shaft	5	20	1.944375	7.663125	0.035	0.035	0.22875
	5	20	0.715275	2.819025	0.035	0.035	0.08415
South Fork Siphon Extension	5	37	7.509405405	29.59589189	0.035	0.035	0.883459459
	5	37	1.703014054	6.711878919	0.035	0.035	0.200354595
Early Intake	1	1	2.89425	11.40675	0.0084	0.0084	0.3405
	1	1	0.65637	2.58687	0.0084	0.0084	0.07722
	1	1	1.08375	4.27125	0.0084	0.0084	0.1275

Total Emissions (tons per phase)

Location	NOx (from explosives; tons)	CO (from explosives; tons)	PM10 (from rock; tons)	PM2.5 (from rock; tons)	SOx (from explosives; tons)	MT CO2 (methodology 1)	MT CO2 (methodology 2)
FCF Pad	0.4033	1.5894	0.0001	0.0001	0.0474	7.9523	7.1899
	-	-	-	-	-		
Priest Portal	0.81618	3.216708	0.000175	0.000175	0.096021125	16.094229	14.55129571
	0	0	0	0	0		
Rickson Road	0.007666	0.030213	0.000245	0.000245	0.000901875	0.1511645	0.136672527
	0	0	0	0	0		
Adit 5/6	0.008256	0.032537	0.0002625	0.0002625	0.00097125	0.1627925	0.147185799
	0	0	0	0	0		
Adit 8/9	0.005897	0.023241	0.000175	0.000175	0.00069375	0.1162804	0.105132713
	0	0	0	0	0		
South Fork Road	0.001297	0.005113	0.0000875	0.0000875	0.000152625	0.0255817	0.023129197
	0	0	0	0	0		
FCF Shaft	0.065087	0.256519	0.0001134	0.0001134	0.007657275	1.2834461	1.160403743
	0.013372	0.0527	0.0001134	0.0001134	0.001573125	0.2636736	0.238395531
FCF Bypass Tunnels	0.07124	0.280769	0.0000875	0.0000875	0.008381175	1.4047799	1.270105467
	0.014019	0.055253	0.0000875	0.0000875	0.00164934	0.2764481	0.249945354
Priest Adit	0.22605	0.890905	0.00035	0.00035	0.026594175	4.4574852	4.030151747
	0.050432	0.198761	0.00035	0.00035	0.00593316	0.9944649	0.899126788
Priest Bulkhead	0.028118	0.110819	0.0000175	0.0000175	0.003308025	0.5544625	0.501306874
	0.003063	0.012072	0.0000175	0.0000175	0.00036036	0.0604004	0.054609909
Priest Rock Trap	0.004081	0.016085	0.0000252	0.0000252	0.00048015	0.0804786	0.072763203
	0.000918	0.003618	0.0000252	0.0000252	0.000108	0.018102	0.016366606
South Fork Shaft	0.019444	0.076631	0.00035	0.00035	0.0022875	0.3834109	0.346653811
	0.007153	0.02819	0.00035	0.00035	0.0008415	0.1410449	0.12752314
South Fork Siphon Extension	0.138924	0.547524	0.0006475	0.0006475	0.016344	2.7394397	2.476813067
	0.031506	0.12417	0.0006475	0.0006475	0.00370656	0.6212615	0.561701924
Early Intake	0.001447	0.005703	0.0000042	0.0000042	0.00017025	0.0285358	0.025800136
	0.000328	0.001293	0.0000042	0.0000042	0.00003861	0.0064715	0.005851062
	0.000542	0.002136	0.0000042	0.0000042	0.00006375	0.0106852	0.009660844

Rock material:

Assumed pounds/cubic yard:*	999
Pounds per ton	2000

*Source: EPA 2016. Volume to Weight Conversion Factors. https://www.epa.gov/sites/production/files/2016-04/documents/volume_to_weight_conversion_factors_memorandum_04192016_508fnl.pdf

1. AP-42, Section 11.9, Table 11.9-1.
   $PM_{10} = 0.52 \times 0.000014 \times (A)^{1.5}$, where A is the horizontal area blasted.
   $PM_{2.5} = 0.03 \times 0.000014 \times (A)^{1.5}$, where A is the horizontal area blasted.
2. AP-42, Section 13.3, Table 13.3-1 for ANFO.

Pollutant	Emission Factor
ROG	-
NOX	17
CO	67
SOX	2
PM10	

San Diego County Drilling and Blasting Operations Blast Area PM Emissions:

Blast Area	Typical Dimensions	Blasted Material	lbs TSP/Blast	lbs PM10/Blast
100 ft2	20' x 5' x 50'd	370 tons	0.014 lbs	0.007 lbs
1,000 ft2	50' x 20' x 50'd	3,700 tons	0.44 lbs	0.23 lbs
10,000 ft2	200' x 50' x 50'd	37,000 tons	14 lbs	7.3 lbs
100,000 ft2	1,000' x 100' x 50'd	370,000 tons	442.7 lbs	230.2 lbs

EP42 Explosives Emissions - Table 13.3.1.

2/80 (Reformatted 1/95) Miscellaneous Sources

Table 13.3-1 (cont.).

Explosive	Composition	Uses	Carbon Monoxide[a] kg/Mg	Carbon Monoxide[a] lb/ton	Nitrogen Oxides[a] kg/Mg	Nitrogen Oxides[a] lb/ton	Methane[b] kg/Mg	Methane[b] lb/ton	Other: Pollutant	Other: kg/Mg	Other: lb/ton
ANFO[4,5]	Ammonium nitrate with 5.8-8% fuel oil	Construction work, blasting in mines	34	67	8	17	ND	ND	SO_2	1 (0-2)	2 (1-3)
TNT[2]	Trinitrotoluene	Main charge in artillery projectiles, mortar rounds, etc.	398 (324-472)	796 (647-944)	ND	ND	7.2 (6.6-7.7)	14.3 (13.2-15.4)	NH_3 HCN C_2H_2 C_2H_6	14 (14-15) 13 (11-16) 61 0.5	29 (27-30) 27 (22-32) 121 1.1
RDX[3]	$(CH_2)_3N_3(NO_2)_3$ Cyclotrimethylenetrinitroamine	Booster	98[d] (2.8-277)	196[d] (5.6-554)	ND	ND	ND	ND	NH_3	22[d] (12-61)	44[d] (24-122)
PETN[2]	$C(CH_2ONO_2)_4$ Pentaerythritol tetranitrate	Booster	149 (138-160)	297 (276-319)	ND	ND	ND	ND	NH_3	1.3 (0-25)	2.5 (0-5)

[a] Based on experiments carried out prior to 1930 except in the case of ANFO, TNT, and PETN. ND = no data.
[b] The factors apply to the chemical species, methane. They do not represent total volatile organic compounds (VOC) expressed as methane. Studies were carried out more than 40 years ago.
[c] Greater than 6 mg per 158 grain projectile (0.6 kg/Mg, 1.2 lb/ton).
[d] These factors are derived from theoretical calculations, not from experimental data.

GHG Emissions Calculation Comparison:

Pollutant	Source	Units
CO_2	1	kg/gallon
CO_2	2	MT/MT

Source/Reference:

1. The Climate Registry. 2018 Emission Factors. Table 12.1 U.S. Default Factors for Calculating CO2 Emissions from Combustion of Fossil Fuel and Biomass.
2. Australian Government - Department of Heritage Australian Greenhouse Office. AGO Factors and Methods Workbook. December 2006

Conversion Values:

7.41	lbs/gallon fuel oil
6.00%	composition of fuel oil #2 in ANFO
10.35	kg CO2/gallon fuel oil #2
2000	lbs/ton
1000	kg/MT
1.102	tons/MT

Notes:

MT = metric tons
kg = kilograms
lb = pounds

Fugitive Dust Emission Factors

Truck Loading Fugitive Dust Emission Factors

$EF_D = k \times (0.0032) \times ((U/5)^{1.3})/((M/2)^{1.4})$

Variable	Amount	Units	
EF (PM_{10})	0.0001	lb/ton	
EF ($PM_{2.5}$)	0.00002	lb/ton	
k (PM_{10})	0.35	factor	
k ($PM_{2.5}$)	0.053	factor	
U (mean wind speed)	3.83	miles/hr	
M (moisture content)	7.90	percent	USEPA, AP-42, July 1998, Table 11.9-3 Typical
Soil density (CalEEMod default)	1.26	tons/cy	
Rip rap density	2.23	tons/cy	
Derrick/Grouted stone density	1.96	tons/cy	

E (lbs) = EF (lb/ton) x TP (tons)

Bulldozing, Scraping and Grading

PM10 Emission Factor [lb/hr] = 0.75 x (silt content [%])$^{1.5}$ / (moisture)$^{1.4}$

PM2.5 Emission Factor [lb/hr] = 0.60 x (silt content [%])$^{1.2}$ / (moisture)$^{1.3}$

Reference: AP-42, Table 11.9-1, July 1998

Parameter	Value	Basis
Silt Content	6.9	USEPA, AP-42, July 1998, Table 11.9-3 Typical Values for Correction Factors Applicable to the Predictive
Moisture	7.9	USEPA, AP-42, July 1998, Table 11.9-3 Typical Values for Correction Factors Applicable to the Predictive

PM10 Emission Factor	0.75	lb/hr
PM2.5 Emission Factor	0.41	lb/hr

Emissions [pounds per day] = Controlled emission factor [pounds per hour] x Bulldozing, scraping or grading time [hours/day]

Paved Road Dust $EF_{DUST} = [(k(sL)^{0.91} \times (W)^{1.02}](1 - P/4N))$

Source: AP-42 Section 13.2.1 (Paved Roads) - http://www.epa.gov/ttnchie1/ap42/ch13/final/c13s0201.pdf

Variable	Value	Description
k (PM10)	0.0022	particle size multiplier for particle size range and units of interest (lb/VMT)
k (PM2.5)	0.00054	particle size multiplier for particle size range and units of interest (lb/VMT)
sL	0.1	road surface silt loading (g/m^2)
W	2.4	average weight (tons) of vehicles (2.4 tons)
W	14.75	haul truck tons
P	30	number of "wet" days with at least 0.254 mm of precipitation during the averaging period
N	365	number of days in averaging period

Pickup and Worker		
EF (PM10)	0.000647473	lb/VMT
EF (PM2.5)	0.000158925	lb/VMT
Haul Truck		
EF (PM10)	0.004126423	lb/VMT
EF (PM2.5)	0.001012849	lb/VMT

Unpaved Road Dust

Equations: EF (unpaved) = ku (s/12)a (W/3)b

Ref: AP-42, Section 13.2.2, "Unpaved Roads," November 2006

Constants:

k_u =	1.8	(Particle size multiplier for PM10)
	0.15	(Particle size multiplier for PM2.5)
s	5	Unpaved surface silt content from SCAQMD CEQA Handbook, (1993) Table A9-9-D-1 for city and county roads
a =	1	for PM10
	1	for PM2.5
b =	0.5	for PM10
	0.5	for PM2.5

[c] Uncontrolled emissions [lb/day] = Emission factor [lb/mi] x Number x Daily miles traveled [mi/vehicle-day]

[d] Control efficiency from watering unpaved road twice a day (55%) and limiting maximum speed to 15 mph (57%), from Table XI-A, Mitigation Measure Examples, Fugitive Dust from Construction & Demolition, http://www.aqmd.gov/ceqa/handbook/mitigation/fugitive/MM_fugitive.html

[e] Controlled emissions [lb/day] = Uncontrolled emissions [lb/day] x (1 - Control efficiency [%])

OFFROAD2017 (v1.0.1) Emissions Inventory
Region Type: County
Region: Tuolumne
Calendar Year: 2020
Scenario: All Adopted Rules - Exhaust
Vehicle Classification: OFFROAD2017 Equipment Types
Units: Emissions: tons/day, Fuel Consumption: gallons/year, Activity: hours/year, HP-Hours: HP-hours/year

Region	CalYr	VehClass	MdlYr	HP_Bin	Fuel	HC_tpd	ROG_tpd	TOG_tpd	CO_tpd	NOx_tpd	CO2_tpd	PM10_tpd	PM2_5_tp	PM_tpd	SOx_tpd	NH3_tpd	Fuel_gpy	Total_Acti	Total_Pop	Horsepower_Hours_hhpy
Tuolumne	2020	AirGrSupp - A/C Tug Narrow Body	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - A/C Tug Narrow Body	Aggregate	50	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - A/C Tug Narrow Body	Aggregate	75	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - A/C Tug Narrow Body	Aggregate	100	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - A/C Tug Narrow Body	Aggregate	175	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - A/C Tug Narrow Body	Aggregate	300	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - A/C Tug Narrow Body	Aggregate	750	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - A/C Tug Wide Body	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - A/C Tug Wide Body	Aggregate	50	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - A/C Tug Wide Body	Aggregate	75	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - A/C Tug Wide Body	Aggregate	100	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - A/C Tug Wide Body	Aggregate	175	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - A/C Tug Wide Body	Aggregate	300	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - A/C Tug Wide Body	Aggregate	600	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - A/C Tug Wide Body	Aggregate	750	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Baggage Tug	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Baggage Tug	Aggregate	50	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Baggage Tug	Aggregate	75	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Baggage Tug	Aggregate	100	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Baggage Tug	Aggregate	175	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Baggage Tug	Aggregate	300	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Belt Loader	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Belt Loader	Aggregate	50	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Belt Loader	Aggregate	75	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Belt Loader	Aggregate	100	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Belt Loader	Aggregate	175	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Belt Loader	Aggregate	300	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Belt Loader	Aggregate	600	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Belt Loader	Aggregate	750	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Bobtail	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Bobtail	Aggregate	50	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Bobtail	Aggregate	75	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Bobtail	Aggregate	100	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Bobtail	Aggregate	175	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Bobtail	Aggregate	300	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Cargo Loader	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Cargo Loader	Aggregate	50	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Cargo Loader	Aggregate	100	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Cargo Loader	Aggregate	175	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Cargo Loader	Aggregate	300	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Cargo Loader	Aggregate	600	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Cargo Loader	Aggregate	750	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Cargo Tractor	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Cargo Tractor	Aggregate	50	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Cargo Tractor	Aggregate	75	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Cargo Tractor	Aggregate	100	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Cargo Tractor	Aggregate	175	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Cargo Tractor	Aggregate	300	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Cargo Tractor	Aggregate	600	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Forklift	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Forklift	Aggregate	50	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Forklift	Aggregate	75	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Forklift	Aggregate	100	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Forklift	Aggregate	175	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Forklift	Aggregate	300	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Forklift	Aggregate	600	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Lift	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Lift	Aggregate	50	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Lift	Aggregate	75	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Lift	Aggregate	100	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Lift	Aggregate	175	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Lift	Aggregate	300	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Other GSE	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Other GSE	Aggregate	50	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Other GSE	Aggregate	75	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Other GSE	Aggregate	100	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Other GSE	Aggregate	175	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Other GSE	Aggregate	300	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Other GSE	Aggregate	600	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Passenger Stand	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Passenger Stand	Aggregate	50	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Passenger Stand	Aggregate	75	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Passenger Stand	Aggregate	100	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Passenger Stand	Aggregate	175	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Passenger Stand	Aggregate	300	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	AirGrSupp - Passenger Stand	Aggregate	600	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	ConstMin - Bore/Drill Rigs	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	ConstMin - Bore/Drill Rigs	Aggregate	50	Diesel	1.92E-06	2.33E-06	2.77E-06	1.47E-05	1.51E-05	0.001945	9.55E-07	8.79E-07	9.55E-07	1.79E-08	1.59E-08	63.10161	54.62121	0.157136	2142.799
Tuolumne	2020	ConstMin - Bore/Drill Rigs	Aggregate	75	Diesel	1.51E-06	1.83E-06	2.17E-06	2.23E-05	2.68E-05	0.003388	1.41E-06	1.3E-06	1.41E-06	3.13E-08	2.77E-08	109.9271	58.30752	0.132325	4280.974
Tuolumne	2020	ConstMin - Bore/Drill Rigs	Aggregate	100	Diesel	3.19E-06	3.86E-06	4.6E-06	5.51E-05	4.43E-05	0.008707	2.26E-06	2.08E-06	2.26E-06	8.04E-08	7.11E-08	282.5004	128.8917	0.347354	11043.75
Tuolumne	2020	ConstMin - Bore/Drill Rigs	Aggregate	175	Diesel	3.84E-06	4.64E-06	5.53E-06	7.82E-05	4.97E-05	0.014062	2.2E-06	2.03E-06	2.2E-06	1.3E-07	1.15E-07	456.2142	117.0837	0.378782	17503.58
Tuolumne	2020	ConstMin - Bore/Drill Rigs	Aggregate	300	Diesel	4.54E-06	5.5E-06	6.54E-06	4.09E-05	6.97E-05	0.019857	2.02E-06	1.86E-06	2.02E-06	1.83E-07	1.62E-07	644.2392	120.7368	0.378782	24960.46
Tuolumne	2020	ConstMin - Bore/Drill Rigs	Aggregate	600	Diesel	6.93E-06	8.39E-06	9.98E-06	7.17E-05	9.58E-05	0.037992	3.02E-06	2.78E-06	3.02E-06	3.51E-07	3.1E-07	1232.598	114.3494	0.327506	47896.53
Tuolumne	2020	ConstMin - Bore/Drill Rigs	Aggregate	750	Diesel	2.48E-06	3E-06	3.57E-06	2.65E-05	3.31E-05	0.014339	1.16E-06	1.07E-06	1.16E-06	1.32E-07	1.17E-07	465.2175	27.43883	0.062855	17725.62
Tuolumne	2020	ConstMin - Bore/Drill Rigs	Aggregate	9999	Diesel	2.98E-06	3.6E-06	4.29E-06	1.99E-05	8.01E-05	0.010515	1.94E-06	1.79E-06	1.94E-06	9.71E-08	8.58E-08	341.1567	7.068193	0.009924	13149.62
Tuolumne	2020	ConstMin - Cranes	Aggregate	25	Diesel	5.77E-08	6.99E-08	8.31E-08	3.27E-07	2.99E-07	3.72E-05	2.25E-08	2.07E-08	2.25E-08	3.42E-10	3.04E-10	1.206738	2.914996	0.006232	72.87491
Tuolumne	2020	ConstMin - Cranes	Aggregate	50	Diesel	1.84E-06	2.23E-06	2.66E-06	7.82E-06	6.31E-06	0.000603	6.66E-07	6.13E-07	6.66E-07	5.52E-09	4.92E-09	19.5533	28.35517	0.066476	1169.1
Tuolumne	2020	ConstMin - Cranes	Aggregate	75	Diesel	5.57E-07	6.74E-07	8.02E-07	2.33E-06	5.09E-06	0.000271	4.73E-07	4.35E-07	4.73E-07	2.49E-09	2.21E-09	8.790836	8.36729	0.022851	585.9444
Tuolumne	2020	ConstMin - Cranes	Aggregate	100	Diesel	1.62E-05	1.96E-05	2.33E-05	0.000112	0.000172	0.013987	1.21E-05	1.11E-05	1.21E-05	1.29E-07	1.14E-07	453.8002	346.1871	0.801866	30560.94
Tuolumne	2020	ConstMin - Cranes	Aggregate	175	Diesel	3.45E-05	4.18E-05	4.97E-05	0.000278	0.000431	0.041299	2.32E-05	2.13E-05	2.32E-05	3.81E-07	3.37E-07	1339.897	611.4077	1.366912	89812.83
Tuolumne	2020	ConstMin - Cranes	Aggregate	300	Diesel	4.37E-05	5.29E-05	6.29E-05	0.000248	0.000635	0.074383	2.6E-05	2.39E-05	2.6E-05	6.86E-07	6.07E-07	2413.264	728.6494	1.572571	162009
Tuolumne	2020	ConstMin - Cranes	Aggregate	600	Diesel	5.78E-05	7E-05	8.33E-05	0.000563	0.000851	0.123499	3.35E-05	3.09E-05	3.35E-05	1.14E-06	1.01E-06	4006.784	727.9635	1.512328	269460.8
Tuolumne	2020	ConstMin - Cranes	Aggregate	750	Diesel	1.98E-06	2.4E-06	2.85E-06	1.95E-05	2.56E-05	0.001978	1.32E-06	1.21E-06	1.32E-06	1.82E-08	1.61E-08	64.18972	6.705882	0.016619	4292.28
Tuolumne	2020	ConstMin - Cranes	Aggregate	9999	Diesel	8.29E-06	1E-05	1.19E-05	8.56E-05	0.000115	0.006926	5.48E-06	5.04E-06	5.48E-06	6.38E-08	5.65E-08	224.6938	16.08346	0.033238	15090.27
Tuolumne	2020	ConstMin - Crawler Tractors	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	ConstMin - Crawler Tractors	Aggregate	50	Diesel	5.74E-06	6.94E-06	8.26E-06	2.47E-05	1.91E-05	0.00195	2E-06	1.84E-06	2E-06	1.79E-08	1.59E-08	63.26435	61.43322	0.184372	2581.817
Tuolumne	2020	ConstMin - Crawler Tractors	Aggregate	75	Diesel	1.97E-06	2.38E-06	2.83E-06	7.71E-06	1.88E-05	0.000644	1.38E-06	1.27E-06	1.38E-06	5.89E-09	5.25E-09	20.88173	12.92746	0.062687	933.471
Tuolumne	2020	ConstMin - Crawler Tractors	Aggregate	100	Diesel	9.34E-05	0.000113	0.000134	0.000646	0.000951	0.08555	7.94E-05	7.31E-05	7.94E-05	7.88E-07	6.98E-07	2775.574	1426.712	3.099302	124871.5
Tuolumne	2020	ConstMin - Crawler Tractors	Aggregate	175	Diesel	7.05E-05	8.53E-05	0.000102	0.000597	0.000872	0.093996	4.88E-05	4.49E-05	4.88E-05	8.67E-07	7.67E-07	3049.612	922.3291	2.087097	137510
Tuolumne	2020	ConstMin - Crawler Tractors	Aggregate	300	Diesel	6.55E-05	7.93E-05	9.44E-05	0.000417	0.000984	0.100482	3.95E-05	3.63E-05	3.95E-05	9.27E-07	8.2E-07	3260.02	711.0908	1.661196	147071.5
Tuolumne	2020	ConstMin - Crawler Tractors	Aggregate	600	Diesel	0.000142	0.000172	0.000205	0.001078	0.002081	0.340114	7.82E-05	7.2E-05	7.82E-05	3.14E-06	2.78E-06	11034.62	1291.866	2.756369	497250.4
Tuolumne	2020	ConstMin - Crawler Tractors	Aggregate	750	Diesel	4.31E-06	5.21E-06	6.21E-06	2.69E-05	8.27E-05	0.007308	2.42E-06	2.23E-06	2.42E-06	6.74E-08	5.96E-08	237.0842	17.26061	0.038718	10712.41
Tuolumne	2020	ConstMin - Crawler Tractors	Aggregate	9999	Diesel	1.32E-05	1.6E-05	1.9E-05	6.73E-05	0.000259	0.020033	7.33E-06	6.75E-06	7.33E-06	1.85E-07	1.64E-07	649.9587	29.8981	0.055312	29247.88
Tuolumne	2020	ConstMin - Excavators	Aggregate	25	Diesel	5.39E-08	6.53E-08	7.77E-08	1.83E-07	1.24E-07	9.64E-06	1.74E-08	1.6E-08	1.74E-08	8.75E-11	7.87E-11	0.312889	0.570803	0.001847	14.27008
Tuolumne	2020	ConstMin - Excavators	Aggregate	50	Diesel	6.51E-05	7.87E-05	9.37E-05	0.000598	0.000535	0.078042	2.95E-05	2.71E-05	2.95E-05	7.2E-07	6.37E-07	2532.002	3221.819	4.511379	115231.5
Tuolumne	2020	ConstMin - Excavators	Aggregate	75	Diesel	1.39E-06	1.68E-06	2.01E-06	1.76E-05	2.49E-05	0.002465	1.44E-06	1.33E-06	1.44E-06	2.27E-08	2.01E-08	79.95956	55.07941	0.081286	4042.077
Tuolumne	2020	ConstMin - Excavators	Aggregate	100	Diesel	4.6E-05	5.56E-05	6.62E-05	0.00066	0.000569	0.098937	3.4E-05	3.13E-05	3.4E-05	9.13E-07	8.08E-07	3209.894	1999.536	3.168311	163237.1
Tuolumne	2020	ConstMin - Excavators	Aggregate	175	Diesel	7.8E-05	9.43E-05	0.000112	0.00125	0.000927	0.213825	4.51E-05	4.15E-05	4.51E-05	1.97E-06	1.75E-06	6937.31	2404.025	4.162219	351005.9
Tuolumne	2020	ConstMin - Excavators	Aggregate	300	Diesel	7.63E-05	9.23E-05	0.00011	0.000584	0.001055	0.271942	3.22E-05	2.96E-05	3.22E-05	2.51E-06	2.22E-06	8822.846	2043.71	3.580284	446373.9
Tuolumne	2020	ConstMin - Excavators	Aggregate	600	Diesel	0.000115	0.000139	0.000166	0.001	0.001419	0.48215	4.67E-05	4.3E-05	4.67E-05	4.45E-06	3.94E-06	15642.82	2350.017	3.755788	793577.6
Tuolumne	2020	ConstMin - Excavators	Aggregate	750	Diesel	3.51E-06	4.24E-06	5.05E-06	2.25E-05	5.39E-05	0.008552	1.77E-06	1.63E-06	1.77E-06	7.9E-08	6.98E-08	277.463	22.46739	0.040643	14074.6
Tuolumne	2020	ConstMin - Excavators	Aggregate	9999	Diesel	3.31E-06	4E-06	4.77E-06	2.98E-05	8.36E-05	0.013477	1.57E-06	1.44E-06	1.57E-06	1.24E-07	1.1E-07	437.2346	18.36667	0.027711	22111.08
Tuolumne	2020	ConstMin - Graders	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	ConstMin - Graders	Aggregate	50	Diesel	1.85E-06	2.24E-06	2.67E-06	7.22E-06	5.17E-06	0.000485	6.36E-07	5.85E-07	6.36E-07	4.43E-09	3.96E-09	15.74637	18.51056	0.053838	670.1565
Tuolumne	2020	ConstMin - Graders	Aggregate	75	Diesel	8.1E-07	9.8E-07	1.17E-06	6.15E-06	7.52E-06	0.0008	5.32E-07	4.89E-07	5.32E-07	7.37E-09	6.53E-09	25.95098	17.08587	0.046412	1227.69
Tuolumne	2020	ConstMin - Graders	Aggregate	100	Diesel	1.94E-05	2.35E-05	2.79E-05	9.85E-05	0.000182	0.010776	1.51E-05	1.39E-05	1.51E-05	9.9E-08	8.79E-08	349.6054	185.8242	0.516098	16692.19
Tuolumne	2020	ConstMin - Graders	Aggregate	175	Diesel	0.000114	0.000137	0.000163	0.000885	0.001341	0.130576	7.49E-05	6.89E-05	7.49E-05	1.2E-06	1.07E-06	4236.401	1346.431	2.920226	200113.3

Tuolumne	2020	ConstMin - Graders	Aggregate	300	Diesel	0.000148	0.000179	0.000213	0.000722	0.002242	0.275693	7.44E-05	6.84E-05	7.44E-05	2.54E-06	2.25E-06	8944.554	1951.01	2.62876	422864.4
Tuolumne	2020	ConstMin - Graders	Aggregate	600	Diesel	6.43E-06	7.79E-06	9.26E-06	2.79E-05	0.000103	0.012024	3.19E-06	2.93E-06	3.19E-06	1.11E-07	9.81E-08	390.1019	52.3427	0.072402	18362.08
Tuolumne	2020	ConstMin - Graders	Aggregate	9999	Diesel	7.28E-06	8.81E-06	1.05E-05	3.72E-05	0.000122	0.009346	3.82E-06	3.52E-06	3.82E-06	8.62E-08	7.63E-08	303.2325	7.926885	0.011139	14342.29
Tuolumne	2020	ConstMin - Off-Highway Tractors	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	ConstMin - Off-Highway Tractors	Aggregate	50	Diesel	4.62E-05	5.59E-05	6.65E-05	0.000305	0.000258	0.032366	1.92E-05	1.76E-05	1.92E-05	2.98E-07	2.64E-07	1050.065	1113.242	1.729859	42002.29
Tuolumne	2020	ConstMin - Off-Highway Tractors	Aggregate	75	Diesel	1.17E-05	1.41E-05	1.68E-05	0.000152	0.000135	0.022231	8.16E-06	7.51E-06	8.16E-06	2.05E-07	1.81E-07	721.2614	451.4897	0.718192	32016.36
Tuolumne	2020	ConstMin - Off-Highway Tractors	Aggregate	100	Diesel	1.7E-05	2.06E-05	2.45E-05	0.000142	0.000189	0.018883	1.56E-05	1.44E-05	1.56E-05	1.74E-07	1.54E-07	612.6224	339.9933	0.539556	27098.57
Tuolumne	2020	ConstMin - Off-Highway Tractors	Aggregate	175	Diesel	1.49E-05	1.8E-05	2.14E-05	0.000214	0.000192	0.035157	9.32E-06	8.57E-06	9.32E-06	3.25E-07	2.87E-07	1140.634	319.9374	0.47758	50656.14
Tuolumne	2020	ConstMin - Off-Highway Tractors	Aggregate	300	Diesel	1.19E-05	1.44E-05	1.72E-05	7.67E-05	0.000173	0.031449	5.86E-06	5.39E-06	5.86E-06	2.9E-07	2.57E-07	1020.313	209.1872	0.333577	45392.34
Tuolumne	2020	ConstMin - Off-Highway Tractors	Aggregate	600	Diesel	2.42E-05	2.93E-05	3.48E-05	0.000194	0.000287	0.096203	9.71E-06	8.93E-06	9.71E-06	8.89E-07	7.85E-07	3121.188	388.7441	0.574189	138963.5
Tuolumne	2020	ConstMin - Off-Highway Tractors	Aggregate	750	Diesel	2.09E-06	2.52E-06	3E-06	1.13E-05	2.51E-05	0.005601	1.02E-06	9.39E-07	1.02E-06	5.17E-08	4.57E-08	181.732	12.81344	0.018228	8170.295
Tuolumne	2020	ConstMin - Off-Highway Tractors	Aggregate	9999	Diesel	2.03E-06	2.46E-06	2.93E-06	1.31E-05	3.71E-05	0.005468	9.76E-07	8.98E-07	9.76E-07	5.05E-08	4.46E-08	177.4025	4.820797	0.009114	7879.848
Tuolumne	2020	ConstMin - Off-Highway Trucks	Aggregate	25	Diesel	4.22E-07	5.1E-07	6.07E-07	1.91E-06	1.26E-06	0.000137	1.3E-07	1.19E-07	1.3E-07	1.26E-09	1.12E-09	4.454127	8.11662	0.005418	202.9155
Tuolumne	2020	ConstMin - Off-Highway Trucks	Aggregate	50	Diesel	3.41E-06	4.13E-06	4.91E-06	2.86E-05	2.4E-05	0.002975	1.67E-06	1.53E-06	1.67E-06	2.74E-08	2.43E-08	96.51242	153.6154	0.097528	4421.712
Tuolumne	2020	ConstMin - Off-Highway Trucks	Aggregate	75	Diesel	4.44E-07	5.37E-07	6.39E-07	6.95E-06	4.08E-06	0.000937	1.64E-07	1.51E-07	1.64E-07	8.65E-09	7.65E-09	30.40039	21.66245	0.014449	1540.949
Tuolumne	2020	ConstMin - Off-Highway Trucks	Aggregate	100	Diesel	1.6E-06	1.94E-06	2.31E-06	1.64E-05	1.65E-05	0.00217	1.33E-06	1.22E-06	1.33E-06	2E-08	1.77E-08	70.38712	40.52669	0.032509	3567.219
Tuolumne	2020	ConstMin - Off-Highway Trucks	Aggregate	175	Diesel	3.66E-05	4.43E-05	5.27E-05	0.000472	0.000375	0.074048	1.96E-05	1.81E-05	1.96E-05	6.84E-07	6.04E-07	2402.42	772.3359	0.563494	121843.9
Tuolumne	2020	ConstMin - Off-Highway Trucks	Aggregate	300	Diesel	6.51E-05	7.88E-05	9.38E-05	0.000399	0.000719	0.150845	2.8E-05	2.58E-05	2.8E-05	1.39E-06	1.23E-06	4893.988	1179.382	0.946382	248967.5
Tuolumne	2020	ConstMin - Off-Highway Trucks	Aggregate	600	Diesel	0.00025	0.000303	0.00036	0.001753	0.002902	0.647241	0.000106	9.75E-05	0.000106	5.98E-06	5.28E-06	20999.04	2826.983	2.127553	1064106
Tuolumne	2020	ConstMin - Off-Highway Trucks	Aggregate	750	Diesel	0.000105	0.000127	0.000152	0.000818	0.001233	0.217977	4.82E-05	4.44E-05	4.82E-05	2.01E-06	1.78E-06	7072.035	541.0496	0.45513	358781.1
Tuolumne	2020	ConstMin - Off-Highway Trucks	Aggregate	9999	Diesel	0.000171	0.000207	0.000246	0.001021	0.003151	0.387153	7.96E-05	7.33E-05	7.96E-05	3.57E-06	3.16E-06	12560.77	501.4596	0.36302	633826.3
Tuolumne	2020	ConstMin - Other Construction Equipment	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	ConstMin - Other Construction Equipment	Aggregate	50	Diesel	2.62E-05	3.17E-05	3.77E-05	0.00016	0.000149	0.017457	1.2E-05	1.1E-05	1.2E-05	1.61E-07	1.42E-07	566.3611	620.2252	1.335483	23633.26
Tuolumne	2020	ConstMin - Other Construction Equipment	Aggregate	75	Diesel	3.38E-06	4.09E-06	4.87E-06	1.8E-05	3.45E-05	0.001958	2.57E-06	2.36E-06	2.57E-06	1.8E-08	1.6E-08	63.50971	40.8518	0.133009	2983.966
Tuolumne	2020	ConstMin - Other Construction Equipment	Aggregate	100	Diesel	4.11E-05	4.97E-05	5.91E-05	0.000369	0.00046	0.052837	3.41E-05	3.14E-05	3.41E-05	4.87E-07	4.31E-07	1714.223	973.5985	2.22161	79845.6
Tuolumne	2020	ConstMin - Other Construction Equipment	Aggregate	175	Diesel	1.83E-05	2.21E-05	2.63E-05	0.000184	0.000234	0.029828	1.24E-05	1.14E-05	1.24E-05	2.75E-07	2.43E-07	967.7495	296.8051	0.735145	45207.35
Tuolumne	2020	ConstMin - Other Construction Equipment	Aggregate	300	Diesel	1.93E-05	2.34E-05	2.78E-05	0.000124	0.000292	0.039861	1.11E-05	1.02E-05	1.11E-05	3.68E-07	3.25E-07	1293.24	272.9488	0.692006	59896.87
Tuolumne	2020	ConstMin - Other Construction Equipment	Aggregate	600	Diesel	5.14E-05	6.22E-05	7.4E-05	0.000436	0.000752	0.151918	2.66E-05	2.45E-05	2.66E-05	1.4E-06	1.24E-06	4928.824	599.8735	1.376823	229840.1
Tuolumne	2020	ConstMin - Other Construction Equipment	Aggregate	750	Diesel	7.88E-06	9.54E-06	1.14E-05	5.92E-05	0.000114	0.027784	3.72E-06	3.42E-06	3.72E-06	2.57E-07	2.27E-07	901.4306	67.98809	0.131212	42091.65
Tuolumne	2020	ConstMin - Other Construction Equipment	Aggregate	9999	Diesel	2.95E-06	3.57E-06	4.25E-06	2.01E-05	6.87E-05	0.009587	1.61E-06	1.48E-06	1.61E-06	8.86E-08	7.83E-08	311.0558	15.8828	0.034151	14489.71
Tuolumne	2020	ConstMin - Pavers	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	ConstMin - Pavers	Aggregate	50	Diesel	3.96E-06	4.79E-06	5.7E-06	2.01E-05	1.73E-05	0.002138	1.46E-06	1.34E-06	1.46E-06	1.96E-08	1.74E-08	69.36111	74.95265	0.216343	2901.008
Tuolumne	2020	ConstMin - Pavers	Aggregate	75	Diesel	5.53E-06	6.69E-06	7.96E-06	2.7E-05	5.03E-05	0.003502	4.8E-06	4.42E-06	4.8E-06	3.22E-08	2.86E-08	113.6053	73.42431	0.209131	5310.458
Tuolumne	2020	ConstMin - Pavers	Aggregate	100	Diesel	9.42E-06	1.14E-05	1.36E-05	0.000114	0.000121	0.017059	7.73E-06	7.11E-06	7.73E-06	1.57E-07	1.39E-07	553.4708	319.2727	0.83292	25862.72
Tuolumne	2020	ConstMin - Pavers	Aggregate	175	Diesel	1.24E-05	1.5E-05	1.78E-05	0.000162	0.000159	0.028341	7.84E-06	7.21E-06	7.84E-06	2.62E-07	2.31E-07	919.4768	270.8105	0.71934	42716.37
Tuolumne	2020	ConstMin - Pavers	Aggregate	300	Diesel	6.15E-06	7.44E-06	8.85E-06	4.29E-05	0.000115	0.022106	3.3E-06	3.03E-06	3.3E-06	2.04E-07	1.8E-07	717.1972	150.9329	0.344346	33422.31
Tuolumne	2020	ConstMin - Pavers	Aggregate	600	Diesel	9.22E-07	1.12E-06	1.33E-06	7.5E-06	1.42E-05	0.004	4.85E-07	4.46E-07	4.85E-07	3.7E-08	3.26E-08	129.7791	16.41349	0.03786	6026.338
Tuolumne	2020	ConstMin - Pavers	Aggregate	750	Diesel	1.5E-07	1.81E-07	2.16E-07	1.52E-06	1.86E-06	0.000828	8.18E-08	7.52E-08	8.18E-08	7.65E-09	6.76E-09	26.86145	1.667089	0.003606	1250.317
Tuolumne	2020	ConstMin - Paving Equipment	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	ConstMin - Paving Equipment	Aggregate	50	Diesel	2.35E-06	2.84E-06	3.38E-06	1.93E-05	1.81E-05	0.002662	9.93E-07	9.13E-07	9.93E-07	2.45E-08	2.17E-08	86.38183	122.5679	0.266394	4251.598
Tuolumne	2020	ConstMin - Paving Equipment	Aggregate	75	Diesel	4.29E-07	5.2E-07	6.18E-07	2.72E-06	4.47E-06	0.000325	3.44E-07	3.16E-07	3.44E-07	2.99E-09	2.65E-09	10.53472	8.562968	0.023399	574.7957
Tuolumne	2020	ConstMin - Paving Equipment	Aggregate	100	Diesel	6.29E-06	7.61E-06	9.06E-06	7.41E-05	7.43E-05	0.011128	4.88E-06	4.49E-06	4.88E-06	1.03E-07	9.08E-08	361.0377	220.7499	0.489589	19623.65
Tuolumne	2020	ConstMin - Paving Equipment	Aggregate	175	Diesel	5.22E-06	6.31E-06	7.52E-06	7.06E-05	6.3E-05	0.012054	3.39E-06	3.12E-06	3.39E-06	1.11E-07	9.84E-08	391.0698	147.3393	0.327592	21330.79
Tuolumne	2020	ConstMin - Paving Equipment	Aggregate	300	Diesel	3.09E-06	3.74E-06	4.45E-06	1.91E-05	4.89E-05	0.00855	1.73E-06	1.59E-06	1.73E-06	7.9E-08	6.98E-08	277.3818	64.52643	0.140397	15084.74
Tuolumne	2020	ConstMin - Paving Equipment	Aggregate	600	Diesel	2.86E-06	3.46E-06	4.12E-06	1.89E-05	4.59E-05	0.008808	1.41E-06	1.3E-06	1.41E-06	8.13E-08	7.19E-08	285.7695	37.6349	0.082798	15490.23
Tuolumne	2020	ConstMin - Paving Equipment	Aggregate	750	Diesel	3.64E-07	4.41E-07	5.24E-07	2.05E-06	6.18E-06	0.001051	1.58E-07	1.45E-07	1.58E-07	9.7E-09	8.57E-09	34.08551	2.714451	0.0054	1855.243
Tuolumne	2020	ConstMin - Paving Equipment	Aggregate	9999	Diesel	1.1E-07	1.33E-07	1.58E-07	1.44E-06	3.43E-06	0.000782	5.52E-08	5.08E-08	5.52E-08	7.23E-09	6.38E-09	25.37683	1.638308	0.0036	1381.117
Tuolumne	2020	ConstMin - Rollers	Aggregate	25	Diesel	3.76E-08	4.55E-08	5.41E-08	1.25E-07	8.9E-08	6.87E-06	1.19E-08	1.1E-08	1.19E-08	6.24E-11	5.61E-11	0.222994	0.413705	0.001854	10.34263
Tuolumne	2020	ConstMin - Rollers	Aggregate	50	Diesel	5.71E-05	6.91E-05	8.23E-05	0.000353	0.000339	0.043931	2.46E-05	2.26E-05	2.46E-05	4.04E-07	3.59E-07	1425.298	1848.947	5.468809	66046.06
Tuolumne	2020	ConstMin - Rollers	Aggregate	75	Diesel	1.14E-06	1.38E-06	1.64E-06	4.55E-06	1.12E-05	0.000395	7.84E-07	7.21E-07	7.84E-07	3.62E-09	3.23E-09	12.82925	9.529696	0.042653	660.3639
Tuolumne	2020	ConstMin - Rollers	Aggregate	100	Diesel	4.04E-05	4.89E-05	5.82E-05	0.000453	0.000492	0.068254	3.13E-05	2.88E-05	3.13E-05	6.3E-07	5.57E-07	2214.437	1307.614	4.037164	114075.9
Tuolumne	2020	ConstMin - Rollers	Aggregate	175	Diesel	2.39E-05	2.89E-05	3.44E-05	0.000394	0.00033	0.070985	1.51E-05	1.39E-05	1.51E-05	6.56E-07	5.79E-07	2303.015	826.1297	2.358876	118793.5
Tuolumne	2020	ConstMin - Rollers	Aggregate	300	Diesel	4.45E-06	5.38E-06	6.4E-06	3.49E-05	6.88E-05	0.011754	2.42E-06	2.22E-06	2.42E-06	1.09E-07	9.59E-08	381.335	90.88893	0.302277	19643.28
Tuolumne	2020	ConstMin - Rollers	Aggregate	600	Diesel	1.82E-06	2.2E-06	2.62E-06	2.02E-05	2.74E-05	0.006896	9.25E-07	8.51E-07	9.25E-07	6.37E-08	5.63E-08	223.7361	32.80888	0.109413	11470.22
Tuolumne	2020	ConstMin - Rough Terrain Forklifts	Aggregate	25	Diesel	3.34E-09	4.04E-09	4.81E-09	7.31E-08	9.82E-08	1.19E-05	3.22E-09	2.96E-09	3.22E-09	1.1E-10	9.69E-11	0.38517	0.666008	0.00214	16.6502
Tuolumne	2020	ConstMin - Rough Terrain Forklifts	Aggregate	50	Diesel	2.75E-06	3.33E-06	3.96E-06	1.58E-05	1.49E-05	0.001996	1E-06	9.21E-07	1E-06	1.84E-08	1.63E-08	64.74528	59.1649	0.220429	2799.644
Tuolumne	2020	ConstMin - Rough Terrain Forklifts	Aggregate	75	Diesel	6.2E-07	7.5E-07	8.92E-07	2.91E-06	4.4E-06	0.000315	3.55E-07	3.27E-07	3.55E-07	2.89E-09	2.57E-09	10.21689	8.364487	0.034241	455.263
Tuolumne	2020	ConstMin - Rough Terrain Forklifts	Aggregate	100	Diesel	4.06E-05	4.91E-05	5.85E-05	0.001052	0.000729	0.172538	2.42E-05	2.23E-05	2.42E-05	1.59E-06	1.41E-06	5597.808	2797.611	10.11407	268943.6
Tuolumne	2020	ConstMin - Rough Terrain Forklifts	Aggregate	175	Diesel	1.98E-05	2.4E-05	2.86E-05	0.000235	0.000221	0.040686	1.48E-05	1.37E-05	1.48E-05	3.76E-07	3.32E-07	1320.002	512.067	1.936783	63472.61
Tuolumne	2020	ConstMin - Rough Terrain Forklifts	Aggregate	300	Diesel	4.84E-07	5.86E-07	6.97E-07	5.22E-06	8.33E-06	0.002822	1.9E-07	1.75E-07	1.9E-07	2.61E-08	2.3E-08	91.57007	20.94702	0.085604	4404.572
Tuolumne	2020	ConstMin - Rough Terrain Forklifts	Aggregate	600	Diesel	1.52E-07	1.83E-07	2.18E-07	1.89E-06	2.82E-06	0.001047	6.02E-08	5.54E-08	6.02E-08	9.68E-09	8.55E-09	33.97935	4.277729	0.017121	1644.491
Tuolumne	2020	ConstMin - Rough Terrain Forklifts	Aggregate	750	Diesel	2.89E-08	3.49E-08	4.16E-08	3.31E-07	4.55E-07	0.000181	3.2E-09	2.94E-09	3.2E-09	1.67E-09	1.47E-09	5.857739	0.451167	0.00214	281.9792
Tuolumne	2020	ConstMin - Rubber Tired Dozers	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	ConstMin - Rubber Tired Dozers	Aggregate	50	Diesel	3.39E-06	4.1E-06	4.88E-06	1.99E-05	1.5E-05	0.00195	1.24E-06	1.14E-06	1.24E-06	1.79E-08	1.59E-08	63.25161	67.07162	0.072338	2781.553
Tuolumne	2020	ConstMin - Rubber Tired Dozers	Aggregate	75	Diesel	3.13E-06	3.79E-06	4.51E-06	1.48E-05	2.98E-05	0.001519	2.38E-06	2.19E-06	2.38E-06	1.4E-08	1.24E-08	49.28545	34.06422	0.051166	2393.095
Tuolumne	2020	ConstMin - Rubber Tired Dozers	Aggregate	100	Diesel	9.9E-06	1.2E-05	1.42E-05	6.04E-05	9.39E-05	0.007424	8.24E-06	7.58E-06	8.24E-06	6.83E-08	6.06E-08	240.8738	138.8645	0.158791	11668.95
Tuolumne	2020	ConstMin - Rubber Tired Dozers	Aggregate	175	Diesel	9.12E-06	1.1E-05	1.31E-05	5.92E-05	0.000108	0.007986	6.24E-06	5.74E-06	6.24E-06	7.36E-08	6.52E-08	259.1069	85.67715	0.116447	12676.75
Tuolumne	2020	ConstMin - Rubber Tired Dozers	Aggregate	300	Diesel	9.41E-06	1.14E-05	1.36E-05	5.99E-05	0.000121	0.008922	5.91E-06	5.44E-06	5.91E-06	8.22E-08	7.28E-08	289.4534	64.83006	0.097039	14165.35
Tuolumne	2020	ConstMin - Rubber Tired Dozers	Aggregate	600	Diesel	8.08E-05	9.78E-05	0.000116	0.00078	0.00105	0.099162	4.73E-05	4.35E-05	4.73E-05	9.14E-07	8.09E-07	3217.195	423.4461	0.594584	156466.3
Tuolumne	2020	ConstMin - Rubber Tired Dozers	Aggregate	750	Diesel	1.06E-06	1.28E-06	1.52E-06	5.71E-06	1.93E-05	0.002817	5.39E-07	4.96E-07	5.39E-07	2.6E-08	2.3E-08	91.39116	6.872278	0.007057	4470.09
Tuolumne	2020	ConstMin - Rubber Tired Loaders	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	ConstMin - Rubber Tired Loaders	Aggregate	50	Diesel	1.27E-05	1.54E-05	1.83E-05	7.04E-05	5.47E-05	0.006107	4.93E-06	4.54E-06	4.93E-06	5.61E-08	4.98E-08	198.1256	228.3954	0.272169	9503.845
Tuolumne	2020	ConstMin - Rubber Tired Loaders	Aggregate	100	Diesel	0.000131	0.000158	0.000188	0.001125	0.001335	0.148389	0.000105	9.62E-05	0.000105	1.37E-06	1.21E-06	4814.302	3026.616	3.381889	259892.2
Tuolumne	2020	ConstMin - Rubber Tired Loaders	Aggregate	175	Diesel	0.000209	0.000253	0.000302	0.002254	0.002354	0.352702	0.00013	0.000119	0.00013	3.25E-06	2.88E-06	11443.04	4083.127	4.435626	612724.5
Tuolumne	2020	ConstMin - Rubber Tired Loaders	Aggregate	300	Diesel	0.000229	0.000277	0.00033	0.001271	0.003222	0.527274	0.000107	9.84E-05	0.000107	4.87E-06	4.3E-06	17106.84	4352.909	4.137711	916313.6
Tuolumne	2020	ConstMin - Rubber Tired Loaders	Aggregate	600	Diesel	0.000311	0.000376	0.000448	0.002015	0.003927	0.655086	0.000148	0.000136	0.000148	6.05E-06	5.35E-06	21253.55	3429.001	3.639347	1142190
Tuolumne	2020	ConstMin - Rubber Tired Loaders	Aggregate	750	Diesel	2.1E-05	2.55E-05	3.03E-05	0.000167	0.000273	0.048515	9.68E-06	8.91E-06	9.68E-06	4.48E-07	3.96E-07	1574.02	127.615	0.148958	84386.1
Tuolumne	2020	ConstMin - Rubber Tired Loaders	Aggregate	9999	Diesel	2.04E-05	2.47E-05	2.93E-05	0.000101	0.000427	0.045507	1.08E-05	9.93E-06	1.08E-05	4.2E-07	3.71E-07	1476.42	82.58984	0.07172	78935.63
Tuolumne	2020	ConstMin - Scrapers	Aggregate	25	Diesel	8.73E-08	1.06E-07	1.26E-07	2.97E-07	2.01E-07	1.56E-05	2.81E-08	2.58E-08	2.81E-08	1.42E-10	1.27E-10	0.506418	0.730141	0.001818	18.25352
Tuolumne	2020	ConstMin - Scrapers	Aggregate	50	Diesel	5.86E-07	7.09E-07	8.44E-07	2E-06	1.44E-06	0.000124	1.98E-07	1.82E-07	1.98E-07	1.13E-09	1.01E-09	4.030697	3.814985	0.01091	147.7541
Tuolumne	2020	ConstMin - Scrapers	Aggregate	75	Diesel	1.94E-06	2.34E-06	2.79E-06	9.15E-06	1.79E-05	0.001057	1.57E-06	1.44E-06	1.57E-06	9.71E-09	8.62E-09	34.284	20.27763	0.049094	1371.552
Tuolumne	2020	ConstMin - Scrapers	Aggregate	100	Diesel	4.87E-06	5.89E-06	7.01E-06	3.95E-05	6.04E-05	0.005191	4.44E-06	4.09E-06	4.44E-06	4.78E-08	4.24E-08	168.4231	74.26545	0.130916	6727.809
Tuolumne	2020	ConstMin - Scrapers	Aggregate	175	Diesel	4.97E-05	6.01E-05	7.16E-05	0.000441	0.000613	0.067486	3.3E-05	3.03E-05	3.3E-05	6.22E-07	5.51E-07	2189.499	521.3975	1.183702	87441.33
Tuolumne	2020	ConstMin - Scrapers	Aggregate	300	Diesel	5.45E-05	6.59E-05	7.84E-05	0.000305	0.000752	0.077471	3.3E-05	3.03E-05	3.3E-05	7.15E-07	6.32E-07	2513.459	450.7706	1.145518	101095.7
Tuolumne	2020	ConstMin - Scrapers	Aggregate	600	Diesel	0.000449	0.000544	0.000647	0.003901	0.006408	0.971698	0.000244	0.000225	0.000244	8.97E-06	7.93E-06	31525.67	2991.092	6.383988	1261799
Tuolumne	2020	ConstMin - Scrapers	Aggregate	750	Diesel	1.68E-05	2.04E-05	2.42E-05	0.000192	0.000279	0.015685	1.14E-05	1.05E-05	1.14E-05	1.45E-07	1.28E-07	508.8703	32.62512	0.085459	20300.04
Tuolumne	2020	ConstMin - Scrapers	Aggregate	9999	Diesel	2.46E-05	2.97E-05	3.54E-05	0.000298	0.000377	0.022499	1.57E-05	1.45E-05	1.57E-05	2.07E-07	1.84E-07	729.9465	18.3245	0.047275	29268.1
Tuolumne	2020	ConstMin - Skid Steer Loaders	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	ConstMin - Skid Steer Loaders	Aggregate	50	Diesel	2.04E-05	2.47E-05	2.94E-05	0.000212	0.000208	0.033253	8.15E-06	7.5E-06	8.15E-06	3.07E-07	2.71E-07	1078.869	1164.119	3.786548	50729.96
Tuolumne	2020	ConstMin - Skid Steer Loaders	Aggregate	75	Diesel	5.09E-05	6.16E-05	7.33E-05	0.001072	0.000816	0.172742	3.49E-05	3.21E-05	3.49E-05	1.6E-06	1.41E-06	5604.417	4173.707	11.97728	294089.7
Tuolumne	2020	ConstMin - Skid Steer Loaders	Aggregate	100	Diesel	1.12E-06	1.35E-06	1.61E-06	2.33E-05	2.11E-05	0.003615	1.37E-06	1.26E-06	1.37E-06	3.34E-08	2.95E-08	117.2876	81.53479	0.242174	6223.461
Tuolumne	2020	ConstMin - Skid Steer Loaders	Aggregate	175	Diesel	2.89E-07	3.5E-07	4.16E-07	6.43E-06	3.87E-06	0.001192	1.63E-07	1.5E-07	1.63E-07	1.1E-08	9.73E-09	38.67327	13.36821	0.050688	2034.978
Tuolumne	2020	ConstMin - Skid Steer Loaders	Aggregate	300	Diesel	1.68E-07	2.04E-07	2.42E-07	2.03E-06	2.57E-06	0.001107	7.29E-08	6.71E-08	7.29E-08	1.02E-08	9.04E-09	35.92064	9.196928	0.031914	1885.196
Tuolumne	2020	ConstMin - Skid Steer Loaders	Aggregate	600	Diesel	7.69E-08	9.31E-08	1.11E-07	5.98E-07	1.25E-06	0.00032	5.39E-08	4.96E-08	5.39E-08	2.96E-09	2.61E-09	10.39149	1.15171	0.003755	544.5285
Tuolumne	2020	ConstMin - Skid Steer Loaders	Aggregate	9999	Diesel	1.96E-07	2.38E-07	2.83E-07	1.36E-06	3.61E-06	0.000434	1.19E-07	1.09E-07	1.19E-07	4E-09	3.54E-09	14.06631	0.739188	0.003755	739.1884
Tuolumne	2020	ConstMin - Surfacing Equipment	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	ConstMin - Surfacing Equipment	Aggregate	50	Diesel	2.27E-07	2.75E-07	3.27E-07	2.02E-06	2.18E-06	0.000308	1.11E-07	1.02E-07	1.11E-07	2.84E-09	2.51E-09	9.98458	15.81506	0.066421	569.4631
Tuolumne	2020	ConstMin - Surfacing Equipment	Aggregate	75	Diesel	1.93E-07	2.33E-07	2.77E-07	1.64E-06	2.74E-06	0.000234	1.71E-07	1.57E-07	1.71E-07	2.16E-09	1.91E-09	7.607981	7.315773	0.028953	486.4669
Tuolumne	2020	ConstMin - Surfacing Equipment	Aggregate	100	Diesel	8.57E-07	1.04E-06	1.23E-06	1.14E-05	1.13E-05	0.001767	6.36E-07	5.85E-07	6.36E-07	1.63E-08	1.44E-08	57.32955	40.9197	0.154983	3674.683
Tuolumne	2020	ConstMin - Surfacing Equipment	Aggregate	175	Diesel	7.93E-07	9.59E-07	1.14E-06	9.51E-06	1.11E-05	0.001654	5.46E-07	5.02E-07	5.46E-07	1.53E-08	1.35E-08	53.6647	25.40289	0.100484	3446.122
Tuolumne	2020	ConstMin - Surfacing Equipment	Aggregate	300	Diesel	1.16E-06	1.4E-06	1.67E-06	8.84E-06	2.12E-05	0.003269	6.85E-07	6.3E-07	6.85E-07	3.02E-08	2.67E-08	106.0511	29.81781	0.124327	6799.105
Tuolumne	2020	ConstMin - Surfacing Equipment	Aggregate	600	Diesel	2.08E-06	2.52E-06	3E-06	2.13E-05	3.15E-05	0.010363	1.13E-06	1.04E-06	1.13E-06	9.58E-08	8.46E-08	336.2278	53.10062	0.189046	21575.82
Tuolumne	2020	ConstMin - Surfacing Equipment	Aggregate	750	Diesel	1.26E-06	1.53E-06	1.82E-06	9.9E-06	2.32E-05	0.00511	8.19E-07	7.53E-07	8.19E-07	4.72E-08	4.17E-08	165.7931	16.71932	0.059609	10633.65
Tuolumne	2020	ConstMin - Surfacing Equipment	Aggregate	9999	Diesel	6.5E-07	7.86E-07	9.36E-07	3.7E-06	1.54E-05	0.001696	3.68E-07	3.38E-07	3.68E-07	1.57E-08	1.38E-08	55.03113	4.029279	0.015328	3530.116
Tuolumne	2020	ConstMin - Sweepers/Scrubbers	Aggregate	25	Diesel	3.05E-07	3.69E-07	4.39E-07	1.01E-06	6.98E-07	5.33E-05	9.6E-08	8.83E-08	9.6E-08	4.84E-10	4.35E-10	1.73079	2.641937	0.003611	66.04843
Tuolumne	2020	ConstMin - Sweepers/Scrubbers	Aggregate	50	Diesel	3.8E-05	4.6E-05	5.47E-05	0.000211	0.000175	0.020205	1.59E-05	1.46E-05	1.59E-05	1.86E-07	1.65E-07	655.5381	701.4665	1.016376	25031.42
Tuolumne	2020	ConstMin - Sweepers/Scrubbers	Aggregate	75	Diesel	5.93E-06	7.18E-06	8.54E-06	4.18E-05	5.91E-05	0.005495	4.76E-06	4.38E-06	4.76E-06	5.06E-08	4.48E-08	178.2699	104.0343	0.182334	7537.484
Tuolumne	2020	ConstMin - Sweepers/Scrubbers	Aggregate	100	Diesel	1.94E-05	2.35E-05	2.8E-05	0.000184	0.000206	0.025816	1.65E-05	1.52E-05	1.65E-05	2.38E-07	2.11E-07	837.5609	449.4354	0.648097	35557.76
Tuolumne	2020	ConstMin - Sweepers/Scrubbers	Aggregate	175	Diesel	5.63E-06	6.81E-06	8.11E-06	4.96E-05	6.8E-05	0.00781	3.5E-06	3.22E-06	3.5E-06	7.2E-08	6.37E-08	253.3888	67.25663	0.09568	10749.78
Tuolumne	2020	ConstMin - Sweepers/Scrubbers	Aggregate	300	Diesel	1.64E-06	1.98E-06	2.36E-06	1.01E-05	2.46E-05	0.00469	7.89E-07	7.26E-07	7.89E-07	4.33E-08	3.83E-08	152.1715	30.78501	0.043327	6455.735
Tuolumne	2020	ConstMin - Sweepers/Scrubbers	Aggregate	600	Diesel	5.1E-07	6.17E-07	7.34E-07	8.39E-06	7.08E-06	0.000633	3.57E-07	3.29E-07	3.57E-07	5.84E-09	5.17E-09	20.55058	2.641937	0.003611	871.8393
Tuolumne	2020	ConstMin - Sweepers/Scrubbers	Aggregate	9999	Diesel	3.11E-07	3.77E-07	4.48E-07	1.62E-06	6.52E-06	0.000814	1.85E-07	1.7E-07	1.85E-07	7.52E-09	6.64E-09	26.40439	1.320969	0.001805	1120.181
Tuolumne	2020	ConstMin - Tractors/Loaders/Backhoes	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	ConstMin - Tractors/Loaders/Backhoes	Aggregate	50	Diesel	7.82E-05	9.46E-05	0.000113	0.000574	0.000501	0.065793	3.28E-05	3.02E-05	3.28E-05	6.06E-07	5.37E-07	2134.578	2675.089	5.299391	101410
Tuolumne	2020	ConstMin - Tractors/Loaders/Backhoes	Aggregate	75	Diesel	2.63E-05	3.18E-05	3.79E-05	0.000106	0.00025	0.010445	2E-05	1.84E-05	2E-05	9.58E-08	8.53E-08	338.892	246.8371	1.126351	17781.98
Tuolumne	2020	ConstMin - Tractors/Loaders/Backhoes	Aggregate	100	Diesel	0.000517	0.000626	0.000745	0.007049	0.006357	1.045486	0.000398	0.000366	0.000398	9.65E-06	8.53E-06	33919.65	21355.17	34.85596	1775414
Tuolumne	2020	ConstMin - Tractors/Loaders/Backhoes	Aggregate	175	Diesel	7.09E-05	8.58E-05	0.000102	0.001085	0.000844	0.18274	4.25E-05	3.91E-05	4.25E-05	1.69E-06	1.49E-06	5928.797	2181.882	4.025321	312841.3
Tuolumne	2020	ConstMin - Tractors/Loaders/Backhoes	Aggregate	300	Diesel	4.03E-05	4.88E-05	5.81E-05	0.000266	0.000591	0.113022	1.97E-05	1.81E-05	1.97E-05	1.04E-06	9.22E-07	3666.877	928.4722	1.685834	192753.2
Tuolumne	2020	ConstMin - Tractors/Loaders/Backhoes	Aggregate	600	Diesel	4.81E-05	5.82E-05	6.92E-05	0.000396	0.000634	0.150352	2.24E-05	2.06E-05	2.24E-05	1.39E-06	1.23E-06	4878	767.4347	1.458717	258330.9
Tuolumne	2020	ConstMin - Tractors/Loaders/Backhoes	Aggregate	750	Diesel	1.09E-06	1.32E-06	1.58E-06	1.02E-05	1.22E-05	0.005085	3.36E-07	3.09E-07	3.36E-07	4.7E-08	4.15E-08	164.9851	13.79533	0.020311	8762.55
Tuolumne	2020	ConstMin - Tractors/Loaders/Backhoes	Aggregate	9999	Diesel	1.41E-05	1.71E-05	2.03E-05	0.000101	0.000331	0.051385	6.72E-06	6.18E-06	6.72E-06	4.75E-07	4.19E-07	1667.123	47.24972	0.077552	87428.94
Tuolumne	2020	ConstMin - Trenchers	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	ConstMin - Trenchers	Aggregate	50	Diesel	2.95E-05	3.57E-05	4.25E-05	0.000191	0.000185	0.023267	1.41E-05	1.29E-05	1.41E-05	2.14E-07	1.9E-07	754.8577	653.7648	1.73772	26082.56
Tuolumne	2020	ConstMin - Trenchers	Aggregate	75	Diesel	2.3E-06	2.79E-06	3.32E-06	1.32E-05	2.33E-05	0.001553	1.6E-06	1.47E-06	1.6E-06	1.43E-08	1.27E-08	50.37959	27.36098	0.104658	1931.58
Tuolumne	2020	ConstMin - Trenchers	Aggregate	100	Diesel	1.37E-05	1.66E-05	1.97E-05	0.000108	0.000152	0.015307	1.15E-05	1.06E-05	1.15E-05	1.41E-07	1.25E-07	496.6172	227.4032	0.701012	19077.96
Tuolumne	2020	ConstMin - Trenchers	Aggregate	175	Diesel	2.29E-06	2.77E-06	3.29E-06	2.19E-05	2.94E-05	0.003443	1.5E-06	1.38E-06	1.5E-06	3.18E-08	2.81E-08	111.6933	30.13848	0.106633	4312.618

Tuolumne	2020	ConstMin - Trenchers	Aggregate	300	Diesel	4.56E-06	5.52E-06	6.57E-06	2.6E-05	6.77E-05	0.008358	2.73E-06	2.51E-06	2.73E-06	7.71E-08	6.82E-08	271.1761	45.47094	0.148101	10405.24
Tuolumne	2020	ConstMin - Trenchers	Aggregate	600	Diesel	3.85E-06	4.66E-06	5.55E-06	3.93E-05	5.47E-05	0.01122	2.06E-06	1.89E-06	2.06E-06	1.04E-07	9.16E-08	364.0085	35.91817	0.100709	13953.67
Tuolumne	2020	ConstMin - Trenchers	Aggregate	750	Diesel	4.24E-07	5.13E-07	6.1E-07	6.6E-06	4.32E-06	0.003662	6.3E-08	5.8E-08	6.3E-08	3.38E-08	2.99E-08	118.8204	7.06381	0.015797	4568.259
Tuolumne	2020	ConstMin - Trenchers	Aggregate	9999	Diesel	5.51E-07	6.66E-07	7.93E-07	7.91E-06	7.64E-06	0.000304	3.53E-07	3.25E-07	3.53E-07	2.79E-09	2.48E-09	9.849223	0.440525	0.001975	378.8511
Tuolumne	2020	Industrial - Aerial Lifts	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	Industrial - Aerial Lifts	Aggregate	50	Diesel	2.93E-06	3.54E-06	4.22E-06	6.56E-05	6.25E-05	0.012424	6.53E-07	6.01E-07	6.53E-07	1.15E-07	1.01E-07	403.0691	492.9964	1.668312	22741.29
Tuolumne	2020	Industrial - Aerial Lifts	Aggregate	75	Diesel	2.62E-06	3.17E-06	3.77E-06	8.63E-05	4.9E-05	0.014346	1.35E-06	1.24E-06	1.35E-06	1.33E-07	1.17E-07	465.4317	404.1744	1.372283	29192.41
Tuolumne	2020	Industrial - Aerial Lifts	Aggregate	100	Diesel	1.28E-06	1.55E-06	1.84E-06	4.41E-05	2.77E-05	0.007332	3.61E-07	3.32E-07	3.61E-07	6.77E-08	5.98E-08	237.8762	191.7285	0.648744	14920.42
Tuolumne	2020	Industrial - Aerial Lifts	Aggregate	175	Diesel	2.02E-07	2.45E-07	2.91E-07	7.13E-06	2.47E-06	0.001325	8.03E-08	7.39E-08	8.03E-08	1.22E-08	1.08E-08	42.98335	20.67438	0.070071	2697.249
Tuolumne	2020	Industrial - Aerial Lifts	Aggregate	300	Diesel	8.4E-09	1.02E-08	1.21E-08	1.42E-07	1.01E-07	7.92E-05	1.34E-09	1.23E-09	1.34E-09	7.32E-10	6.46E-10	2.56859	0.700797	0.002362	161.1832
Tuolumne	2020	Industrial - Aerial Lifts	Aggregate	600	Diesel	4.79E-09	5.79E-09	6.89E-09	1E-07	2.77E-08	5.62E-05	9.43E-10	8.68E-10	9.43E-10	5.2E-10	4.59E-10	1.824071	0.233599	0.000787	114.4635
Tuolumne	2020	Industrial - Forklifts	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	Industrial - Forklifts	Aggregate	50	Diesel	1.32E-05	1.6E-05	1.9E-05	8.12E-05	6.67E-05	0.008362	5.12E-06	4.71E-06	5.12E-06	7.69E-08	6.82E-08	271.2817	552.9687	0.773392	23445.87
Tuolumne	2020	Industrial - Forklifts	Aggregate	75	Diesel	1.91E-06	2.31E-06	2.75E-06	7.75E-06	1.81E-05	0.000792	1.5E-06	1.38E-06	1.5E-06	7.26E-09	6.46E-09	25.68732	33.69387	0.066473	2478.368
Tuolumne	2020	Industrial - Forklifts	Aggregate	100	Diesel	7.05E-05	8.53E-05	0.000101	0.00071	0.000771	0.099938	5.73E-05	5.27E-05	5.73E-05	9.22E-07	8.16E-07	3242.391	3788.735	5.096718	312358.3
Tuolumne	2020	Industrial - Forklifts	Aggregate	175	Diesel	1.68E-05	2.04E-05	2.43E-05	0.000196	0.0002	0.031813	1.08E-05	9.97E-06	1.08E-05	2.94E-07	2.6E-07	1032.135	702.9656	0.95875	99341.82
Tuolumne	2020	Industrial - Forklifts	Aggregate	300	Diesel	3.26E-06	3.95E-06	4.7E-06	1.98E-05	4.36E-05	0.006939	1.71E-06	1.58E-06	1.71E-06	6.41E-08	5.66E-08	225.133	102.9852	0.140617	21614.53
Tuolumne	2020	Industrial - Forklifts	Aggregate	600	Diesel	5.81E-07	7.03E-07	8.37E-07	4.01E-06	6.59E-06	0.001746	2.41E-07	2.22E-07	2.41E-07	1.61E-08	1.42E-08	56.63988	15.32836	0.021732	5414.977
Tuolumne	2020	Industrial - Forklifts	Aggregate	9999	Diesel	1.71E-08	2.07E-08	2.46E-08	2.58E-07	6.13E-07	0.000139	5.25E-09	4.83E-09	5.25E-09	1.28E-09	1.13E-09	4.498495	0.491933	0.000639	432.9014
Tuolumne	2020	Industrial - Other General Industrial Equipment	Aggregate	25	Diesel	1.09E-08	1.32E-08	1.57E-08	3.63E-08	2.5E-08	1.91E-06	3.44E-09	3.16E-09	3.44E-09	1.73E-11	1.56E-11	0.061955	0.126096	0.000565	3.152405
Tuolumne	2020	Industrial - Other General Industrial Equipment	Aggregate	50	Diesel	2.39E-05	2.89E-05	3.44E-05	0.000168	0.000141	0.01798	1.02E-05	9.38E-06	1.02E-05	1.66E-07	1.47E-07	583.351	843.0715	1.030989	29598.69
Tuolumne	2020	Industrial - Other General Industrial Equipment	Aggregate	75	Diesel	6.2E-06	7.5E-06	8.93E-06	8.14E-05	7.58E-05	0.011715	4.86E-06	4.47E-06	4.86E-06	1.08E-07	9.56E-08	380.0713	300.1871	0.363446	21474.42
Tuolumne	2020	Industrial - Other General Industrial Equipment	Aggregate	100	Diesel	3.8E-06	4.59E-06	5.47E-06	2.21E-05	3.46E-05	0.002763	3.19E-06	2.93E-06	3.19E-06	2.54E-08	2.26E-08	89.63954	64.8437	0.085916	5077.592
Tuolumne	2020	Industrial - Other General Industrial Equipment	Aggregate	175	Diesel	3.02E-06	3.65E-06	4.34E-06	4.18E-05	3.46E-05	0.00677	1.86E-06	1.71E-06	1.86E-06	6.25E-08	5.53E-08	219.6452	83.61438	0.102873	12416.31
Tuolumne	2020	Industrial - Other General Industrial Equipment	Aggregate	300	Diesel	3.06E-06	3.7E-06	4.4E-06	1.86E-05	4.66E-05	0.007279	1.51E-06	1.39E-06	1.51E-06	6.72E-08	5.94E-08	236.1675	61.0419	0.076872	13335.81
Tuolumne	2020	Industrial - Other General Industrial Equipment	Aggregate	600	Diesel	6.26E-06	7.57E-06	9.01E-06	5.05E-05	7.05E-05	0.021043	2.48E-06	2.29E-06	2.48E-06	1.94E-07	1.72E-07	682.7301	100.9791	0.121526	38583.74
Tuolumne	2020	Industrial - Other General Industrial Equipment	Aggregate	750	Diesel	9.38E-07	1.13E-06	1.35E-06	1.21E-05	9.09E-06	0.003537	4.33E-07	3.98E-07	4.33E-07	3.27E-08	2.89E-08	114.7392	10.26801	0.012435	6474.079
Tuolumne	2020	Industrial - Other General Industrial Equipment	Aggregate	9999	Diesel	3.45E-07	4.17E-07	4.97E-07	2.38E-06	8.7E-06	0.001225	1.75E-07	1.61E-07	1.75E-07	1.13E-08	1E-08	39.75571	1.931794	0.002261	2248.125
Tuolumne	2020	Industrial - Other Material Handling Equipment	Aggregate	25	Diesel	1.41E-08	1.71E-08	2.03E-08	4.79E-08	3.25E-08	2.52E-06	4.54E-09	4.17E-09	4.54E-09	2.29E-11	2.06E-11	0.081787	0.143888	0.000645	3.597208
Tuolumne	2020	Industrial - Other Material Handling Equipment	Aggregate	50	Diesel	1.46E-06	1.77E-06	2.11E-06	8.81E-06	7.35E-06	0.000838	6.26E-07	5.76E-07	6.26E-07	7.71E-09	6.84E-09	27.20164	33.50871	0.045149	1189.316
Tuolumne	2020	Industrial - Other Material Handling Equipment	Aggregate	75	Diesel	2.04E-07	2.47E-07	2.93E-07	1.74E-06	2.2E-06	0.000228	1.77E-07	1.63E-07	1.77E-07	2.1E-09	1.86E-09	7.40182	5.022421	0.00774	363.6702
Tuolumne	2020	Industrial - Other Material Handling Equipment	Aggregate	100	Diesel	3.4E-06	4.12E-06	4.9E-06	6.09E-05	4.69E-05	0.0092	2.15E-06	1.98E-06	2.15E-06	8.5E-08	7.51E-08	298.469	156.4915	0.205752	14583.03
Tuolumne	2020	Industrial - Other Material Handling Equipment	Aggregate	175	Diesel	3.46E-06	4.19E-06	4.99E-06	3.99E-05	3.56E-05	0.00635	2.42E-06	2.23E-06	2.42E-06	5.86E-08	5.18E-08	206.0033	72.53697	0.101908	10061.08
Tuolumne	2020	Industrial - Other Material Handling Equipment	Aggregate	300	Diesel	5.18E-06	6.26E-06	7.46E-06	2.81E-05	7.18E-05	0.011154	2.62E-06	2.41E-06	2.62E-06	1.03E-07	9.1E-08	361.8678	73.7924	0.099328	17696.03
Tuolumne	2020	Industrial - Other Material Handling Equipment	Aggregate	600	Diesel	5.35E-06	6.48E-06	7.71E-06	3.78E-05	7.68E-05	0.013054	2.64E-06	2.43E-06	2.64E-06	1.21E-07	1.07E-07	423.5125	56.16177	0.076109	20660.37
Tuolumne	2020	Industrial - Other Material Handling Equipment	Aggregate	750	Diesel	2.61E-07	3.15E-07	3.75E-07	1.23E-06	2.94E-06	0.000601	1.44E-07	1.33E-07	1.44E-07	5.55E-09	4.91E-09	19.49968	1.530252	0.001935	953.8572
Tuolumne	2020	Industrial - Other Material Handling Equipment	Aggregate	9999	Diesel	2.52E-07	3.05E-07	3.63E-07	1.9E-06	5.94E-06	0.000972	1.12E-07	1.03E-07	1.12E-07	8.98E-09	7.93E-09	31.52274	1.530252	0.001935	1541.984
Tuolumne	2020	OFF - Agricultural - Agricultural Tractors	Aggregate	25	Diesel	0.000444	0.000528	0.000639	0.00252	0.004027	0.535237	0.000152	0.00014	0.000152	7.25E-06	4.48E-06	17804.7	24652.1	46.29	445624.9
Tuolumne	2020	OFF - Agricultural - Hydro Power Units	Aggregate	25	Diesel	3.01E-06	3.58E-06	4.33E-06	1.59E-05	2.73E-05	0.003608	1.03E-06	9.45E-07	1.03E-06	4.73E-08	2.85E-08	113.15	266.45	0.32	4471.25
Tuolumne	2020	OFF - Agricultural - Other Agricultural Equipment	Aggregate	25	Diesel	6.99E-06	8.31E-06	1.01E-05	3.71E-05	6.36E-05	0.00835	2.5E-06	2.3E-06	2.5E-06	1.1E-07	6.98E-08	277.4	492.75	1.08	9563
Tuolumne	2020	OFF - Agricultural - Sprayers	Aggregate	25	Diesel	7.26E-07	8.64E-07	1.05E-06	3.35E-06	6.12E-06	0.000766	2.9E-07	2.66E-07	2.9E-07	9.72E-09	0	0	54.75	0.44	1040.25
Tuolumne	2020	OFF - ConstMin - Bore/Drill Rigs	Aggregate	25	Diesel	1.7E-06	2.03E-06	2.45E-06	9.15E-06	1.55E-05	0.002046	5.83E-07	5.36E-07	5.83E-07	2.7E-08	1.65E-08	65.7	98.55	0.11	1522.05
Tuolumne	2020	OFF - ConstMin - Cement and Mortar Mixers	Aggregate	25	Diesel	4.32E-06	5.14E-06	6.21E-06	3E-05	3.88E-05	0.005241	1.54E-06	1.42E-06	1.54E-06	7.85E-08	4.59E-08	182.5	536.55	1.75	5588.15
Tuolumne	2020	OFF - ConstMin - Concrete/Industrial Saws	Aggregate	25	Diesel	1.41E-07	1.68E-07	2.04E-07	6.95E-07	1.29E-06	0.000169	4.81E-08	4.42E-08	4.81E-08	2.14E-09	0	0	0	0	0
Tuolumne	2020	OFF - ConstMin - Concrete/Industrial Saws	Aggregate	50	Diesel	2.59E-06	3.08E-06	3.73E-06	2.13E-05	1.96E-05	0.002654	9.9E-07	9.11E-07	9.9E-07	3.43E-08	2.02E-08	80.3	58.4	0.14	1927.2
Tuolumne	2020	OFF - ConstMin - Dumpers/Tenders	Aggregate	25	Diesel	4.39E-07	5.23E-07	6.33E-07	2.16E-06	4E-06	0.000524	1.52E-07	1.4E-07	1.52E-07	6.65E-09	3.67E-09	14.6	40.15	0.09	642.4
Tuolumne	2020	OFF - ConstMin - Excavators	Aggregate	25	Diesel	3.08E-06	3.66E-06	4.43E-06	1.51E-05	2.8E-05	0.003674	1.05E-06	9.63E-07	1.05E-06	4.66E-08	3.03E-08	120.45	167.9	0.12	3861.7
Tuolumne	2020	OFF - ConstMin - Other Construction Equipment	Aggregate	25	Diesel	9.93E-06	1.18E-05	1.43E-05	7.01E-05	8.97E-05	0.012199	3.47E-06	3.2E-06	3.47E-06	1.83E-07	1.01E-07	401.5	839.5	1.23	11380.7
Tuolumne	2020	OFF - ConstMin - Pavers	Aggregate	25	Diesel	8.34E-07	9.93E-07	1.2E-06	4.09E-06	7.6E-06	0.000994	2.94E-07	2.7E-07	2.94E-07	1.26E-08	9.18E-09	36.5	36.5	0.01	876
Tuolumne	2020	OFF - ConstMin - Paving Equipment	Aggregate	25	Diesel	9.87E-07	1.17E-06	1.42E-06	4.85E-06	8.98E-06	0.001178	3.35E-07	3.08E-07	3.35E-07	1.49E-08	9.18E-09	36.5	65.7	0.06	1248.3
Tuolumne	2020	OFF - ConstMin - Plate Compactors	Aggregate	25	Diesel	2.92E-06	3.47E-06	4.2E-06	2.2E-05	2.63E-05	0.003606	1.03E-06	9.45E-07	1.03E-06	5.61E-08	3.03E-08	120.45	613.2	1.03	4905.6
Tuolumne	2020	OFF - ConstMin - Rollers	Aggregate	25	Diesel	1.78E-05	2.12E-05	2.56E-05	0.000112	0.000161	0.021651	6.17E-06	5.67E-06	6.17E-06	3.08E-07	1.82E-07	722.7	1883.4	2.73	22535.1
Tuolumne	2020	OFF - ConstMin - Rubber Tired Loaders	Aggregate	25	Diesel	8.22E-07	9.79E-07	1.18E-06	4.04E-06	7.48E-06	0.000981	2.8E-07	2.57E-07	2.8E-07	1.25E-08	7.35E-09	29.2	40.15	0.05	1003.75
Tuolumne	2020	OFF - ConstMin - Signal Boards	Aggregate	25	Diesel	4.56E-05	5.42E-05	6.56E-05	0.000344	0.000411	0.056365	1.61E-05	1.48E-05	1.61E-05	8.77E-07	4.73E-07	1879.75	6679.5	8.89	40077
Tuolumne	2020	OFF - ConstMin - Signal Boards	Aggregate	50	Diesel	1.13E-06	1.35E-06	1.63E-06	9.18E-06	8.53E-06	0.001173	4.25E-07	3.91E-07	4.25E-07	1.52E-08	1.01E-08	40.15	0	0	0
Tuolumne	2020	OFF - ConstMin - Skid Steer Loaders	Aggregate	25	Diesel	8.24E-05	9.8E-05	0.000119	0.000398	0.000741	0.095579	3.01E-05	2.77E-05	3.01E-05	1.21E-06	7.98E-07	3171.85	5066.2	6.07	101324
Tuolumne	2020	OFF - ConstMin - Tractors/Loaders/Backhoes	Aggregate	25	Diesel	1.53E-05	1.82E-05	2.2E-05	7.51E-05	0.000139	0.018234	5.23E-06	4.81E-06	5.23E-06	2.31E-07	1.52E-07	605.9	839.5	0.9	19308.5
Tuolumne	2020	OFF - ConstMin - Trenchers	Aggregate	25	Diesel	7.2E-06	8.57E-06	1.04E-05	3.9E-05	6.54E-05	0.008652	2.46E-06	2.27E-06	2.46E-06	1.15E-07	6.98E-08	277.4	299.3	0.49	6679.5
Tuolumne	2020	OFF - Industrial - Aerial Lifts	Aggregate	25	Diesel	3.36E-06	4E-06	4.84E-06	1.9E-05	3.01E-05	0.003957	1.21E-06	1.12E-06	1.21E-06	5.39E-08	3.31E-08	131.4	284.7	0.71	4985.9
Tuolumne	2020	OFF - Industrial - Other General Industrial Equipment	Aggregate	25	Diesel	4.05E-06	4.82E-06	5.83E-06	2.29E-05	3.77E-05	0.005	1.42E-06	1.31E-06	1.42E-06	6.68E-08	4.04E-08	160.6	321.2	0.22	5818.1
Tuolumne	2020	OFF - Industrial - Sweepers/Scrubbers	Aggregate	25	Diesel	8.06E-07	9.6E-07	1.16E-06	4.95E-06	7.62E-06	0.001017	2.9E-07	2.66E-07	2.9E-07	1.4E-08	7.35E-09	29.2	43.8	0.08	777.45
Tuolumne	2020	OFF - Light Commercial - Air Compressors	Aggregate	25	Diesel	4.63E-06	5.51E-06	6.66E-06	2.36E-05	3.99E-05	0.005009	1.88E-06	1.73E-06	1.88E-06	6.65E-08	3.86E-08	153.3	295.65	0.37	6000.6
Tuolumne	2020	OFF - Light Commercial - Air Compressors	Aggregate	50	Diesel	6.59E-05	7.84E-05	9.48E-05	0.000502	0.000429	0.056028	2.39E-05	2.2E-05	2.39E-05	7.24E-07	4.72E-07	1876.1	1835.95	2.26	67930.15
Tuolumne	2020	OFF - Light Commercial - Generator Sets	Aggregate	25	Diesel	0.00011	0.00013	0.000158	0.000678	0.001039	0.130979	4.77E-05	4.39E-05	4.77E-05	1.83E-06	1.1E-06	4354.45	7172.25	21.22	103160
Tuolumne	2020	OFF - Light Commercial - Generator Sets	Aggregate	50	Diesel	0.000125	0.000149	0.000181	0.001077	0.001101	0.155073	5.12E-05	4.71E-05	5.12E-05	2E-06	1.3E-06	5179.35	3697.45	10.96	122015.8
Tuolumne	2020	OFF - Light Commercial - Pressure Washers	Aggregate	25	Diesel	5.98E-07	7.12E-07	8.61E-07	4.25E-06	5.86E-06	0.00074	2.72E-07	2.5E-07	2.72E-07	1.1E-08	0	0	80.3	0.74	1043.9
Tuolumne	2020	OFF - Light Commercial - Pressure Washers	Aggregate	50	Diesel	4.36E-07	5.19E-07	6.28E-07	4.41E-06	5.09E-06	0.000745	2.04E-07	1.88E-07	2.04E-07	9.63E-09	0	0	36.5	0.23	1387
Tuolumne	2020	OFF - Light Commercial - Pumps	Aggregate	25	Diesel	6.1E-05	7.26E-05	8.79E-05	0.000363	0.000535	0.067241	2.58E-05	2.37E-05	2.58E-05	9.61E-07	5.61E-07	2230.15	4803.4	11.94	52662.2
Tuolumne	2020	OFF - Light Commercial - Pumps	Aggregate	50	Diesel	8.03E-05	9.55E-05	0.000116	0.000662	0.000653	0.090762	3.17E-05	2.92E-05	3.17E-05	1.17E-06	7.63E-07	3033.15	1927.2	4.79	71306.4
Tuolumne	2020	OFF - Light Commercial - Welders	Aggregate	25	Diesel	5.41E-05	6.44E-05	7.79E-05	0.000299	0.00047	0.059109	2.24E-05	2.06E-05	2.24E-05	8.15E-07	4.94E-07	1963.7	5033.35	7.82	76587.95
Tuolumne	2020	OFF - Light Commercial - Welders	Aggregate	50	Diesel	0.000283	0.000336	0.000407	0.002162	0.001929	0.257497	0.000104	9.6E-05	0.000104	3.33E-06	2.17E-06	8639.55	7241.6	11.29	333113.6
Tuolumne	2020	OFF - Logging - Fellers/Bunchers	Aggregate	100	Diesel	0.001466	0.001745	0.002111	0.025752	0.015452	4.031624	0.000545	0.000501	0.000545	4.73E-05	3.37E-05	134133.8	32123.65	25.16	3308736
Tuolumne	2020	OFF - Logging - Fellers/Bunchers	Aggregate	175	Diesel	0.002255	0.002684	0.003247	0.041504	0.01671	7.358957	0.00069	0.000635	0.00069	8.28E-05	6.15E-05	244458.8	39730.25	31.11	6038998
Tuolumne	2020	OFF - Logging - Fellers/Bunchers	Aggregate	300	Diesel	0.001716	0.002043	0.002471	0.01243	0.010509	6.468957	0.000326	0.0003	0.000326	7.28E-05	5.37E-05	213601.7	24243.3	18.97	5309283
Tuolumne	2020	OFF - Logging - Fellers/Bunchers	Aggregate	600	Diesel	0.000755	0.000898	0.001087	0.005268	0.004394	2.85445	0.000142	0.000131	0.000142	2.8E-05	2.37E-05	94243	7121.15	5.58	2342858
Tuolumne	2020	OFF - Logging - Fellers/Bunchers	Aggregate	750	Diesel	0.000114	0.000136	0.000165	0.000798	0.00067	0.432482	2.16E-05	1.99E-05	2.16E-05	4.35E-06	3.59E-06	14271.5	536.55	0.41	350367.2
Tuolumne	2020	OFF - Logging - Shredders	Aggregate	175	Diesel	1.24E-07	1.47E-07	1.78E-07	2.4E-06	1.91E-06	0.000491	7.49E-08	6.89E-08	7.49E-08	5.53E-09	0	0	0	0	0
Tuolumne	2020	OFF - Logging - Skidders	Aggregate	100	Diesel	0.000821	0.000977	0.001183	0.013993	0.008344	2.164274	0.000295	0.000271	0.000295	2.54E-05	1.81E-05	72018.15	16702.4	11.57	1703645
Tuolumne	2020	OFF - Logging - Skidders	Aggregate	175	Diesel	0.001635	0.001945	0.002354	0.029252	0.011698	5.124004	0.000483	0.000444	0.000483	5.77E-05	4.28E-05	170246.9	26714.35	18.52	4033867
Tuolumne	2020	OFF - Logging - Skidders	Aggregate	300	Diesel	0.000782	0.000931	0.001126	0.00551	0.004621	2.833277	0.000144	0.000132	0.000144	3.19E-05	2.35E-05	93564.1	9833.1	6.79	2232114
Tuolumne	2020	OFF - Logging - Skidders	Aggregate	600	Diesel	5.22E-05	6.21E-05	7.51E-05	0.000353	0.000293	0.189561	9.52E-06	8.76E-06	9.52E-06	1.86E-06	1.57E-06	6248.8	547.5	0.38	147825
Tuolumne	2020	Oil Drilling - Drill Rig (Mobile)	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	Oil Drilling - Drill Rig (Mobile)	Aggregate	50	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	Oil Drilling - Drill Rig (Mobile)	Aggregate	75	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	Oil Drilling - Drill Rig (Mobile)	Aggregate	100	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	Oil Drilling - Drill Rig (Mobile)	Aggregate	175	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	Oil Drilling - Drill Rig (Mobile)	Aggregate	300	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	Oil Drilling - Drill Rig (Mobile)	Aggregate	600	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	Oil Drilling - Drill Rig (Mobile)	Aggregate	750	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	Oil Drilling - Drill Rig (Mobile)	Aggregate	9999	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	Oil Drilling - Workover Rig (Mobile)	Aggregate	25	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	Oil Drilling - Workover Rig (Mobile)	Aggregate	75	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	Oil Drilling - Workover Rig (Mobile)	Aggregate	175	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	Oil Drilling - Workover Rig (Mobile)	Aggregate	300	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	Oil Drilling - Workover Rig (Mobile)	Aggregate	600	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	Oil Drilling - Workover Rig (Mobile)	Aggregate	750	Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuolumne	2020	Portable Equipment - Non-Rental Generator	Aggregate	50	Diesel	2.93E-05	3.54E-05	4.22E-05	0.000423	0.000227	0.041154	3.34E-06	3.07E-06	3.34E-06	3.8E-07	3.36E-07	1335.189	1497.682	1.140138	79293.58
Tuolumne	2020	Portable Equipment - Non-Rental Generator	Aggregate	75	Diesel	2.62E-05	3.18E-05	3.78E-05	0.000367	0.000253	0.048124	2.45E-06	2.26E-06	2.45E-06	4.44E-07	3.93E-07	1561.32	1497.682	1.140138	103081.7
Tuolumne	2020	Portable Equipment - Non-Rental Generator	Aggregate	175	Diesel	5.03E-05	6.08E-05	7.24E-05	0.00069	0.00065	0.107353	3.74E-05	3.44E-05	3.74E-05	9.91E-07	8.76E-07	3482.945	1497.682	1.140138	229951.4
Tuolumne	2020	Portable Equipment - Non-Rental Generator	Aggregate	600	Diesel	0.00013	0.000157	0.000187	0.000575	0.001428	0.276896	6.92E-05	6.37E-05	6.92E-05	2.56E-06	2.26E-06	8983.597	1497.682	1.140138	593116
Tuolumne	2020	Portable Equipment - Non-Rental Other Portable Equipm	Aggregate	175	Diesel	5.31E-06	6.43E-06	7.65E-06	0.00027	6.22E-05	0.049612	8.17E-07	7.51E-07	8.17E-07	4.59E-07	4.05E-07	1609.597	699.3686	2.280276	106269
Tuolumne	2020	Portable Equipment - Non-Rental Pump	Aggregate	100	Diesel	3.49E-06	4.22E-06	5.03E-06	8.55E-05	7.16E-05	0.013512	4.75E-06	4.37E-06	4.75E-06	1.25E-07	1.1E-07	438.3866	350.4319	1.140138	28943.21
Tuolumne	2020	TRU - Instate Genset TRU	Aggregate	50	Diesel	0.000103	0.000124	0.000148	0.002094	0.001628	0.045515	6.91E-06	6.36E-06	6.91E-06	4.21E-07	3.74E-07	28.89159	17405.15	22.29369	548262.1
Tuolumne	2020	TRU - Instate Trailer TRU	Aggregate	50	Diesel	0.002056	0.002487	0.00296	0.031865	0.0228	0.542525	0.000437	0.000402	0.000437	4.99E-06	4.46E-06	344.3752	137887.8	104.0755	4688186
Tuolumne	2020	TRU - Instate Truck TRU	Aggregate	25	Diesel	0.000315	0.000382	0.000454	0.003074	0.003703	0.073705	0.000154	0.000141	0.000154	6.77E-07	6.06E-07	46.7853	37105.05	27.26308	523181.2
Tuolumne	2020	TRU - Instate Van TRU	Aggregate	25	Diesel	7.3E-06	8.83E-06	1.05E-05	7.12E-05	8.57E-05	0.001706	3.56E-06	3.27E-06	3.56E-06	1.57E-08	1.4E-08	1.083112	1345.779	0.988816	12112.01
Tuolumne	2020	TRU - Out-of-State Genset TRU	Aggregate	50	Diesel	6.45E-05	7.8E-05	9.29E-05	0.001317	0.001025	0.028681	4.38E-06	4.03E-06	4.38E-06	2.65E-07	2.36E-07	18.20538	10967.46	88.70195	345474.9
Tuolumne	2020	TRU - Out-of-State Trailer TRU	Aggregate	50	Diesel	0.001077	0.001303	0.00155	0.01843	0.01319	0.334498	0.000135	0.000124	0.000135	3.08E-06	2.75E-06	212.3273	85015.84	405.1774	2890539
Tuolumne	2020	TRU - Railcar TRU	Aggregate	50	Diesel	0.000111	0.000135	0.00016	0.001908	0.001365	0.034625	1.4E-05	1.28E-05	1.4E-05	3.19E-07	2.84E-07	21.97861	8800.235	27.29347	299208

Equipment Name	Quantity	HP	HPF
301 Mini-Exc 3.8k/.04cy	1	17	65
Airtrak, 4"-6"/12' feed-900cfm	1	900	80
Asphalt Milling Machine	1	600	85
Boom truck, 5.0ton/32'boom	1	170	65
Cat 226B / Bobcat Loader	1	54	70
Compactor, BW5AS, 6t/40"	1	50	80
Compressor, stationary 1200cfm	2	360	75
Compressor, trailer 1600cfm	3	500	75
Compressor, trailer 450cfm	1	170	75
Conc. pump, truck 130cy/hr	1	310	50
Crawler Crane 100ton/200'	1	265	40
Dozer Cat D5/2.9cy	1	90	70
Drill Rig	1	175	70
Dump truck 14cy, hwy	4	265	50
Dump truck 7.5cy, hwy	1	210	35
General Utility truck, F350	1	137	65
Generator, skid 210kW	1	314	65
Generator, trailer 10.0kW	1	23	65
Generator, trailer 5.0kW	1	9	65
Genset, skid 545kW	1	817	65
Grader, Cat 12-H/12' blade	1	140	60
Grout Pump-Moyno/Mixer	1	600	50
HP Conc. pump, traylor 40cy/hr	1	127	70
Hydraulic Crane 30ton/94'	1	130	65
Hydraulic Hoe Ram	1	100	70
Jackleg drill, 100cfm	1	100	65
Light Plant/Genset, 6kW, 4/1000W	1	12	85
Light Plant/Genset, 6kW, 4/1250W	2	11	85
Load-Haul-Dump 4ton/2.5cy	1	82	70
Man-Lift 55' articulated boom	1	80	65
Mechanic's truck, F350	1	137	65
Asphalt Paver	1	50	80
Pickup truck, F150	2	130	15
Pump, trash 705gpm/106ft head	1	26	90
Roller	1	50	80
Screening and Crushing plant	2	60	75
Shotcrete plant, skid 12cy/hr	1	125	75
Sinker drill, 100cfm	1	103	65
SK330LC Exc 77.8/2.1cy	2	238	65
Street Sweeper (Auxilliary Engine)	1	175	85

Transit mixer, 9cy/60k GVR	1	600	50
Utility Vehicle Diesel/elec.	12	40	85
Water truck, 3000gal, F350	2	137	65
Wheel Loader Cat 950/3.5cy	1	180	65
Saw	1	50	65
Logging skidder (small)	1	100	65
Medium-Large Heel-boom loader with pavemen	1	100	70

OFFRoad Orion Equip Category	HP_Bin	HC_tpd	ROG_tpd	TOG_tpd
ConstMin - Excavators	50	6.5061E-05	7.87238E-05	9.36878E-05
ConstMin - Other Construction Equi	9999	2.94878E-06	3.56802E-06	4.24624E-06
ConstMin - Other Construction Equi	750	7.8834E-06	9.53891E-06	1.13521E-05
ConstMin - Off-Highway Trucks	175	3.65796E-05	4.42613E-05	5.26746E-05
ConstMin - Skid Steer Loaders	75	5.08952E-05	6.15832E-05	7.32891E-05
ConstMin - Rollers	50	5.713E-05	6.91273E-05	8.22672E-05
ConstMin - Other Construction Equi	600	5.14221E-05	6.22207E-05	7.40478E-05
ConstMin - Other Construction Equi	600	5.14221E-05	6.22207E-05	7.40478E-05
ConstMin - Other Construction Equi	175	1.82565E-05	2.20904E-05	2.62894E-05
Portable Equipment - Non-Rental Pı	100	3.49152E-06	4.22474E-06	5.02779E-06
ConstMin - Crawler Tractors	300	6.55424E-05	7.93063E-05	9.4381E-05
ConstMin - Tractors/Loaders/Backh	100	0.000517131	0.000625729	0.000744669
ConstMin - Bore/Drill Rigs	175	3.83686E-06	4.6426E-06	5.52508E-06
ConstMin - Off-Highway Trucks	300	6.51337E-05	7.88118E-05	9.37926E-05
ConstMin - Off-Highway Trucks	300	6.51337E-05	7.88118E-05	9.37926E-05
ConstMin - Off-Highway Trucks	175	3.65796E-05	4.42613E-05	5.26746E-05
Portable Equipment - Non-Rental G	600	0.000129663	0.000156893	0.000186715
OFF - Light Commercial - Generator	25	0.000109614	0.00013045	0.000157845
OFF - Light Commercial - Generator	25	0.000109614	0.00013045	0.000157845
Portable Equipment - Non-Rental G	600	0.000129663	0.000156893	0.000186715
ConstMin - Graders	175	0.000113536	0.000137379	0.000163492
OFF - ConstMin - Cement and Morta	25	4.31563E-06	5.13595E-06	6.2145E-06
Portable Equipment - Non-Rental Pı	100	3.49152E-06	4.22474E-06	5.02779E-06
ConstMin - Cranes	175	3.45082E-05	4.17549E-05	4.96917E-05
ConstMin - Tractors/Loaders/Backh	100	0.000517131	0.000625729	0.000744669
ConstMin - Bore/Drill Rigs	100	3.19372E-06	3.8644E-06	4.59895E-06
OFF - Light Commercial - Generator	25	0.000109614	0.00013045	0.000157845
OFF - Light Commercial - Generator	25	0.000109614	0.00013045	0.000157845
ConstMin - Off-Highway Trucks	100	1.60354E-06	1.94028E-06	2.30909E-06
Industrial - Aerial Lifts	175	2.02122E-07	2.44567E-07	2.91055E-07
ConstMin - Off-Highway Trucks	175	3.65796E-05	4.42613E-05	5.26746E-05
OFF - ConstMin - Pavers	25	8.34211E-07	9.9278E-07	1.20126E-06
ConstMin - Off-Highway Trucks	175	3.65796E-05	4.42613E-05	5.26746E-05
OFF - Light Commercial - Pumps	50	8.02701E-05	9.55281E-05	0.000115589
OFF - ConstMin - Rollers	25	1.78007E-05	2.11843E-05	2.5633E-05
Industrial - Other General Industrial	75	6.19813E-06	7.49974E-06	8.92531E-06
Industrial - Other General Industrial	75	6.19813E-06	7.49974E-06	8.92531E-06
ConstMin - Bore/Drill Rigs	100	3.19372E-06	3.8644E-06	4.59895E-06
ConstMin - Excavators	300	7.63125E-05	9.23381E-05	0.00010989
ConstMin - Sweepers/Scrubbers	175	5.62934E-06	6.8115E-06	8.10625E-06

OFF - ConstMin - Cement and Mort	25	4.31563E-06	5.13595E-06	6.2145E-06
ConstMin - Off-Highway Trucks	50	3.41147E-06	4.12788E-06	4.91251E-06
ConstMin - Off-Highway Trucks	175	3.65796E-05	4.42613E-05	5.26746E-05
ConstMin - Rubber Tired Loaders	300	0.000228999	0.000277089	0.000329758
OFF - ConstMin - Concrete/Industri	50	2.58839E-06	3.08039E-06	3.72727E-06
OFF - Logging - Skidders	100	0.000821292	0.000977405	0.00118266
ConstMin - Tractors/Loaders/Backh	100	0.000517131	0.000625729	0.000744669

CO_tpd	NOx_tpd	CO2_tpd	PM10_tpd	PM2_5_tpd	PM_tpd
0.000597545	0.00053531	0.078042466	2.94906E-05	2.71314E-05	2.94906E-05
2.00754E-05	6.87256E-05	0.009587496	1.60996E-06	1.48116E-06	1.60996E-06
5.91516E-05	0.00011385	0.027784288	3.72077E-06	3.42311E-06	3.72077E-06
0.000471668	0.000374925	0.074048449	1.96498E-05	1.80778E-05	1.96498E-05
0.001071567	0.000815732	0.172741791	3.48571E-05	3.20686E-05	3.48571E-05
0.000352813	0.000338599	0.043931162	2.45524E-05	2.25882E-05	2.45524E-05
0.000436275	0.000752267	0.151918367	2.65775E-05	2.44513E-05	2.65775E-05
0.000436275	0.000752267	0.151918367	2.65775E-05	2.44513E-05	2.65775E-05
0.000183747	0.000233969	0.029828398	1.23638E-05	1.13747E-05	1.23638E-05
8.54704E-05	7.15537E-05	0.013512143	4.74955E-06	4.36959E-06	4.74955E-06
0.000416854	0.000984124	0.100481762	3.94903E-05	3.63311E-05	3.94903E-05
0.007049174	0.006357441	1.045486182	0.000397775	0.000365953	0.000397775
7.82069E-05	4.96985E-05	0.014061634	2.2021E-06	2.02593E-06	2.2021E-06
0.00039899	0.000719144	0.150844625	2.80192E-05	2.57777E-05	2.80192E-05
0.00039899	0.000719144	0.150844625	2.80192E-05	2.57777E-05	2.80192E-05
0.000471668	0.000374925	0.074048449	1.96498E-05	1.80778E-05	1.96498E-05
0.000575377	0.001428131	0.276896338	6.9201E-05	6.36649E-05	6.9201E-05
0.000677538	0.001039409	0.130979042	4.77078E-05	4.38912E-05	4.77078E-05
0.000677538	0.001039409	0.130979042	4.77078E-05	4.38912E-05	4.77078E-05
0.000575377	0.001428131	0.276896338	6.9201E-05	6.36649E-05	6.9201E-05
0.000884792	0.001340968	0.130576198	7.48557E-05	6.88672E-05	7.48557E-05
3.00223E-05	3.87578E-05	0.005240875	1.54026E-06	1.41704E-06	1.54026E-06
8.54704E-05	7.15537E-05	0.013512143	4.74955E-06	4.36959E-06	4.74955E-06
0.00027766	0.000431331	0.041298885	2.31827E-05	2.1328E-05	2.31827E-05
0.007049174	0.006357441	1.045486182	0.000397775	0.000365953	0.000397775
5.5146E-05	4.43369E-05	0.00870735	2.2574E-06	2.07681E-06	2.2574E-06
0.000677538	0.001039409	0.130979042	4.77078E-05	4.38912E-05	4.77078E-05
0.000677538	0.001039409	0.130979042	4.77078E-05	4.38912E-05	4.77078E-05
1.63813E-05	1.64883E-05	0.002169503	1.33072E-06	1.22426E-06	1.33072E-06
7.12692E-06	2.47062E-06	0.001324852	8.0343E-08	7.39156E-08	8.0343E-08
0.000471668	0.000374925	0.074048449	1.96498E-05	1.80778E-05	1.96498E-05
4.09428E-06	7.60361E-06	0.000994351	2.9351E-07	2.70029E-07	2.9351E-07
0.000471668	0.000374925	0.074048449	1.96498E-05	1.80778E-05	1.96498E-05
0.000661954	0.000652609	0.09076194	3.17121E-05	2.91751E-05	3.17121E-05
0.000112015	0.000161219	0.021651283	6.16585E-06	5.67259E-06	6.16585E-06
8.1429E-05	7.58463E-05	0.011714725	4.85642E-06	4.4679E-06	4.85642E-06
8.1429E-05	7.58463E-05	0.011714725	4.85642E-06	4.4679E-06	4.85642E-06
5.5146E-05	4.43369E-05	0.00870735	2.2574E-06	2.07681E-06	2.2574E-06
0.000584287	0.001055036	0.271941618	3.21724E-05	2.95986E-05	3.21724E-05
4.95726E-05	6.80051E-05	0.00781006	3.49867E-06	3.21878E-06	3.49867E-06

3.00223E-05	3.87578E-05	0.005240875	1.54026E-06	1.41704E-06	1.54026E-06
2.85516E-05	2.39746E-05	0.002974748	1.66806E-06	1.53461E-06	1.66806E-06
0.000471668	0.000374925	0.074048449	1.96498E-05	1.80778E-05	1.96498E-05
0.001271262	0.0032217	0.527274356	0.000106955	9.83983E-05	0.000106955
2.12574E-05	1.95951E-05	0.002653598	9.90046E-07	9.10842E-07	9.90046E-07
0.01399344	0.008343571	2.164274364	0.000294666	0.000271093	0.000294666
0.007049174	0.006357441	1.045486182	0.000397775	0.000365953	0.000397775

SOx_tpd	NH3_tpd	Fuel_gpy	Total_Activity_hp	Total_Population	Horsepower_Ho
7.19589E-07	6.36972E-07	2532.001869	3221.818659	4.511379395	115231.4703
8.85527E-08	7.82519E-08	311.0557559	15.88280111	0.034150968	14489.70884
2.56643E-07	2.26772E-07	901.4306169	67.98809248	0.131211612	42091.64972
6.83517E-07	6.04373E-07	2402.420377	772.3359418	0.563494487	121843.9014
1.59556E-06	1.4099E-06	5604.417163	4173.707046	11.97728225	294089.7261
4.04451E-07	3.5856E-07	1425.298185	1848.947128	5.468808854	66046.05831
1.40302E-06	1.23994E-06	4928.824097	599.8734694	1.376823218	229840.142
1.40302E-06	1.23994E-06	4928.824097	599.8734694	1.376823218	229840.142
2.75231E-07	2.43455E-07	967.749524	296.8050842	0.735144512	45207.35063
1.24822E-07	1.10284E-07	438.386604	350.4318724	1.140137815	28943.2058
9.27037E-07	8.20119E-07	3260.020092	711.090758	1.661196178	147071.489
9.65052E-06	8.53312E-06	33919.64776	21355.17345	34.85595992	1775414.143
1.29892E-07	1.14769E-07	456.2142334	117.0836749	0.378781633	17503.57722
1.39268E-06	1.23117E-06	4893.987726	1179.381696	0.946381767	248967.4964
1.39268E-06	1.23117E-06	4893.987726	1179.381696	0.946381767	248967.4964
6.83517E-07	6.04373E-07	2402.420377	772.3359418	0.563494487	121843.9014
2.55615E-06	2.25999E-06	8983.596755	1497.681877	1.140137815	593115.9559
1.82812E-06	1.09544E-06	4354.45	7172.25	21.22	103159.95
1.82812E-06	1.09544E-06	4354.45	7172.25	21.22	103159.95
2.55615E-06	2.25999E-06	8983.596755	1497.681877	1.140137815	593115.9559
1.20384E-06	1.06575E-06	4236.400931	1346.431488	2.920226176	200113.302
7.85409E-08	4.59113E-08	182.5	536.55	1.75	5588.15
1.24822E-07	1.10284E-07	438.386604	350.4318724	1.140137815	28943.2058
3.80793E-07	3.37076E-07	1339.896839	611.4077106	1.366911505	89812.83165
9.65052E-06	8.53312E-06	33919.64776	21355.17345	34.85595992	1775414.143
8.0408E-08	7.10682E-08	282.5003751	128.8916724	0.347354336	11043.74549
1.82812E-06	1.09544E-06	4354.45	7172.25	21.22	103159.95
1.82812E-06	1.09544E-06	4354.45	7172.25	21.22	103159.95
2.001E-08	1.77072E-08	70.38712104	40.52669067	0.032509297	3567.219064
1.22428E-08	1.08133E-08	42.98335318	20.67437961	0.070070673	2697.24866
6.83517E-07	6.04373E-07	2402.420377	772.3359418	0.563494487	121843.9014
1.26164E-08	9.18225E-09	36.5	36.5	0.01	876
6.83517E-07	6.04373E-07	2402.420377	772.3359418	0.563494487	121843.9014
1.17333E-06	7.63045E-07	3033.15	1927.2	4.79	71306.4
3.07749E-07	1.81809E-07	722.7	1883.4	2.73	22535.1
1.08122E-07	9.5614E-08	380.0713363	300.1870951	0.363446147	21474.41694
1.08122E-07	9.5614E-08	380.0713363	300.1870951	0.363446147	21474.41694
8.0408E-08	7.10682E-08	282.5003751	128.8916724	0.347354336	11043.74549
2.51195E-06	2.21955E-06	8822.846316	2043.709948	3.580283893	446373.9157
7.2039E-08	6.37447E-08	253.3887815	67.25663211	0.095680111	10749.78458

7.85409E-08	4.59113E-08	182.5	536.55	1.75	5588.15
2.74007E-08	2.42795E-08	96.5124183	153.6154369	0.097527892	4421.712408
6.83517E-07	6.04373E-07	2402.420377	772.3359418	0.563494487	121843.9014
4.86804E-06	4.30354E-06	17106.83578	4352.908714	4.137710847	916313.6135
3.43044E-08	2.0201E-08	80.3	58.4	0.14	1927.2
2.5388E-05	1.81175E-05	72018.15	16702.4	11.57	1703644.8
9.65052E-06	8.53312E-06	33919.64776	21355.17345	34.85595992	1775414.143

*gpy = grams per year

urs_hhpy	HC_gpy	ROG_gpy	TOG_gpy	CO_gpy	NOx_gpy	CO2_gpy	PM10_gpy	PM2_5_gp	PM_gpy
	23747.26	28734.19	34196.06	218104.1	195388.2	28485500	10764.08	9902.952	10764.08
	1076.304	1302.327	1549.877	7327.534	25084.86	3499436	587.636	540.6251	587.636
	2877.44	3481.703	4143.514	21590.33	41555.27	10141265	1358.082	1249.435	1358.082
	13351.56	16155.38	19226.24	172158.8	136847.6	27027684	7172.163	6598.39	7172.163
	18576.75	22477.87	26750.52	391121.9	297742	63050754	12722.86	11705.03	12722.86
	20852.46	25231.48	30027.55	128776.8	123588.8	16034874	8961.612	8244.683	8961.612
	18769.05	22710.55	27027.43	159240.2	274577.5	55450204	9700.789	8924.726	9700.789
	18769.05	22710.55	27027.43	159240.2	274577.5	55450204	9700.789	8924.726	9700.789
	6663.633	8062.996	9595.631	67067.48	85398.83	10887365	4512.775	4151.753	4512.775
	1274.406	1542.032	1835.145	31196.68	26117.11	4931932	1733.587	1594.9	1733.587
	23922.97	28946.8	34449.08	152151.6	359205.3	36675843	14413.96	13260.84	14413.96
	188752.9	228391	271804.2	2572949	2320466	3.82E+08	145187.9	133572.8	145187.9
	1400.454	1694.549	2016.654	28545.53	18139.94	5132496	803.7671	739.4658	803.7671
	23773.82	28766.32	34234.3	145631.2	262487.4	55058288	10227.01	9408.848	10227.01
	23773.82	28766.32	34234.3	145631.2	262487.4	55058288	10227.01	9408.848	10227.01
	13351.56	16155.38	19226.24	172158.8	136847.6	27027684	7172.163	6598.39	7172.163
	47327.1	57265.79	68151.02	210012.7	521268	1.01E+08	25258.37	23237.7	25258.37
	40009.2	47614.26	57613.25	247301.5	379384.5	47807350	17413.34	16020.28	17413.34
	40009.2	47614.26	57613.25	247301.5	379384.5	47807350	17413.34	16020.28	17413.34
	47327.1	57265.79	68151.02	210012.7	521268	1.01E+08	25258.37	23237.7	25258.37
	41440.74	50143.3	59674.67	322949.2	489453.4	47660312	27322.31	25136.53	27322.31
	1575.204	1874.622	2268.293	10958.15	14146.6	1912919	562.1942	517.2187	562.1942
	1274.406	1542.032	1835.145	31196.68	26117.11	4931932	1733.587	1594.9	1733.587
	12595.47	15240.52	18137.48	101345.9	157435.8	15074093	8461.671	7784.737	8461.671
	188752.9	228391	271804.2	2572949	2320466	3.82E+08	145187.9	133572.8	145187.9
	1165.706	1410.504	1678.617	20128.28	16182.96	3178183	823.9513	758.0352	823.9513
	40009.2	47614.26	57613.25	247301.5	379384.5	47807350	17413.34	16020.28	17413.34
	40009.2	47614.26	57613.25	247301.5	379384.5	47807350	17413.34	16020.28	17413.34
	585.2904	708.2014	842.8182	5979.172	6018.247	791868.4	485.7126	446.8556	485.7126
	73.77447	89.26711	106.2352	2601.325	901.7755	483570.9	29.32519	26.97918	29.32519
	13351.56	16155.38	19226.24	172158.8	136847.6	27027684	7172.163	6598.39	7172.163
	304.487	362.3646	438.4612	1494.413	2775.318	362938	107.1311	98.56059	107.1311
	13351.56	16155.38	19226.24	172158.8	136847.6	27027684	7172.163	6598.39	7172.163
	29298.6	34867.76	42189.99	241613.2	238202.3	33128108	11574.91	10648.91	11574.91
	6497.243	7732.257	9356.03	40885.56	58845.02	7902718	2250.537	2070.494	2250.537
	2262.319	2737.406	3257.74	29721.58	27683.91	4275874	1772.592	1630.784	1772.592
	2262.319	2737.406	3257.74	29721.58	27683.91	4275874	1772.592	1630.784	1772.592
	1165.706	1410.504	1678.617	20128.28	16182.96	3178183	823.9513	758.0352	823.9513
	27854.05	33703.4	40109.83	213264.7	385088.1	99258691	11742.94	10803.5	11742.94
	2054.709	2486.198	2958.781	18094	24821.87	2850672	1277.016	1174.855	1277.016

1575.204	1874.622	2268.293	10958.15	14146.6	1912919	562.1942	517.2187	562.1942
1245.185	1506.674	1793.067	10421.34	8750.715	1085783	608.8401	560.1329	608.8401
13351.56	16155.38	19226.24	172158.8	136847.6	27027684	7172.163	6598.39	7172.163
83584.61	101137.4	120361.8	464010.7	1175920	1.92E+08	39038.46	35915.38	39038.46
944.7607	1124.343	1360.455	7758.969	7152.228	968563.1	361.3667	332.4573	361.3667
299771.4	356752.7	431670.8	5107606	3045403	7.9E+08	107553	98948.77	107553
188752.9	228391	271804.2	2572949	2320466	3.82E+08	145187.9	133572.8	145187.9

*g/hp-hr = grams per horsepower hour

SOx_gpy	NH3_gpy	HC_g/hp-h	ROG_g/hp-	TOG_g/hp-	CO_g/hp-h	NOx_g/hp-	CO2_g/hp-	PM10_g/h
262.6502	232.4948	0.206083	0.249361	0.29676	1.892748	1.695615	247.2024	0.093413
32.32173	28.56193	0.074281	0.089879	0.106964	0.505706	1.731219	241.5118	0.040555
93.6747	82.77164	0.068361	0.082717	0.09844	0.512936	0.987257	240.9329	0.032265
249.4838	220.5963	0.109579	0.132591	0.157794	1.412946	1.123139	221.8222	0.058864
582.3782	514.6118	0.063167	0.076432	0.09096	1.329941	1.012419	214.3929	0.043262
147.6248	130.8745	0.315726	0.382029	0.454646	1.949803	1.871251	242.7832	0.135687
512.1016	452.5771	0.081661	0.09881	0.117592	0.69283	1.194645	241.2555	0.042207
512.1016	452.5771	0.081661	0.09881	0.117592	0.69283	1.194645	241.2555	0.042207
100.4592	88.86121	0.147402	0.178356	0.212258	1.483553	1.889047	240.8317	0.099824
45.55993	40.25377	0.044031	0.053278	0.063405	1.077859	0.902357	170.4003	0.059896
338.3687	299.3433	0.162662	0.196821	0.234234	1.034542	2.442386	249.3743	0.098006
3522.441	3114.588	0.106315	0.128641	0.153093	1.44921	1.307	214.9372	0.081777
47.41046	41.89075	0.08001	0.096812	0.115214	1.630839	1.036356	293.2256	0.04592
508.328	449.3783	0.09549	0.115542	0.137505	0.584941	1.054304	221.1465	0.041078
508.328	449.3783	0.09549	0.115542	0.137505	0.584941	1.054304	221.1465	0.041078
249.4838	220.5963	0.109579	0.132591	0.157794	1.412946	1.123139	221.8222	0.058864
932.9962	824.8966	0.079794	0.096551	0.114903	0.354084	0.878864	170.4003	0.042586
667.2643	399.8366	0.387837	0.461558	0.558485	2.397263	3.677633	463.4294	0.168799
667.2643	399.8366	0.387837	0.461558	0.558485	2.397263	3.677633	463.4294	0.168799
932.9962	824.8966	0.079794	0.096551	0.114903	0.354084	0.878864	170.4003	0.042586
439.4	388.9971	0.207086	0.250575	0.298204	1.613832	2.445881	238.1666	0.136534
28.66744	16.75761	0.281883	0.335464	0.405911	1.960963	2.531535	342.3171	0.100605
45.55993	40.25377	0.044031	0.053278	0.063405	1.077859	0.902357	170.4003	0.059896
138.9896	123.0327	0.140241	0.169692	0.201948	1.128413	1.752932	167.839	0.094214
3522.441	3114.588	0.106315	0.128641	0.153093	1.44921	1.307	214.9372	0.081777
29.3489	25.9399	0.105554	0.12772	0.151997	1.822595	1.46535	287.7812	0.074608
667.2643	399.8366	0.387837	0.461558	0.558485	2.397263	3.677633	463.4294	0.168799
667.2643	399.8366	0.387837	0.461558	0.558485	2.397263	3.677633	463.4294	0.168799
7.303658	6.463124	0.164075	0.19853	0.236268	1.676144	1.687098	221.9848	0.13616
4.468639	3.94684	0.027352	0.033096	0.039387	0.964437	0.334332	179.283	0.010872
249.4838	220.5963	0.109579	0.132591	0.157794	1.412946	1.123139	221.8222	0.058864
4.604995	3.351522	0.347588	0.413658	0.500527	1.705951	3.168172	414.3128	0.122296
249.4838	220.5963	0.109579	0.132591	0.157794	1.412946	1.123139	221.8222	0.058864
428.2638	278.5115	0.410883	0.488985	0.591672	3.388381	3.340546	464.5881	0.162326
112.3283	66.36014	0.288317	0.343121	0.415176	1.814306	2.611261	350.6849	0.099868
39.46471	34.89911	0.10535	0.127473	0.151703	1.384046	1.289158	199.1148	0.082544
39.46471	34.89911	0.10535	0.127473	0.151703	1.384046	1.289158	199.1148	0.082544
29.3489	25.9399	0.105554	0.12772	0.151997	1.822595	1.46535	287.7812	0.074608
916.8602	810.1361	0.062401	0.075505	0.089857	0.477771	0.862703	222.3667	0.026307
26.29423	23.2668	0.19114	0.231279	0.275241	1.683197	2.309058	265.1841	0.118795

28.66744	16.75761		0.281883	0.335464	0.405911	1.960963	2.531535	342.3171	0.100605
10.00125	8.862015		0.281607	0.340745	0.405514	2.356857	1.979033	245.5571	0.137693
249.4838	220.5963		0.109579	0.132591	0.157794	1.412946	1.123139	221.8222	0.058864
1776.836	1570.793		0.091218	0.110374	0.131354	0.506388	1.283317	210.032	0.042604
12.5211	7.373349		0.490225	0.583408	0.705923	4.026032	3.711201	502.5753	0.187509
9266.637	6612.889		0.175959	0.209406	0.253381	2.998046	1.787581	463.6883	0.063131
3522.441	3114.588		0.106315	0.128641	0.153093	1.44921	1.307	214.9372	0.081777

Emissions Factors

PM2_5_g/l	PM_g/hp-l	SOx_g/hp-	NH3_g/hp-hr	Equpment	ROG_g/hp-	NOx_g/hp-	CO_g/hp-h	PM10_g/h
0.08594	0.093413	0.002279	0.002018	301 Mini-E	0.249361	1.695615	1.892748	0.093413
0.037311	0.040555	0.002231	0.001971	Airtrak, 4"-	0.089879	1.731219	0.505706	0.040555
0.029684	0.032265	0.002225	0.001966	Asphalt Mi	0.082717	0.987257	0.512936	0.032265
0.054154	0.058864	0.002048	0.00181	Boom truc	0.132591	1.123139	1.412946	0.058864
0.039801	0.043262	0.00198	0.00175	Cat 226B /	0.076432	1.012419	1.329941	0.043262
0.124832	0.135687	0.002235	0.001982	Compactoı	0.382029	1.871251	1.949803	0.135687
0.03883	0.042207	0.002228	0.001969	Compressc	0.09881	1.194645	0.69283	0.042207
0.03883	0.042207	0.002228	0.001969	Compressc	0.09881	1.194645	0.69283	0.042207
0.091838	0.099824	0.002222	0.001966	Compressc	0.178356	1.889047	1.483553	0.099824
0.055104	0.059896	0.001574	0.001391	Conc. pum	0.053278	0.902357	1.077859	0.059896
0.090166	0.098006	0.002301	0.002035	Crawler Cr	0.196821	2.442386	1.034542	0.098006
0.075235	0.081777	0.001984	0.001754	Dozer Cat I	0.128641	1.307	1.44921	0.081777
0.042247	0.04592	0.002709	0.002393	Drill Rig	0.096812	1.036356	1.630839	0.04592
0.037791	0.041078	0.002042	0.001805	Dump truc	0.115542	1.054304	0.584941	0.041078
0.037791	0.041078	0.002042	0.001805	Dump truc	0.115542	1.054304	0.584941	0.041078
0.054154	0.058864	0.002048	0.00181	General Ut	0.132591	1.123139	1.412946	0.058864
0.039179	0.042586	0.001573	0.001391	Generator,	0.096551	0.878864	0.354084	0.042586
0.155295	0.168799	0.006468	0.003876	Generator,	0.461558	3.677633	2.397263	0.168799
0.155295	0.168799	0.006468	0.003876	Generator,	0.461558	3.677633	2.397263	0.168799
0.039179	0.042586	0.001573	0.001391	Genset, ski	0.096551	0.878864	0.354084	0.042586
0.125611	0.136534	0.002196	0.001944	Grader, Ca	0.250575	2.445881	1.613832	0.136534
0.092556	0.100605	0.00513	0.002999	Grout Pum	0.335464	2.531535	1.960963	0.100605
0.055104	0.059896	0.001574	0.001391	HP Conc. p	0.053278	0.902357	1.077859	0.059896
0.086677	0.094214	0.001548	0.00137	Hydraulic (	0.169692	1.752932	1.128413	0.094214
0.075235	0.081777	0.001984	0.001754	Hydraulic I	0.128641	1.307	1.44921	0.081777
0.068639	0.074608	0.002658	0.002349	Jackleg dril	0.12772	1.46535	1.822595	0.074608
0.155295	0.168799	0.006468	0.003876	Light Plant	0.461558	3.677633	2.397263	0.168799
0.155295	0.168799	0.006468	0.003876	Light Plant	0.461558	3.677633	2.397263	0.168799
0.125267	0.13616	0.002047	0.001812	Load-Haul-	0.19853	1.687098	1.676144	0.13616
0.010002	0.010872	0.001657	0.001463	Man-Lift 5!	0.033096	0.334332	0.964437	0.010872
0.054154	0.058864	0.002048	0.00181	Mechanic's	0.132591	1.123139	1.412946	0.058864
0.112512	0.122296	0.005257	0.003826	Asphalt Pa	0.413658	3.168172	1.705951	0.122296
0.054154	0.058864	0.002048	0.00181	Pickup truc	0.132591	1.123139	1.412946	0.058864
0.14934	0.162326	0.006006	0.003906	Pump, tras	0.488985	3.340546	3.388381	0.162326
0.091879	0.099868	0.004985	0.002945	Roller	0.343121	2.611261	1.814306	0.099868
0.075941	0.082544	0.001838	0.001625	Screening a	0.127473	1.289158	1.384046	0.082544
0.075941	0.082544	0.001838	0.001625	Shotcrete p	0.127473	1.289158	1.384046	0.082544
0.068639	0.074608	0.002658	0.002349	Sinker drill	0.12772	1.46535	1.822595	0.074608
0.024203	0.026307	0.002054	0.001815	SK330LC E:	0.075505	0.862703	0.477771	0.026307
0.109291	0.118795	0.002446	0.002164	Street Swe	0.231279	2.309058	1.683197	0.118795

0.092556	0.100605	0.00513	0.002999
0.126678	0.137693	0.002262	0.002004
0.054154	0.058864	0.002048	0.00181
0.039196	0.042604	0.001939	0.001714
0.172508	0.187509	0.006497	0.003826
0.058081	0.063131	0.005439	0.003882
0.075235	0.081777	0.001984	0.001754

Transit mix	0.335464	2.531535	1.960963	0.100605
Utility Veh	0.340745	1.979033	2.356857	0.137693
Water truc	0.132591	1.123139	1.412946	0.058864
Wheel Loa	0.110374	1.283317	0.506388	0.042604
Saw	0.583408	3.711201	4.026032	0.187509
Logging ski	0.209406	1.787581	2.998046	0.063131
Medium-La	0.128641	1.307	1.44921	0.081777

*Source: EPA 2018. Emission Factors for Greenhouse Gas Inventories: https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

CH4 Emissions Factor (g/gal diesel):	0.57
N2O Emissions Factor (g/gal diesel):	0.26

PM2_5_g/	CO2_g/hp-	CH4_g/hp-	N2O_g/hp-hr
0.08594	247.2024	0.012525	0.005713027
0.037311	241.5118	0.012236	0.005581513
0.029684	240.9329	0.012207	0.005568134
0.054154	221.8222	0.011239	0.005126472
0.039801	214.3929	0.010862	0.004954775
0.124832	242.7832	0.012301	0.005610895
0.03883	241.2555	0.012223	0.005575589
0.03883	241.2555	0.012223	0.005575589
0.091838	240.8317	0.012202	0.005565796
0.055104	170.4003	0.008633	0.003938075
0.090166	249.3743	0.012635	0.005763219
0.075235	214.9372	0.01089	0.004967353
0.042247	293.2256	0.014857	0.006776655
0.037791	221.1465	0.011205	0.005110855
0.037791	221.1465	0.011205	0.005110855
0.054154	221.8222	0.011239	0.005126472
0.039179	170.4003	0.008633	0.003938075
0.155295	463.4294	0.02406	0.010974773
0.155295	463.4294	0.02406	0.010974773
0.039179	170.4003	0.008633	0.003938075
0.125611	238.1666	0.012067	0.005504203
0.092556	342.3171	0.018615	0.008491182
0.055104	170.4003	0.008633	0.003938075
0.086677	167.839	0.008504	0.00387888
0.075235	214.9372	0.01089	0.004967353
0.068639	287.7812	0.014581	0.006650832
0.155295	463.4294	0.02406	0.010974773
0.155295	463.4294	0.02406	0.010974773
0.125267	221.9848	0.011247	0.005130229
0.010002	179.283	0.009084	0.00414336
0.054154	221.8222	0.011239	0.005126472
0.112512	414.3128	0.02375	0.010833333
0.054154	221.8222	0.011239	0.005126472
0.14934	464.5881	0.024246	0.011059582
0.091879	350.6849	0.01828	0.008338192
0.075941	199.1148	0.010088	0.004601687
0.075941	199.1148	0.010088	0.004601687
0.068639	287.7812	0.014581	0.006650832
0.024203	222.3667	0.011266	0.005139055
0.109291	265.1841	0.013436	0.006128596

0.092556	342.3171	0.018615	0.008491182
0.126678	245.5571	0.012441	0.005675002
0.054154	221.8222	0.011239	0.005126472
0.039196	210.032	0.010641	0.00485399
0.172508	502.5753	0.02375	0.010833333
0.058081	463.6883	0.024096	0.010990976
0.075235	214.9372	0.01089	0.004967353

Tier 4 Emissions Factors

	Low HP	High HP	ROG (g/bhp-hr)	NOX (g/bhp-hr)	CO (g/bhp-hr)	PM10 (g/bhp-hr)	PM2.5 (g/bhp-hr)
Tier 4	25	49	0.12	2.75	4.1	0.008	0.008
Tier 4	50	74	0.12	2.74	3.7	0.008	0.008
Tier 4	75	119	0.06	0.26	3.7	0.008	0.008
Tier 4	120	174	0.06	0.26	3.7	0.008	0.008
Tier 4	175	299	0.06	0.26	2.2	0.008	0.008
Tier 4	300	599	0.06	0.26	2.2	0.008	0.008
Tier 4	600	750	0.06	0.26	2.2	0.008	0.008
Tier 4 (exc	751	2000	0.06	2.24	2.6	0.016	0.016
Tier 4 (gen	751	1200	0.06	0.5	2.6	0.016	0.016

Tuolumne County 2020 On-Road Emission Factors

Worker Vehicles:

Vehicle Class	Model Year	Speed (mph)	Fuel	Population (vehicles)	VMT (mi/dy)	Percent VMT	Trips (trips/dy)	ROG_RUNEX (gms/mile)	NOX_RUNEX (gms/mile)	CO_RUNEX (gms/mile)	PM10_Total (gms/mile)	PM2.5_Exhaust (gms/mile)	PM2_5_Total (gms/mile)	CO2_RUNEX (gms/mile)	CH4_RUNEX (gms/mile)	N2O_RUNEX (gms/mile)
LDA	Aggregated	Aggregated	GAS	19327.1858	751473.0952	56%	88132.72401	0.026786425	0.09406699	1.190282656	0.046783042	0.001869475	0.01961948	295.462263	0.006112363	0.008041508
LDA	Aggregated	Aggregated	DSL	237.0606741	9196.828397	1%	1073.094203	0.035758656	0.270318004	0.425617156	0.063621691	0.018055297	0.035805302	231.2581819	0.001660921	0.036350566
LDA	Aggregated	Aggregated	ELEC	179.9492231	8266.19093	1%	906.8246852	0	0	0	0.044750013	0	0.017750005	0	0	0
LDT1	Aggregated	Aggregated	GAS	4453.292141	141511.9469	11%	18501.17207	0.090416063	0.352382893	3.365935725	0.049054926	0.003959417	0.021709422	358.0322796	0.018804119	0.020902001
LDT1	Aggregated	Aggregated	DSL	5.938994599	85.27824114	0%	19.49131604	0.246564208	1.436887908	1.567729572	0.233464523	0.180550804	0.198300809	447.8023935	0.011452436	0.0703883
LDT1	Aggregated	Aggregated	ELEC	2.952103574	144.7081488	0%	15.18529806	0	0	0	0.044750013	0	0.017750005	0	0	0
LDT2	Aggregated	Aggregated	GAS	11153.12109	421501.6301	32%	49476.59229	0.047662333	0.23476276	1.905024303	0.047043805	0.002109378	0.019859383	390.5086996	0.010400444	0.014724989
LDT2	Aggregated	Aggregated	DSL	33.1011956	1572.744119	0%	158.2957245	0.030039983	0.168428494	0.256280553	0.05619748	0.010952255	0.02870226	307.6058932	0.0013953	0.048351363
Total				35392.60122	1333752.422	100%	158283.3796									
Average								0.040045753	0.166733782	1.633142259	0.047232826	0.002288989	0.020038994	329.8563117	0.008739654	0.011714186
Source:	EMFAC 2017															

Small Haul Trucks:

Vehicle Class	Model Year	Speed (mph)	Fuel	Population (vehicles)	VMT (mi/dy)	Percent VMT	Trips (trips/dy)	ROG_RUNEX (gms/mile)	NOX_RUNEX (gms/mile)	CO_RUNEX (gms/mile)	PM10_Total (gms/mile)	PM2.5_Exhaust (gms/mile)	PM2_5_Total (gms/mile)	CO2_RUNEX (gms/mile)	CH4_RUNEX (gms/mile)	N2O_RUNEX (gms/mile)
LHD1	Aggregated	Aggregated	GAS	2371.92415	84874.07321	19%	29835.82193	0.29767037	0.862262316	5.675933847	0.089511591	0.004667933	0.039427943	1053.77925	0.053841673	0.04213229
LHD1	Aggregated	Aggregated	DSL	129.4314476	4648.880783	1%	1928.335716	0.23444549	4.447225982	1.107009964	0.133658978	0.043262801	0.079022811	589.61405	0.010889545	0.092679118
LHD2	Aggregated	Aggregated	GAS	543.437067	21135.48887	5%	6835.754659	0.130188142	0.523989297	2.556234674	0.100281546	0.002851732	0.043071743	1193.579737	0.025218529	0.028512557
LHD2	Aggregated	Aggregated	DSL	9614.436295	334455.3645	74%	41761.61017	0.19256306	2.94636747	0.903900939	0.136041432	0.033353314	0.074573326	657.8807019	0.008944186	0.103409685
MDV	Aggregated	Aggregated	GAS	194.2937856	8675.889782	2%	915.1893364	0.089567028	0.320501754	2.882058063	0.047434109	0.002474859	0.020224864	473.9840927	0.016360334	0.018832413
MDV	Aggregated	Aggregated	DSL	8.057513695	327.0327514	0%	41.42297172	0.025541385	0.151973449	0.379009203	0.055868803	0.010637796	0.028387801	416.1611032	0.001186349	0.06541473
Total				12861.58026	454116.7299	100%	81318.13478									
Average								0.207645225	2.40729262	1.912187064	0.123905738	0.026067589	0.065512498	752.4200572	0.018248946	0.086718066
Source:	EMFAC 2017															

Large Haul Trucks:

Vehicle Class	Model Year	Speed (mph)	Fuel	Population (vehicles)	VMT (mi/dy)	Percent VMT	Trips (trips/dy)	ROG_RUNEX (gms/mile)	NOX_RUNEX (gms/mile)	CO_RUNEX (gms/mile)	PM10_Total (gms/mile)	PM2.5_Exhaust (gms/mile)	PM2_5_Total (gms/mile)	CO2_RUNEX (gms/mile)	CH4_RUNEX (gms/mile)	N2O_RUNEX (gms/mile)
T7 Single	Aggregated	Aggregated	DSL	65.7110766	3916.030673	-	758.2967134	0.28224044	10.37123941	0.922599625	0.220297013	0.117255224	0.152715234	1735.024763	0.013109337	0.272721731
Source:	EMFAC 2017															

EMFAC2017 (v1.0.2) Emission Rates
Region Type: County
Region: TUOLUMNE
Calendar Year: 2020
Season: Annual
Vehicle Classification: EMFAC2011 Categories
Units: miles/day for VMT, trips/day for Trips, g/mile for RUNEX, PMBW and PMTW, g/trip for STREX, HTSK and RUNLS, g/vehicle/day for IDLEX, RES

Region	Calendar Y	Vehicle Cat	Model Yea	Speed	Fuel	Population	VMT	Trips	ROG_RUNI	ROG_IDLE	ROG_STRE	ROG_HOTS
TUOLUMN	2020	All Other B	Aggregate	Aggregate	DSL	16.53037	987.3146	138.8551	0.304107	0.109316	0	0
TUOLUMN	2020	LDA	Aggregate	Aggregate	GAS	19327.19	751473.1	88132.72	0.026786	0	0.469882	0.232461
TUOLUMN	2020	LDA	Aggregate	Aggregate	DSL	237.0607	9196.828	1073.094	0.035759	0	0	0
TUOLUMN	2020	LDA	Aggregate	Aggregate	ELEC	179.9492	8266.191	906.8247	0	0	0	0.004888
TUOLUMN	2020	LDT1	Aggregate	Aggregate	GAS	4453.292	141511.9	18501.17	0.090416	0	1.039292	0.649857
TUOLUMN	2020	LDT1	Aggregate	Aggregate	DSL	5.938995	85.27824	19.49132	0.246564	0	0	0
TUOLUMN	2020	LDT1	Aggregate	Aggregate	ELEC	2.952104	144.7081	15.1853	0	0	0	0.004888
TUOLUMN	2020	LDT2	Aggregate	Aggregate	GAS	11153.12	421501.6	49476.59	0.047662	0	0.72616	0.327777
TUOLUMN	2020	LDT2	Aggregate	Aggregate	DSL	33.1012	1572.744	158.2957	0.03004	0	0	0
TUOLUMN	2020	LDT2	Aggregate	Aggregate	ELEC	25.71436	1011.687	130.8874	0	0	0	0.004888
TUOLUMN	2020	LHD1	Aggregate	Aggregate	GAS	1597.112	50687.58	23794.58	0.29767	0.461605	0.21498	0.368583
TUOLUMN	2020	LHD1	Aggregate	Aggregate	DSL	2371.924	84874.07	29835.82	0.234445	0.10976	0	0
TUOLUMN	2020	LHD2	Aggregate	Aggregate	GAS	129.4314	4648.881	1928.336	0.130188	0.468018	0.185183	0.238978
TUOLUMN	2020	LHD2	Aggregate	Aggregate	DSL	543.4371	21135.49	6835.755	0.192563	0.10976	0	0
TUOLUMN	2020	MCY	Aggregate	Aggregate	GAS	2440.921	14321.18	4881.841	2.909942	0	2.373959	1.070488
TUOLUMN	2020	MDV	Aggregate	Aggregate	GAS	9614.436	334455.4	41761.61	0.089567	0	0.970453	0.383427
TUOLUMN	2020	MDV	Aggregate	Aggregate	DSL	194.2938	8675.89	915.1893	0.025541	0	0	0
TUOLUMN	2020	MDV	Aggregate	Aggregate	ELEC	8.057514	327.0328	41.42297	0	0	0	0.004888
TUOLUMN	2020	MH	Aggregate	Aggregate	GAS	437.8753	3584.9	43.80505	0.191525	0	0.183871	0.151979
TUOLUMN	2020	MH	Aggregate	Aggregate	DSL	144.1136	1371.751	14.41136	0.159054	0	0	0
TUOLUMN	2020	Motor Coa	Aggregate	Aggregate	DSL	3.957542	507.0652	57.78011	0.237406	6.114015	0	0
TUOLUMN	2020	OBUS	Aggregate	Aggregate	GAS	45.54868	2129.533	911.3381	0.129938	0.740386	0.165634	0.048945
TUOLUMN	2020	PTO	Aggregate	Aggregate	DSL	0	777.5765	0	0.415583	0	0	0
TUOLUMN	2020	SBUS	Aggregate	Aggregate	GAS	2.365618	121.5069	9.462471	0.309179	9.849127	0.411398	0.530239
TUOLUMN	2020	SBUS	Aggregate	Aggregate	DSL	108.6123	3381.59	1253.371	0.130094	0.327531	0	0
TUOLUMN	2020	T6 CAIRP h	Aggregate	Aggregate	DSL	4.547414	904.359	66.39224	0.040382	0.06732	0	0
TUOLUMN	2020	T6 CAIRP s	Aggregate	Aggregate	DSL	1.434051	67.94775	20.93715	0.124084	0.096262	0	0
TUOLUMN	2020	T6 instate (	Aggregate	Aggregate	DSL	1.789408	121.6586	8.089844	0.487292	0.079408	0	0
TUOLUMN	2020	T6 instate (	Aggregate	Aggregate	DSL	80.03478	4085.762	361.8341	0.469177	0.117252	0	0
TUOLUMN	2020	T6 instate l	Aggregate	Aggregate	DSL	56.1575	5604.769	648.0498	0.297535	0.115195	0	0
TUOLUMN	2020	T6 instate s	Aggregate	Aggregate	DSL	178.9593	8254.118	2065.166	0.282874	0.119706	0	0
TUOLUMN	2020	T6 OOS hea	Aggregate	Aggregate	DSL	2.541859	502.1351	37.11115	0.040152	0.067245	0	0
TUOLUMN	2020	T6 OOS sm	Aggregate	Aggregate	DSL	1.083211	54.01547	15.81488	0.098754	0.088128	0	0
TUOLUMN	2020	T6 Public	Aggregate	Aggregate	DSL	47.01825	670.15	142.622	0.160871	0.607189	0	0
TUOLUMN	2020	T6 utility	Aggregate	Aggregate	DSL	4.206073	70.16368	48.36984	0.026062	0.140842	0	0
TUOLUMN	2020	T6TS	Aggregate	Aggregate	GAS	58.82549	2418.874	1176.98	0.229591	0.966679	0.259484	0.234479
TUOLUMN	2020	T7 Ag	Aggregate	Aggregate	DSL	2.434985	57.62498	10.71394	0.613207	1.612582	0	0
TUOLUMN	2020	T7 CAIRP	Aggregate	Aggregate	DSL	7.765293	1405.671	113.3733	0.071855	10.69255	0	0
TUOLUMN	2020	T7 CAIRP c	Aggregate	Aggregate	DSL	0.475124	87.38839	2.148019	0.163321	1.589538	0	0
TUOLUMN	2020	T7 NNOOS	Aggregate	Aggregate	DSL	8.565848	1729.531	125.0614	0.074594	13.60588	0	0
TUOLUMN	2020	T7 NOOS	Aggregate	Aggregate	DSL	3.024248	547.0716	44.15403	0.067451	13.24976	0	0
TUOLUMN	2020	T7 POAK	Aggregate	Aggregate	DSL	0.915235	101.5262	6.955783	0.299641	2.622505	0	0
TUOLUMN	2020	T7 Public	Aggregate	Aggregate	DSL	81.67405	1656.943	247.7446	0.198478	1.26724	0	0
TUOLUMN	2020	T7 Single	Aggregate	Aggregate	DSL	65.71108	3916.031	758.2967	0.28224	1.834692	0	0
TUOLUMN	2020	T7 single c	Aggregate	Aggregate	DSL	3.073864	216.7945	13.89682	0.527049	1.571257	0	0
TUOLUMN	2020	T7 SWCV	Aggregate	Aggregate	DSL	17.38223	708.457	67.79069	0.02774	1.45086	0	0
TUOLUMN	2020	T7 tractor	Aggregate	Aggregate	DSL	0.895112	110.3708	11.36792	0.176446	1.68176	0	0
TUOLUMN	2020	T7 tractor (	Aggregate	Aggregate	DSL	2.544794	178.8364	11.50491	0.550076	1.584839	0	0
TUOLUMN	2020	T7 utility	Aggregate	Aggregate	DSL	0.110052	2.232824	1.265592	0.077584	0.578331	0	0
TUOLUMN	2020	T7IS	Aggregate	Aggregate	GAS	0.704822	16.32859	14.10208	3.890517	0	0.000337	0.576769
TUOLUMN	2020	UBUS	Aggregate	Aggregate	GAS	8.316144	756.4924	33.26458	0.018687	0	0.476299	0.063639
TUOLUMN	2020	UBUS	Aggregate	Aggregate	DSL	7.450745	629.1448	29.80298	0.00862	0	0	0

TUOLUMN	2020	UBUS	Aggregatec	Aggregatec	ELEC	0.145424	3.113204	0.581695	0	0	0	0
TUOLUMN	2020	UBUS	Aggregatec	Aggregatec	NG	5.529052	494.5464	22.11621	0.220065	0	0	0

TL and DIURN

ROG_RUNI	ROG_REST	ROG_DIUR	TOG_RUNE	TOG_IDLEX	TOG_STRE	TOG_HOTS	TOG_RUNL	TOG_RESTI	TOG_DIUR	CO_RUNEX	CO_IDLEX	CO_STREX
0	0	0	0.346203	0.124447	0	0	0	0	0	0.808604	2.177412	0
0.421345	0.318186	0.387446	0.03902	0	0.514447	0.232461	0.421345	0.318186	0.387446	1.190283	0	3.032752
0	0	0	0.040709	0	0	0	0	0	0	0.425617	0	0
0	0.004814	0.01453	0	0	0	0.004888	0	0.004814	0.01453	0	0	0
2.733937	0.88917	1.193099	0.131572	0	1.137833	0.649857	2.733937	0.88917	1.193099	3.365936	0	4.332679
0	0	0	0.280697	0	0	0	0	0	0	1.56773	0	0
0	0.004814	0.01453	0	0	0	0.004888	0	0.004814	0.01453	0	0	0
1.338756	0.481018	0.580813	0.069445	0	0.795034	0.327777	1.338756	0.481018	0.580813	1.905024	0	4.013048
0	0	0	0.034199	0	0	0	0	0	0	0.256281	0	0
0	0.004814	0.01453	0	0	0	0.004888	0	0.004814	0.01453	0	0	0
3.594079	0.055442	0.111757	0.428848	0.672531	0.235258	0.368583	3.594079	0.055442	0.111757	5.675934	3.64742	2.848609
0	0	0	0.266901	0.124954	0	0	0	0	0	1.10701	0.909745	0
2.275842	0.036337	0.070911	0.18997	0.682931	0.202752	0.238978	2.275842	0.036337	0.070911	2.556235	3.713859	2.390588
0	0	0	0.21922	0.124954	0	0	0	0	0	0.903901	0.909745	0
3.475284	1.144237	1.829315	3.463203	0	2.579714	1.070488	3.475284	1.144237	1.829315	25.42276	0	9.547084
1.458667	0.579929	0.676875	0.120745	0	1.061947	0.383427	1.458667	0.579929	0.676875	2.882058	0	5.969714
0	0	0	0.029077	0	0	0	0	0	0	0.379009	0	0
0	0.004814	0.01453	0	0	0	0.004888	0	0.004814	0.01453	0	0	0
4.273106	0.057302	0.15296	0.276214	0	0.201244	0.151979	4.273106	0.057302	0.15296	5.361293	0	4.101886
0	0	0	0.181072	0	0	0	0	0	0	0.599059	0	0
0	0	0	0.270269	6.960341	0	0	0	0	0	0.790657	55.78525	0
0.843314	0.027808	0.060091	0.189605	1.080369	0.181349	0.048945	0.843314	0.027808	0.060091	2.886056	5.7395	3.730434
0	0	0	0.473109	0	0	0	0	0	0	1.539267	0	0
8.986936	0.059915	0.182811	0.451153	14.37182	0.450428	0.530239	8.986936	0.059915	0.182811	6.967171	77.50511	11.70563
0	0	0	0.148102	0.37287	0	0	0	0	0	0.332688	4.829138	0
0	0	0	0.045972	0.076639	0	0	0	0	0	0.166737	2.001285	0
0	0	0	0.14126	0.109587	0	0	0	0	0	0.44152	2.029796	0
0	0	0	0.554745	0.0904	0	0	0	0	0	1.021616	1.885276	0
0	0	0	0.534123	0.133482	0	0	0	0	0	1.033345	2.148844	0
0	0	0	0.338721	0.131141	0	0	0	0	0	0.801425	1.730618	0
0	0	0	0.32203	0.136277	0	0	0	0	0	0.800823	2.097526	0
0	0	0	0.04571	0.076553	0	0	0	0	0	0.170386	2.009518	0
0	0	0	0.112423	0.100327	0	0	0	0	0	0.357372	2.051498	0
0	0	0	0.183139	0.691238	0	0	0	0	0	0.344543	4.288277	0
0	0	0	0.029669	0.160338	0	0	0	0	0	0.118716	4.866267	0
1.83435	0.050129	0.097155	0.335019	1.410576	0.284103	0.234479	1.83435	0.050129	0.097155	5.119309	14.58488	6.245904
0	0	0	0.698089	1.835802	0	0	0	0	0	1.703232	11.3875	0
0	0	0	0.081801	12.17266	0	0	0	0	0	0.330654	134.7059	0
0	0	0	0.185928	1.809568	0	0	0	0	0	0.745644	21.2297	0
0	0	0	0.084919	15.48926	0	0	0	0	0	0.352538	168.7957	0
0	0	0	0.076788	15.08385	0	0	0	0	0	0.319633	167.8758	0
0	0	0	0.341118	2.985523	0	0	0	0	0	1.010165	27.30954	0
0	0	0	0.225952	1.442656	0	0	0	0	0	0.643792	7.541345	0
0	0	0	0.321309	2.088657	0	0	0	0	0	0.9226	23.54838	0
0	0	0	0.600005	1.788757	0	0	0	0	0	1.297597	19.31049	0
0	0	0	0.03158	1.651693	0	0	0	0	0	0.08285	9.771683	0
0	0	0	0.200871	1.914555	0	0	0	0	0	0.642374	18.59632	0
0	0	0	0.626219	1.804218	0	0	0	0	0	1.460365	19.49614	0
0	0	0	0.088324	0.658386	0	0	0	0	0	0.305605	6.693801	0
4.962009	0.110857	0.197014	5.671389	0	0.000369	0.576769	4.962009	0.110857	0.197014	187.5614	0	0.400973
0.412564	0.010526	0.014703	0.027268	0	0.521488	0.063639	0.412564	0.010526	0.014703	0.33618	0	7.469351
0	0	0	0.048655	0	0	0	0	0	0	0.121633	0	0

0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	3.961958	0	0	0	0	0	0	18.63872	0	0

NOx_RUNE	NOx_IDLEX	NOx_STREX	CO2_RUNE	CO2_IDLEX	CO2_STREX	CH4_RUNE	CH4_IDLEX	CH4_STREX	PM10_RUN	PM10_IDLE	PM10_STR	PM10_PMT
4.157876	5.991869	1.471043	1119.623	653.3119	0	0.014125	0.005077	0	0.103177	0.027235	0	0.012
0.094067	0	0.300408	295.4623	0	61.9482	0.006112	0	0.091573	0.002033	0	0.002645	0.008
0.270318	0	0	231.2582	0	0	0.001661	0	0	0.018872	0	0	0.008
0	0	0	0	0	0	0	0	0	0	0	0	0.008
0.352383	0	0.580476	358.0323	0	78.84409	0.018804	0	0.176915	0.004305	0	0.005539	0.008
1.436888	0	0	447.8024	0	0	0.011452	0	0	0.188715	0	0	0.008
0	0	0	0	0	0	0	0	0	0	0	0	0.008
0.234763	0	0.578091	390.5087	0	84.20051	0.0104	0	0.134233	0.002294	0	0.002842	0.008
0.168428	0	0	307.6059	0	0	0.001395	0	0	0.011447	0	0	0.008
0	0	0	0	0	0	0	0	0	0	0	0	0.008
0.862262	0.040593	0.537237	1053.779	124.3561	20.88713	0.053842	0.113568	0.038253	0.005072	0	0.000996	0.008
4.447226	2.545058	0	589.614	141.7702	0	0.01089	0.005098	0	0.045219	0.028464	0	0.012
0.523989	0.040978	0.577217	1193.58	142.965	22.75702	0.025219	0.123497	0.034823	0.003102	0	0.000576	0.008
2.946367	2.528123	0	657.8807	226.4558	0	0.008944	0.005098	0	0.034861	0.027713	0	0.012
1.238574	0	0.282725	221.9737	0	67.70544	0.399618	0	0.298532	0.002274	0	0.004479	0.004
0.320502	0	0.697939	473.9841	0	104.6689	0.01636	0	0.16981	0.002684	0	0.003832	0.008
0.151973	0	0	416.1611	0	0	0.001186	0	0	0.011119	0	0	0.008
0	0	0	0	0	0	0	0	0	0	0	0	0.008
1.05365	0	0.32547	1877.459	0	28.79979	0.039154	0	0.03805	0.00291	0	0.00057	0.012
6.319735	0	0	1073.38	0	0	0.007388	0	0	0.155048	0	0	0.016
4.817264	91.90554	1.436136	1566.103	11171.47	0	0.011027	0.28398	0	0.116591	0.438833	0	0.012
0.865851	0.064678	0.327853	1864.578	389.4627	27.8228	0.025739	0.192015	0.03168	0.000974	0	0.000312	0.012
12.27327	0	0	2229.347	0	0	0.019303	0	0	0.150136	0	0	0
1.36291	0.874699	0.828526	886.8019	2603.797	54.26812	0.061918	2.158426	0.068437	0.00775	0	0.00274	0.008
8.153352	48.32009	0.477591	1189.7	3779.314	0	0.006043	0.015213	0	0.055516	0.071713	0	0.012
1.493955	4.280324	1.078143	940.0686	637.7387	0	0.001876	0.003127	0	0.031726	0.008997	0	0.012
2.654132	5.965536	0.838591	1034.061	673.4233	0	0.005763	0.004471	0	0.092305	0.02148	0	0.012
5.572808	5.476008	1.798049	1274.992	667.7913	0	0.022633	0.003688	0	0.14577	0.01438	0	0.012
4.445611	6.80614	1.527916	1264.834	672.6338	0	0.021792	0.005446	0	0.143001	0.031261	0	0.012
6.054872	8.414568	0.82334	1113.84	680.1819	0	0.01382	0.005351	0	0.129323	0.033589	0	0.012
3.995608	7.325603	1.112929	1119.971	681.1765	0	0.013139	0.00556	0	0.125546	0.032476	0	0.012
1.474468	4.239312	1.082225	942.1911	638.6801	0	0.001865	0.003123	0	0.032807	0.008875	0	0.012
2.215089	5.38662	0.930466	1008.72	656.9139	0	0.004587	0.004093	0	0.073605	0.017938	0	0.012
10.57369	52.21723	0.261651	1319.398	3518.417	0	0.007472	0.028202	0	0.075367	0.179024	0	0.012
1.820266	11.90113	1.554655	1071.713	1784.224	0	0.00121	0.006542	0	0.008137	0.005179	0	0.012
1.095945	0.085442	0.426798	1818.629	552.5888	42.57297	0.042545	0.225671	0.043711	0.002305	0	0.001076	0.012
10.61748	15.97039	4.015046	1642.415	1917.335	0	0.028482	0.0749	0	0.267846	0.17866	0	0.036
3.241064	131.9094	1.848711	1404.865	26037.7	0	0.003337	0.496641	0	0.050377	0.244244	0	0.036
4.986482	21.16931	3.886788	1778.156	4011.583	0	0.007586	0.07383	0	0.045656	0.01724	0	0.036
2.76831	152.9311	1.891032	1353.706	30324.94	0	0.003465	0.631958	0	0.055426	0.47443	0	0.036
3.193764	164.2874	1.858013	1405.508	32512.95	0	0.003133	0.615417	0	0.049164	0.280674	0	0.036
6.65484	45.66691	1.035967	1904.911	7552.987	0	0.013918	0.121809	0	0.038663	0.01533	0	0.036
13.17528	38.67304	1.257645	1927.516	3423.473	0	0.009219	0.05886	0	0.088937	0.140348	0	0.036
10.37124	28.35003	2.412364	1735.025	4834.967	0	0.013109	0.085217	0	0.122557	0.042573	0	0.036
7.601087	23.26478	3.313673	1892.046	3866.101	0	0.02448	0.072981	0	0.141891	0.039488	0	0.036
10.045	41.09926	1.495957	4192.705	4326.463	0	0.001288	0.067389	0	0.015474	0.110267	0	0.036
5.949878	27.99432	1.048096	1436.034	4164.831	0	0.008195	0.078113	0	0.10095	0.054338	0	0.036
7.59948	23.28173	3.375488	1897.639	4078.094	0	0.02555	0.073612	0	0.128767	0.027509	0	0.036
5.123483	13.99078	2.062328	1729.723	1791.601	0	0.003604	0.026862	0	0.019998	0.0108	0	0.036
14.29685	0	0.001475	2417.418	0	41.96855	0.596489	0	6.46E-05	0.008324	0	0.002782	0.02
0.291862	0	0.846378	1958.368	0	80.72341	0.005704	0	0.111452	0.001026	0	0.000297	0.010743
1.18987	0	0	1075.012	0	0	0.039008	0	0	0.004712	0	0	0.012

0	0	0	0	0	0	0	0	0	0	0	0	0.012
1.59102	0	0	1326.114	0	0	3.695338	0	0	0.003188	0	0	0.012

PM10_PMI	PM2_5_RU	PM2_5_IDI	PM2_5_ST	PM2_5_PN	PM2_5_PN	SOx_RUNE	SOx_IDLEX	SOx_STREX	N2O_RUNE	N2O_IDLEX	N2O_STREX
0.13034	0.098714	0.026056	0	0.003	0.05586	0.010578	0.006172	0	0.175989	0.102692	0
0.03675	0.001869	0	0.002433	0.002	0.01575	0.002924	0	0.000613	0.008042	0	0.032932
0.03675	0.018055	0	0	0.002	0.01575	0.002186	0	0	0.036351	0	0
0.03675	0	0	0	0.002	0.01575	0	0	0	0	0	0
0.03675	0.003959	0	0.005097	0.002	0.01575	0.003543	0	0.00078	0.020902	0	0.043009
0.03675	0.180551	0	0	0.002	0.01575	0.004233	0	0	0.070388	0	0
0.03675	0	0	0	0.002	0.01575	0	0	0	0	0	0
0.03675	0.002109	0	0.002614	0.002	0.01575	0.003864	0	0.000833	0.014725	0	0.047277
0.03675	0.010952	0	0	0.002	0.01575	0.002908	0	0	0.048351	0	0
0.03675	0	0	0	0.002	0.01575	0	0	0	0	0	0
0.07644	0.004668	0	0.000919	0.002	0.03276	0.010428	0.001231	0.000207	0.042132	0.002676	0.036786
0.07644	0.043263	0.027233	0	0.003	0.03276	0.005574	0.00134	0	0.092679	0.022284	0
0.08918	0.002852	0	0.00053	0.002	0.03822	0.011811	0.001415	0.000225	0.028513	0.002968	0.041723
0.08918	0.033353	0.026514	0	0.003	0.03822	0.006219	0.002141	0	0.10341	0.035596	0
0.01176	0.002146	0	0.004254	0.001	0.00504	0.002197	0	0.00067	0.069473	0	0.015595
0.03675	0.002475	0	0.003539	0.002	0.01575	0.00469	0	0.001036	0.018832	0	0.052055
0.03675	0.010638	0	0	0.002	0.01575	0.003934	0	0	0.065415	0	0
0.03675	0	0	0	0.002	0.01575	0	0	0	0	0	0
0.13034	0.002678	0	0.000525	0.003	0.05586	0.018579	0	0.000285	0.051911	0	0.028188
0.13034	0.148341	0	0	0.004	0.05586	0.010147	0	0	0.16872	0	0
0.13034	0.111547	0.41985	0	0.003	0.05586	0.014796	0.105542	0	0.24617	1.755999	0
0.13034	0.000896	0	0.000287	0.003	0.05586	0.018452	0.003854	0.000275	0.037875	0.005109	0.024938
0	0.143641	0	0	0	0	0.021062	0	0	0.350422	0	0
0.7448	0.007126	0	0.00252	0.002	0.3192	0.008776	0.025767	0.000537	0.064816	0.067131	0.052465
0.7448	0.053114	0.068611	0	0.003	0.3192	0.01124	0.035705	0	0.187004	0.594056	0
0.13034	0.030353	0.008608	0	0.003	0.05586	0.008881	0.006025	0	0.147766	0.100244	0
0.13034	0.088312	0.020551	0	0.003	0.05586	0.009769	0.006362	0	0.16254	0.105853	0
0.13034	0.139464	0.013758	0	0.003	0.05586	0.012045	0.006309	0	0.200411	0.104967	0
0.13034	0.136815	0.029909	0	0.003	0.05586	0.01195	0.006355	0	0.198814	0.105729	0
0.13034	0.123728	0.032136	0	0.003	0.05586	0.010523	0.006426	0	0.17508	0.106915	0
0.13034	0.120115	0.031071	0	0.003	0.05586	0.010581	0.006435	0	0.176044	0.107071	0
0.13034	0.031388	0.008491	0	0.003	0.05586	0.008901	0.006034	0	0.148099	0.100392	0
0.13034	0.070421	0.017162	0	0.003	0.05586	0.00953	0.006206	0	0.158557	0.103258	0
0.13034	0.072107	0.171279	0	0.003	0.05586	0.012465	0.03324	0	0.207391	0.553046	0
0.13034	0.007785	0.004955	0	0.003	0.05586	0.010125	0.016856	0	0.168458	0.280455	0
0.13034	0.002119	0	0.00099	0.003	0.05586	0.017997	0.005468	0.000421	0.046243	0.005673	0.02616
0.06174	0.256259	0.170931	0	0.009	0.02646	0.015517	0.018114	0	0.258165	0.301378	0
0.06174	0.048197	0.233678	0	0.009	0.02646	0.013272	0.245991	0	0.220825	4.092763	0
0.06174	0.04368	0.016495	0	0.009	0.02646	0.016799	0.037899	0	0.279501	0.630565	0
0.06174	0.053029	0.453907	0	0.009	0.02646	0.012789	0.286495	0	0.212784	4.766658	0
0.06174	0.047037	0.268532	0	0.009	0.02646	0.013279	0.307166	0	0.220926	5.110583	0
0.06174	0.03699	0.014667	0	0.009	0.02646	0.017997	0.071357	0	0.299425	1.187224	0
0.06174	0.08509	0.134277	0	0.009	0.02646	0.01821	0.032343	0	0.302979	0.538122	0
0.06174	0.117255	0.040731	0	0.009	0.02646	0.016392	0.045678	0	0.272722	0.759989	0
0.06174	0.135753	0.03778	0	0.009	0.02646	0.017875	0.036525	0	0.297403	0.607697	0
0.06174	0.014804	0.105497	0	0.009	0.02646	0.039611	0.040874	0	0.659035	0.68006	0
0.06174	0.096583	0.051988	0	0.009	0.02646	0.013567	0.039347	0	0.225725	0.654653	0
0.06174	0.123196	0.026319	0	0.009	0.02646	0.017928	0.038528	0	0.298282	0.64102	0
0.06174	0.019133	0.010333	0	0.009	0.02646	0.016342	0.016926	0	0.271888	0.281615	0
0.06174	0.007655	0	0.002558	0.005	0.02646	0.023922	0	0.000415	0.357123	0	7.15E-05
0.117408	0.000943	0	0.000273	0.002686	0.050318	0.01938	0	0.000799	0.024299	0	0.072468
0.128189	0.004508	0	0	0.003	0.054938	0.010163	0	0	0.168977	0	0

0.13034	0	0	0	0.003	0.05586	0	0	0	0	0	0
0.130254	0.00305	0	0	0.003	0.055823	0	0	0	0.270337	0	0